Revealing Myths about People, Energy and Buildings

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ABSTRACT

In this essay we take a closer look at some energy myths, focusing on the ways energy professionals and the public alike, talk, write and teach about how energy affects the way in which we design, operate, retrofit and inhabit buildings. What myths about people, energy and buildings are current today? Who tells these myths and why do we believe them? How do myths affect our behavior? Myths are a way of understanding the world we live in. They may represent incomplete understanding, or be based on premises that are scientifically not valid, but they help us understand and explain how the world works, and we shape our behavior accordingly.

Introduction

Several questions shape the enquiry of this paper: What are the prevalent myths about people, energy and buildings? Who tells these myths and to whom? What can we learn by studying these myths? Why do they arise and persist and what, if anything, should and can be done to keep them in check? While much of this enquiry is empirical, relying on anecdotal and everyday experience, we are also keen to ground our observations in theory, which would allow us to generalize and make stronger claims for our findings. Answering these questions requires an awareness of the multidisciplinary character of the energy profession (Wilk 1999), a group comprised of many different theoretical and ideological perspectives who often talk past each other. Energy professionals are a group that summarize, judge, and pass around "knowledge" in a pattern that can lend itself to myth-making, in part, because of the great differences in motivations and evaluations of truth held by the various actors in the system.

The purpose of this paper is to address three key issues. First, many statements and ideas commonly promoted as true in energy policy and building science have, at best, a weak basis as objectively true. Second, that despite the lack of a good basis in fact, such statements and ideas often guide the actions of both energy professionals and those to whom the information is provided. Third, how can we, as researchers in energy policy and building science, pay more attention to finding the truth, by questioning our own statements and assumptions?

Definitions

The term "myth" in popular usage is defined as "any fictitious story or unscientific account, theory, belief, etc." (Webster's *New World Dictionary* 1988). Folklorists and others

who study myths reserve the term "myth" to refer to narratives about origins, usually sacred and often metaphorical. For this paper we are generally referring to the popular definition of myth, but we draw on two themes from folklore theory. First, that myths, whether true or not, are a way of structuring understanding of how the world works, and second, that these myths are shared by a specific group, which could be any collection of people—for example a professional group—who hold and communicate some common beliefs. Thus, our myths are mini-narratives that are reflections of "mental models" (Senge 1990) and "folk models" (Kempton 1986) used to describe how groups and individuals view the world, and in this case, energy use.

Who Tells Myths about Energy and Buildings, and Why?

Myths about energy and buildings appear everywhere, in the professional and practitioner literature, the public press, through movies and television, in business and advertising, and in government and in schools. Wherever people talk about energy and buildings, whether educators, visionaries, political leaders, salesmen, or scientists, we can find myths. Our focus on myths highlights a particular perspective on how individual and community knowledge is structured, a complex of ideas and statements, some of which are more true and some of which are less true. This framework leads to the question of how people know what they think they know. For our purposes, what we as individuals think we know is a complicated hybrid of what we are told, what we observe, and our own processing of these sources of information. In distinguishing myths as a type of knowledge, we focus on the relationship between what is claimed and what is true. The distinction between fact and fiction is strongly pertinent to the energy profession because of the political role energy policy plays as negotiator between science and politics. This task of negotiation is made all the more difficult because of the "invisibility" of energy and by the strong moral views people have regarding the environment.

As in most knowledge systems, little of what energy professionals believe as true, and use as truth in their daily work, can be shown to be carefully weighed, carefully articulated statements of irrefutable fact. Rather, such claims and assumptions are combinations of what we believe to be true, what we want to believe, and what we want others to believe. All of these desires and beliefs are situational. They yield to slippages of language and the desire, especially strong in policy and marketing, for positive and simple statements that transform specific statements into general ones. Even to begin with, the knowledge of scientists is hardly absolute. Any truth uncovered by science is usually a very particular one, involving conditions, limitations, and uncertainties that may not apply to a general situation. As an example, the finding from a laboratory measurement about the efficiency of a new furnace has many qualifying conditions that are not passed on to the purchaser of the furnace.

Individuals use myths to articulate, legitimize, and support their beliefs, often gaining power and influence by asserting a particular viewpoint. Promoters of energy efficiency, for example, are often faced with defending their beliefs about energy efficiency and with directing others to share their vision and to take action towards it. This may lead them to make claims that portray energy efficiency as easy, effective, good, healthy, or otherwise the right thing to do: those bent on selling energy efficiency may tell company owners that energy efficiency will increase productivity of building staff, tell those shopping for appliances that energy efficiency will save them money and give them a better product, and

tell those reading the utility brochure that they can and should take a few simple energy-saving steps to do their part for the environment. To support their views, energy efficiency advocates draw on a traditional set of beliefs as to what is technically effective, and to some extent what is psychologically effective. The combination of ideology with the desire to provide practical steps promotes a sort of magical thinking, with technology the first-order substitute for the supernatural (see Benthall 1991). For example, Christopher Alexander and his colleagues, in their influential work, *A Pattern Language*, talk about how their approach to design has an underlying connectedness to a "timeless ways of building" (Alexander 1978). Such language reassures the reader that this approach has both validity and universality, which will appeal to the designer's desire to do the right thing. We, too, face a world bigger than our understanding (Eco 1984). Myths, thus, are used to provide a pattern of social order, bringing meaning to perceived chaos.

Our Collection of Myths

For the past few years we have been collecting myths about energy and buildings, a list which quickly expanded from a few personal favorites to several dozen examples, as friends and colleagues have been eager to share their myths (Diamond 1998). We have chosen to organize this list of myths about people, energy and buildings, into four categories, based on who is telling the myths to whom. Our four categories are: (1) myths told to consumers by utilities, public institutions, non-profits; (2) myths consumers tell themselves; (3) myths told by design professionals (architects and engineers) to clients; and (4) myths told by energy professionals to consumers and each other. By organizing the myths based on which group of people tells them, we can start to look for patterns or motives for why these myths develop and continue. How do these myths influence our policies and efforts to promote energy conservation? Does recognizing that different groups tell different stories help in crafting public policy? Does revealing the truth or lack of truth in these myths further our understanding? Our hope is that by studying these myths we can understand how they shape how we construct policy that ultimately affects the way we design and inhabit buildings.

Myths Told to Consumers by Utilities, Public Institutions, Non-Profits.

We give two examples here of myths that have appeared in countless guides and brochures provided by utilities, governments and energy conservation advocates. These myths are often in the form of "Ten simple things you can do to save the earth/planet/environment" and are typically directed to homeowners and renters. Often the information from these sources cannot be traced to any authoritative source, but are commonly borrowed from similar, earlier documents, having gained a relatively unquestioned claim to truth by virtue of their traditionality. These tips are usually offered as generalizations, and without quantification. If real savings do result, in most cases they would be too small to be noticed at the consumer level, even if in aggregate—from the utility or national level—they result in observable savings. These recommendations provide positive actions that a homeowner can take immediately, hence their appeal to recommendation-givers. Some might argue that by taking a small positive step in the right direction it will be easier to have the homeowner undertake larger actions, even if the true energy savings from this small step alone are inconsequential. On the other hand, if a homeowner does not see the result

from their actions they may be less likely to bother with further energy-efficiency recommendations

Myth #1. Cleaning the refrigerator coils improves refrigerator efficiency. There is some intuitive logic that if you clean the years of accumulated dust from the surfaces of the coils, the heat transfer will improve. Unfortunately there is little data to support this claim when it comes to refrigerator coils. A review of measured tests with refrigerators showed that there was no or little evidence of improved efficiency from cleaning the coils (Litt, Megowan, and Meier 1993). We put this in the category of things that energy industry professionals like to recommend, fulfilling their jobs by helping people feel that they have done something good for the environment, and supporting the image of energy efficiency as an easy step in right living. The drawbacks of this recommendation are at least threefold. First, people may try to clean their refrigerator coils and not see the savings in their monthly utility bills, and consequently feel there is nothing more they can or should do. This could easily happen even if cleaning refrigerator coils did save some energy, since small savings can be difficult to observe. Second, they may be unable to clean the coils—a non-trivial task for many elderly or disabled—and feel guilty that they can't do "their part" for the environment. Third, each recommendation provided to consumers might be considered a cost, one more thing the consumer is being told to do and thus one more step on the road to nagging and to disenfranchising the consumer. In that case, it becomes all the more important that recommendations are effective, and that they do not encourage consumers to substitute small steps for big ones, or to relinquish responsibility altogether.

Why do we tell this myth? Because it intuitively makes sense (foul coils reduce heat exchange) and because it is a simple thing to do, unlike, for example, insulating a crawlspace. Keeping a clean house is also the sign of a good housekeeper, and we see an association here with energy efficiency and the positive values of homeowner responsibility, indirectly stressing the link between energy efficiency and morality via the idea of cleanliness. Electricity itself is associated with cleanliness, in part courtesy of its cleanliness at point-of-use as compared to that of other fuels; efficiency also connotes cleanliness, as representing the minimal resources necessary to accomplish a job (Hopkins and Moezzi 1997).

Myth #2. Installing foam gaskets in electrical outlets will significantly reduce air infiltration. This recommendation is a simple step for homeowners and is often accompanied by information how it will lower drafts and reduce heating and air conditioning bills. The probable origin for this myth—an unusual case where an origin can actually be identified—was a study in the late 1970s which showed that 20% of the air leakage in fifty homes was due to wall outlets (Caffey 1979). Later studies showed leakage values for outlets to be under 1% (ASHRAE 1997) but the recommendation has been a perennial favorite in the home retrofit literature. Again, there is an intuitive appeal that an outlet is a hole in the wall, and certainly there are instances where one can feel a draft, but the appeal of this myth may be that it is a simple, inexpensive fix, which was associated with large energy savings. While there may be little harm with respect to immediate effect on energy consumption in making this recommendation (although installing the gasket can actually increase the leakage if the outlet cover was painted to the wall) it may be a poor move for an overall strategy of gaining consumer confidence, since it raises expectations of energy savings and improvements in comfort, when neither are likely to occur.

Myths Consumers Tell Themselves

We are interested here in the popular myths, ideas that consumers often share but which are not directly the product of marketing or information programs. One of the classic examples is the common idea of how a thermostat works. Kempton and his colleagues noted that homeowners often use their own mental model of how a thermostat operates, which may be entirely different from an engineering model. In this example, the common myth is that thermostats will make the house heat more quickly if the setting is made higher (Kempton 1986).

Myth #3. Leaving on lights, computers, televisions, printers, copiers, etc., uses less energy than shutting them off and turning them on again. There is a widespread belief that it is better to leave some appliances on then to turn them off, even for short periods of time. There may be good reasons for leaving appliances and lights on, but energy savings is not one of them. Though there are examples when an appliances uses more power in standby than in on, an appliance cannot use less energy when it is left running than when it is off. And yet one hears countless stories that it is better to leave on lights—particularly fluorescent lights—as well as copiers, computers and other appliances.[1] Why do so many people believe this myth? Convenience? Pseudo-science: "there are surges of wasted energy if I turn the switch off and on"? There is, in fact a small surge in power associated with turning on an incandescent light, but it is minor compared to the energy used when the light is operating. At one time, manufacturers advised against switching fluorescent fixtures on and off frequently because you could reduce tube life by as much as 20 percent. However, the introduction of rapid-start tubes that last for 20,000 hours, twice the lifetime of the old ones, reduce tube life from 5 to 10 percent.

Myth #4. Fluorescent lighting is bad (for your health, bad quality light, noisy, not natural, etc.) and can cause problems with your electrical appliances. There is a large literature on the impacts of fluorescent lighting on human health and performance (Ott 2000). Our intent is not to critique this literature, but to acknowledge that there is a widespread belief in the United States that this particular light source is bad for human health. These beliefs about the aesthetics and health effects are not global; in Japan, for example, fluorescent lights are often preferred (Wilhite et al. 1996). Where do these ideas that fluorescent lighting is harmful come from and are they myths or do they have basis in fact?

Myths told by design professionals (architects and engineers) to clients.

The myths told by design professionals can come from a number of sources, from traditional rules of thumb which may no longer apply in current building practice, from formal education, and from a misapplication of a specific finding which has become more widespread. Often these myths are not primarily about energy efficiency, rather they address

[1] For example, Cecil Adams, author of *The Straight Dope*, a syndicated newspaper column, considers this question one of his classics: "isn't it true that it takes more electricity to turn the lights on and off frequently than just to leave them on?" *see* (http://www.straightdope.com/).

points out how energy experts "can only 'see' through methodological spectacles of their own making," (Shove 1997) in which case claims can constitute a defining truth.

Myth #14. Energy efficiency measures result in using less energy. Sometimes the installation of an energy efficiency strategy results in improvements or the amount of service, but not energy savings. One way to think of this is the difference between "energy conservation" and "energy efficiency" (Moezzi 1998). Many would argue that what we care about is efficiency: reducing waste by getting the most "bang for the buck." Others would see the need to reduce consumption of resources and reducing carbon emissions. An example is the consumer who buys 50% less-fat potato chips—and then eats twice as many (Huber 1998). The chips are more efficient (less fat used per chip) and the customer benefits by getting twice as much pleasure (arguably—the low-fat chips do taste worse)—but no calories have been saved. Focusing too much on energy efficiency as opposed to energy consumption can lead to the reduction in consumption itself being overlooked, even while reduced consumption is central for pollution control, creating the myth that: "do whatever you want, as long as you do it efficiently," will lead to reduced consumption. This may occur even to the extent that higher consumption is rewarded because of the way that efficiency is defined (Moezzi 1998).

Conclusions: What Can We Learn From These Myths?

Myths about energy, like most myths, are not randomly generated and transmitted. Instead they are products of a particular structure of actors and motivations within the energy profession, and of mental models that are deeply ingrained in our minds and tools, so that the myths are prone to persist even in the face of strong evidence to the contrary. They persist because people believe in them. Different groups tell different myths, and these different myths exist simultaneously, creating barriers to understanding between consumers, designers, and other energy professionals. Many of these myths are generalizations that are not easy to disprove. Providing knowledge alone is not sufficient to counter a myth, instead, we may have to reveal the underlying reasons for the need for the myth.

The implications for policy are twofold. In one case, policymakers may be perpetuating myths about energy by merely passing them along. Ideas about the impossibility of having operable windows in new commerical buildings, or the expected behavior of energy users, can be perpetuated because no one stops to verify whether these myths are actually true. The second case is where policymakers—and researchers—themselves are blind to their own myth making, by failing to take note of the assumptions in their own work. It is in this regard that we like to reinforce the idea that we always need to question assumptions, and to realize that different groups may interpret the same incomplete data in different ways. Questioning assumptions often requires collecting more data, probing commonly held beliefs and a willingness to set aside our pre-conceptions. Of course, much information must still be assumed. However, it is incumbent on us as scientists and researchers, to acknowledge carefully and explicitly our assumptions, rather than to internalize them, and thus to perpetuate them as myths.

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References

Alexander, Christopher, et al. 1977. *A pattern language: towns, building construction.* Oxford University Press.

Arnold, David, 1996. "Mixed-Mode HVAC—An alternative philosophy". *ASHRAE Trans*, volume 102 part 1.

ASHRAE Journal, (editorial) 1998. "A guiding light" July 1998 p. 9.

ASHRAE Fundamentals, (handbook) 1997.

Bentall, Jonathon.1991. "Disasters, Donors, and Magical Agencies." *Anthropology Today* 7(5):3

Bijker, Wiebe E. 1995. *Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change.* Cambridge: MIT Press.

Buckley, Jim. 1996. "Fireplaces: Studies in Contrasts—by A. C. S. Hayden—Critiqued." (http://www.rumford.com/articleHayden.html

Caffey, Garry, 1979. "Residential air infiltration". *ASHRAE Trans*, volume 85 part 1.

Carey, James W. and Quirk, John J. (1970). "The Mythos of the Electronic Revolution". *American Scholar* (39)2, p. 219-241 and (39)3, p. 395-424.

Diamond, R. C.,1998. "Building Science Meets Architectural Practice," in the *Proceedings* of the 32nd Annual Conference of the Australian and New Zealand Architectural Science Association.

Diamond, R.C., et al. 1999. "EMCS retrofit analysis interim report," Lawrence Berkeley National Laboratory, *Report* LBNL-43256, March 1999.

Eco, Umberto, 1984. *Postscript to The Name of the Rose.* San Diego: Harcourt Brace Jovanovich.

Fishbein, Martin and Icek Ajzen, 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Reading: Addison-Wesley.

Gill, Sam D. 1987. *Mother Earth: An American Story.* Chicago: The University of Chicago Press.

Gieryn, Thomas F. 1999. *Cultural Boundaries of Science: Credibility on the Line.* Chicago: The University of Chicago Press.

Hayden, Skip, 1994. "Fireplaces: Studies in Contrasts, *Home Energy Magazine*, Volume 11, No. 5: September/October 1994. http://hearth.com/what/more/skip.html

Hopkins, Deborah L. and Mithra Moezzi. 1997. Driving an Electric Car to Utopia. Presented at the 1997 Meeting of the Society for the History of Technology, San Diego, California.

Huber, Peter. 1998. "The Energy Diet That Flopped." *Forbes* 161(10):306.

Kempton, Willett, 1986. "Homeowners Models of the Heating System and Heat Loss: Effects on Home Energy Management." *In Proceedings of the 1986 ACEEE Summer Study* 7. Washington DC: ACEEE.

Litt, Barbara, Megowan, Andrew and Meier, Alan, 1993. "[Refrigerator] maintenance doesn't necessarily lower energy use," *Home Energy Magazine*, January/February 1993. http://hem.dis.anl.gov/eehem/93/930108.html#93010801

Merton, Robert K. 1973. *The Sociology of Science: Theoretical and Empirical Investigations.* Chicago: The University of Chicago Press.

Modera, Mark and Sonderegger, Robert, 1980. "Determination of In-Situ Performance Of Fireplaces." Lawrence Berkeley National Laboratory, *Report*, LBL-10701.

Moezzi, Mithra, 1998. "The Predicament of Efficiency." *in Proceedings of the 1998 Summer Study on Energy Efficiency in Buildings* 4.

Ott, John, 2000. *Health and Light: The Effects of Natural and Artificial Light on Man and Other Living Things.* Ariel Press.

Pantin, Dennis. 2000. http://www.tidco.co.tt/local/seduweb/research/dennisp/stkitts.htm

Pileggi, D.J., E.M. Gulachenski, C.E. Root, T.J. Gentile, and others. 1993. "The Effect of Modern Compact Fluorescent Lights on Voltage Distortion." *IEEE Transactions on Power Delivery* 8(3):1451.

Romm, Joseph J. and William D. Browning, 1994. "Greening the Building and the Bottom Line: Increasing Productivity Through Energy-Efficient Design," *In Proceedings of the 1994 Summer Study on Energy Efficiency in Buildings* 9.

Senge, Peter W.,1990. *The Fifth Discipline: The Art and Practice of the Learning Organization.* New York: Doubleday.

Shove, Elizabeth, 1997. "Energy Knowledges." *In Proceedings of the 1997 ECEEE Summer Study.*

Stekel, Peter. 1996. "Warriors and Chiefs: Did Chief Seattle really say, 'The earth does not belong to man; man belongs to the earth'? *Wild West.* February. http://www.thehistorynet.com/WildWest/articles/02965_text.htm

Weber, Lukas. 1997. "Some Reflections on Barriers to the Efficient Use of Energy." *Energy Policy* 25(10):833-835.

Wilhite, Harold, Hidetoshi Nakagami, Takashi Masuda, Yukiko Yamaga, and others. 1996. "A cross-cultural analysis of household energy use behavior in Japan and Norway." *Energy Policy* 24(9):795-803.

Wilk, Rick. 1999. "Towards a Useful Multigenic Theory of Consumption." *In Proceedings of the 1999 ECEEE Summer Study.*

World Commission on Environment and Development. 1987. *Our Common Future.* Oxford and New York: Oxford University Press.

Wright, Frank Lloyd.1954. *The Natural House*, New York: The Horizon Press.

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