Defining efficiency: What is "equivalent service" and why does it matter?

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Defining Efficiency

"Energy efficiency" is commonly defined as "using less energy to provide the same service" (LBNL, n.d.). Familiar examples of energy-efficient technologies that appear to meet this definition include low-e windows, compact fluorescent light bulbs, efficient appliances like air conditioners, washing machines, and others. A more technical definition of efficiency would be "the rate of consumption for a *given level of amenity* (Schipper 1976) [italics added].

The questions we want to raise are how is the "same" service or "given level of amenity" defined, who determines equivalence, and why does equivalence matter for energy demand reduction.

Representing equivalence

There are many ways that a service can be defined, for example with reference to physical parameters or to values ascribed by users, producers or third parties. When compact fluorescent light bulbs (CFLs) were first introduced they were said to be "equivalent" to incandescent light bulbs - and they were, but only with reference to a single characteristic, namely their light output, as measured in lumens. Promoters of the new CFLs talked about delivering "the same light as a bulb using 4 times the energy." While the light output as measured in lumens was often "equivalent" to the incandescent bulb with which it was compared, CFLs were not at all equivalent in terms of

shape, size, weight, noise, longevity, fragility, indoor/outdoor usage, perceived "whiteness", the ability to show true colors as measured by the Color Rendition Index (CRI), and of course, cost.

Some of these differences were addressed by suppliers, e.g., the high initial costs were justified to customers in that the "light bulbs will pay for themselves in less than 4 years due to longer lifetimes and less energy use." Consumers were left to discover other aspects of non-equivalence, experiencing some as significant *reduction* of service when seen in the round.

This is not an isolated example. Low-e windows are thermally more efficient and typically reduce daylight transmission. This feature also reduces sound transmission and the fading of fabrics. For the same reason rooms appear darker. These various sometimes competing characteristics are impossible to capture in such a singular concept as a "given level of amenity."

Given levels of amenity

In daily life, levels of amenity are never "given": they are always made and always have a history. Invoking "the same" level of service and aiming for equivalence naturalizes templates of normal which are themselves outcomes of specific conjunctions of technologies and practice.

This is unfortunate if the aim is to reduce energy demand. For example, heat pumps are an energy efficient technology for providing heating and cooling, but they differ from more familiar systems in that the air temperature at the register can be several degrees lower than with traditional gas-fired heating systems.

Heat pumps may be efficient and capable of delivering similar service (narrowly defined) but they cannot match other qualities of gas central

heating – e.g. speed of response, the experience of air temperature etc. When compared in these terms, they are found to be wanting.

They are so not because they are inherently inferior, but because familiar systems have come to define what is normal and set benchmarks of experience and expectations which are difficult and sometimes impossible to meet in other ways.

Efficiency, equivalence and demand reduction

Concepts of energy efficiency depend on quite specific interpretations of equivalence. This is fundamentally problematic when thinking about appliances and technologies in use. As we have seen, discourses of efficiency systematically obscure the multi-dimensional qualities of service, and marginalize the many aspects of non-equivalence that necessarily follow. The dogged re-statement of equivalence – this is "the same" only more efficient – is in effect a political move, prioritizing and valuing certain features over others.

More importantly, the goal of being equivalent is itself fundamentally limiting. It is so in that the ambition of mimicking current levels of service – whether narrowly or broadly defined - constrains lines of technological innovation and related realms of energy policy.

Setting this constraint aside would help in transforming, and not reproducing, what people take to be "normal" (or "given"). Current expectations and standards are not natural: they are themselves outcomes of experiences and encounters with incumbent technologies.

Instead of persistently positioning lower energy strategies as the same, but more efficient, a more plausible and also more promising approach is to

recognize, value and actively construct different versions of "normal" service. This would involve promoting methods of lighting, cooling, heating etc. which *do not* mimic incumbent systems but which have the potential to become part of substantially lower energy ways of life. In promoting some technological solutions and directions and not others, energy-related policies and strategies support and sustain specific interpretations of what constitutes acceptable and appropriate forms of service: in that sense they are already culturally and politically loaded. There are obvious reasons why researchers and policy makers might be keen to perpetuate present conventions and standards, and to take these as a benchmark for efficiency. However, there are also obvious reasons – including the pressing problems of climate change – for setting the pursuit of efficiency aside and concentrating instead on the more contentions but also more important challenge of enabling and building substantially lower carbon ways of living that are, of necessity, *not at all the same* as those with which we are familiar today.

References

Lawrence Berkeley National Laboratory, n.d., "What is Energy Efficiency?" Berkeley, California
http://eetd.lbl.gov/ee/ee-1.html

Schipper, L. 1976. "Raising the Productivity of Energy Utilization." In *Annual Review of Energy*, eds. Hollander, Jack M. and Melvin K. Simmons. Vol 1. pp. 455-518.