

“On” Is Not “Off”

Energy Efficiency and Energy Conservation Are Not the Same

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by Paul Grover

Most people use the terms “efficiency” and “conservation” interchangeably. When we understand how different they are, solutions to our energy and environmental problems become much clearer.

Engineers originally created the term “efficiency” to quantify machine performance. Efficiency is “the ratio of energy developed by a machine to the energy supplied it.” If we put 100 units of energy into a boiler and get 90 units of useable energy back, that boiler is said to be 90-percent efficient.

We must maintain, and periodically buy, (costly) equipment to become more energy-efficient. This efficient equipment must be “on” to produce savings, and the longer it’s on, the more we “save.” If we buy a Prius, we are driving a high-efficiency vehicle. The more we drive, the more we “save,” often with little thought to how many miles we drive in a year.

Energy conservation is quite different from energy efficiency. The late Fred Tuttle best summed up “conservation” when he told me, “if y’don’t need it, turn the durn thing off.” The goal of energy conservation is to minimize resource use and eliminate waste. While efficiency strives for more energy “bang for the buck” when equipment is

on, conservation delivers even greater benefits when that same equipment is off.

A simple example illustrates the difference. After we turn on a light, our concern is how efficient the bulb is. When we turn the light off, we conserve electricity whether the bulb is energy-efficient or not.


If energy efficiency is our only concern and we do not practice conservation, lights can be on night and day, and as long as the bulbs are energy-efficient we are using electricity efficiently. Again, the longer we burn our energy-efficient bulbs, the more we “save.” Efficiency without conservation can waste a lot of electricity.

Energy efficiency may enable consumers to get “more” from the energy they use, but without conservation, resource use increases, leading to more negative environmental and health consequences. Today, our cars are more fuel efficient (more MPG), yet we drive more miles per vehicle, burning more gas every year and importing more oil. It’s like buying low-fat potato chips to “save” calories and then eating three bags.

In 1865, economist William Stanley Jevons observed that England’s consumption of coal soared after James Watt introduced a more efficient coal-fired steam engine. This led to “Jevon’s Paradox,” which states that more efficient technology reduces the cost of the benefit produced and increases the consumption of resources.

This “paradox” certainly applies to electricity use in Vermont, the U.S., and the world. Our focus on producing more-efficient and cheaper electricity over the past century has led to huge increases in the consumption of the natural resources used to meet the demand.

Since 1991, Vermont has mandated millions of dollars be spent encouraging and subsidizing the purchase of energy-efficient equipment, administered first by electric utilities and then, beginning in 2000, through Efficiency Vermont. Yet between 1991 and 2005, Vermont’s electricity use has continued to rise. It’s time to question whether efficiency without conservation is delivering the results we want and need.

So, the next time you see efficiency and conservation in the same sentence, remember that they are not the same and that they produce very different results. “On” is not “off,” and using electricity more efficiently does not mean you are using less. 

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