

Making Sense of Science

Visit the Making Sense Website

[Visit the Making Sense Website](#)

- [Ask a Question](#)
- [Refer a Friend](#)
- [View Past Newsletters](#)

Next Week:

[Are We In The Future Yet?](#)



Inaugural Newsletter

Welcome, to the inaugural Making Sense newsletter, where science, research, engineering and technology are discussed in plain language that anyone can understand and enjoy. You are receiving this newsletter because you & I have met at some time or another, or we have exchanged emails previously.

Do you have a question about science that nobody has properly explained to you before? Send me an email and your question may become the subject of a future Making Sense newsletter.

I opened the newspaper recently and found an article about a “revolutionary” new electric water heater that was “more efficient’ than conventional water heaters. Right away, my Nonsense Alarm started buzzing (it was set to vibrate that morning). How is anything more efficient than an electrical heating element, which converts 100% of the electrical power it consumes into heat? You can’t be more efficient than 100%.

Once when I made that statement out loud in public (usually a bad idea in our science-challenged society), someone replied with, “Haven’t you ever heard of a reverse cycle heater? They put out more energy than they consume. That’s more than 100% efficient.” Of course I’ve heard of a reverse cycle heater, having been quite intimate (as a foolish young uni student) with the thermodynamics equations that describe them.

The problem here is that efficiency is the wrong idea. Efficiency greater than 100% implies that energy is being created out of nothing – that is, more comes out than goes in. This is never the case, since the universe contains as much energy as it ever has had and ever will have. A better word to use would be “performance.”

A reverse cycle heater not only consumes electrical energy, but also absorbs heat energy from the environment. Even on a cold, 2° C morning, there's 275° K of thermal energy in the air, and that's more than enough to heat a house. You just have to concentrate it and "pump" it indoors somehow, hence the common name "heat pump." The heat energy you get out of it equals the electrical energy you paid for, plus the heat energy absorbed from outside, minus friction losses and heat lost to the outside.

Heat Produced = Electricity Used + Heat Absorbed – Heat Wasted

"Efficiency" in this case would answer the question, "How much of the available energy ends up where it is needed?" Or in other words, "How much energy is NOT wasted?" With devices like this, the answer will never quite be 100%, but close to it if it's properly designed and well constructed.

A reverse-cycle system with high Performance will produce more heat for the electricity used. A Performance value of 150% or more is possible if the unit absorbs a lot of outside heat and wastes very little. The actual figure will depend on the outside temperature at any moment.

So what about this "revolutionary" water heater? It turned out to be a reverse-cycle heater combined with a storage hot water system. Good idea, actually. Higher Performance means that you get more hot water for your money. Rest assured, however, that a significant amount of heat will be lost through the insulation over time, making the real "efficiency" far less than perfect.

In terms of cost-effectiveness, a gas system is still usually better, since gas costs less per heat unit than the equivalent electricity. Gas is also far less greenhouse-gas intensive than coal-based electricity. Even better would be a solar hot water system, but the price of a new system should be compared to the few dollars per month that hot water is costing you now. A better investment to my mind would be a \$20 low-flow shower head that saves both energy and water. And insulate those hot water pipes, for goodness' sake!

Later in the newspaper article, it was stated that the system uses "less

energy than a light bulb - around 0.8 kW!" I don't know about you, but none of the light bulbs at my house burn 800 Watts apiece. I find that almost everything in the press even a little bit technical seems to come out mangled. Perhaps they meant one of those big, big light bulbs, like at Subiaco Oval.

Regards,

John

Our mailing address is:

PO Box 2208

Carlisle North 6101

Western Australia

Australia

Copyright (C) 2008 * Wallinup Research * All rights reserved.