

**How I learned to reduce energy consumption by 90% and increase comfort ...
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In 1972, at the International Solar Energy Society meeting, I attended a lecture by a NASA scientist (whose name I remember as Don Cherry, but have not been able to track down) illustrating how human effects on global systems had already just passed the threshold of net photosynthetic fixation across wide areas. Fossil fuel use in the United States was exceeding the total harvest of solar energy by every green plant within our national boundaries. His extrapolated heat-based measurements suggested that Americans needed to reduce energy consumption by fully 90%, if we wished to survive as a culture. Because proven climatic disturbances were coming from these heat balances, not from concern with CO₂, shifting energy sources became a chimera, with nuclear far more dangerous for other reasons. What mattered most essentially was the total for energy released, including that from related production and distribution facilities. His remarks paralleled, but in a more specific way, the Club of Rome's better-known *Limits to Growth*.

Data and analyses since have done nothing to suggest that Cherry was underestimating the overall need to change before sustainability would be possible. Taking him seriously, and having been raised to believe example was the best teaching tool, I have found ways since then to at least come increasingly closer to achieving that expressed goal. But, having overdone the austerity bit beforehand, and changed patterns further by choosing to share life with a woman who has less tolerance for unnecessary suffering, it became a primary goal to achieve that dramatic efficiency increase within a comfortable lifestyle, one potentially even more so than that enjoyed by most other Americans.



Material simplicity admittedly comes easier for me than it may for most. Both parents came of age during the Great Depression, as well as from already austere religious backgrounds, with my mother born on a dryland Montana homestead, where the empty chair in this image shortly became hers. These families' desire for a better lifestyle for their own children meant that I was raised in early suburbia, although not amidst the excess that word now often conjures. One moral message regularly appearing during my adolescence was, what would happen if everyone across the world did as I do? That, at least, has persistently been useful in evaluating energy choices (imagine a billion Chinese in SUVs ...), and I easily fell in with those in the late '60s questing for still less reliance on "stuff", trading acquisitiveness for nature and more spiritual satisfaction.

That pursuit led to 1970 in northern New Mexico, finishing a chemistry/physics master's thesis with a manual typewriter, slide rule, and kerosene light, living without

electricity or running water, cutting wood for warmth with a manual saw and ax. In short order that choice of extreme simplicity, when not required, ever so obviously became too much (or too little). Experiencing serious diarrhea in an outhouse, with snow blowing between my legs, became an effective and lasting argument for indoor flush toilets, water treatment, and effective refrigeration. The associated 20 minutes of hard labor cutting wood for each hour of inadequate heat similarly called for other methods of staying warm.

However, none of those conclusions meant that improvement by reducing the impacts of the more modern systems and what they are connected to was not possible. That goal flamed particularly brightly—from an example of using energy in an efficient, elegantly satisfying, and surprising way—that I had found within the heart of America’s energy-use problems, transportation. The summer of my high school graduation came in 1965, with me as a somewhat typical male, at least by lusting after more spectacular automobiles than my parents’ aging Nash Rambler. Also wanting to be away from home, I took the train to work for a while for a Missouri uncle, who regularly let me drive his biggest new Chrysler, a two-ton, 300+ horsepower monster. Despite its entertainment value in accelerating from stoplights, it was easy to discover that after many hours on the road the consequences from all its weight and wasted energy meant that noise and vibration could not be hidden by its insulation or plushness, so that exhaustion ensued. Even more dramatic was a particular moment of serious fear, meeting a semi-truck on a bridge built for narrower machines, which memorably began my contemplations on the subject of excess width. Cliches do often start with truth: bigger isn’t always better.

More proof came when getting to Montana that summer, where the extended family had convened, and another uncle called to ask if I could bring his second car from his house in Bozeman down to the West Yellowstone airport to meet him. That 356 Porsche weighed 1600 pounds, with all of 80 horsepower. Because acceleration is a function of both power and weight (which contemporary design and advertising ignore), I quickly found on that (at the time) uncrowded, speed-limit-free road, I could quite comfortably double the recommended speed posted on the corner signs and add five more mph. Along the way, I passed a new Ford station wagon on one curve. Its driver then tried to follow me around the next. The much lighter Porsche went around neatly, no problem, not even a squeal, but the big station wagon slewed spectacularly towards the edge, tires smoking, the driver’s eyes wide with fright. The comparison clearly brought home how Newton’s laws of physics still apply, since increased mass makes any change—in direction or speed—that much more difficult.



Underlining the concept that the advantage of well-designed, lighter weight was not just in control, I got to drive the car on to my uncle’s other home in Needles, California, averaging 40 mpg at well over 60 mph. Despite the August heat in Nevada without air conditioning, the car was so comfortable and fun that I could look forward to getting back into it after many hours, unlike the heavyweight “luxury” machine I had been driving earlier that summer. Less weight clearly meant more capability with less waste, and that, in

turn, meant less vibration and noise, making more comfort possible.

Improving the efficiency of cars, of course, cannot solve the many problems that reliance upon them creates. The admonition in Robert Pirsig's *Zen and the Art of Motorcycle Maintenance*, to know how one's machines worked if one was going to use them, reached me at about the same time I was deepening friendships with folks who felt similarly. That combination led to overhauling a particularly exquisite engine from a classic Lancia in my living room, there being no garage. The moment of epiphany came by seeing how its relatively small engine was so out of place in that environment, how massive and powerful it rightfully appeared there, and realizing how much more so a whole car would be in that context.



It dawned on me then that this engine's 125 horsepower was numerically equivalent to 100,000 watts. And Americans routinely fire up yet more power to get a loaf of bread! Putting all energy uses on an equivalent scale, and not hiding them behind multiples (i.e., use 200,000 watts, not 200 kw or 250 hp for vehicles—and 5,000 watts for lawn mowers, not 7 hp) can start isolating key forms of waste and disruption, pointing out where the greatest effort for improvement is needed.

Most Americans seem to have turned to making their transport machines still more like their homes, and are willing to spend ever more time in them. With my more efficient vehicles and use of bicycles, feet, and public transport whenever possible, I'm now down to averaging less than two quarts of gas a day, including occasional fairly long jaunts. If everyone did this, America would have no problem meeting Kyoto accord targets, have no need to import fuel, and our own supplies could last until we could (re)build more efficient pathways.

A recent month-long vacation, after carefully researching alternatives, again revealed through experience the practical value of wasting less. My wife and I wended 10,742 miles through North America by rail in April, with comparatively first class accommodations on the train or during stopovers, at a cost of less than \$100 per person per day, getting in all kinds of glorious views and interpersonal experiences, while never fighting traffic, compaction, or crowds. We used an off-season 30 day railpass, but if governments helped the rails as much as highways or airlines (airlines received at least three times more subsidies in the year 2001 alone than the total for the entire history of Amtrak), many more could do the same, on a routine basis.



Our home is the other prime example of upgrading efficiency with comfort. Utilizing my experience, we could build in better efficiency than we could buy, but doing so would break new ground and use more material. We chose instead to go with improving an



existing, 25 year old structure. Among its other advantages was providing many better materials to work with than are now available. The forests they came from should not have been harvested, at least the way they were, but since the material was taken, we felt that it should begin to be more respected.

We put in triple-fold insulating curtains over the already double-paned windows, added lighting that would illuminate what we actively

wanted to see (but not spread much elsewhere), and installed a 95% efficient direct-radiating hot water heating system. We replaced the electric stove with a gas version that made cooking easier (no professional chef uses an electric stove) while cutting energy use by 70%, and purchased a state-of-the-art refrigerator. The furniture is Shaker inspired, using the least wood (which also allows easier hand finishing) and gaining the most in both beauty and function through superior design. With the careful siting of the house, including shading by native trees, and by adjusting the curtains and window openings twice a day, no air-conditioning has proved necessary, despite brutal local summer temperatures. Our computers are laptops, put in sleep mode or turned off (like the lights) when not in active use. Laptops have the additional advantages of being less noisy, less visually intrusive, and needing less space. The apparently big stereo system includes the most efficient components on the market, and sounds all the better for being capable of putting out 100 db from just 1 watt. When I'm alone, I often turn to headphones, which give 10 times the sound quality per dollar invested as speakers, and allow ignoring neighbors' mechanical disturbances (as well as not transferring what they may not think is music to them). All this adds up to electricity bills that are less than 10% of the national average, with less unwanted noise and annoyance all around.



In winter, we admittedly maintain far cooler temperatures (in winter 67°F or less) indoors than most Americans. Yet our truly cozy down comforter (already 30 years old, with its higher quality long since paid for by savings from reduced heating bills) keeps in too much heat to sleep under when bedroom temperatures are above 60°F, making no heat at all necessary at night, unless temperatures fall well below zero outside. A setback thermostat dispels any morning chill. We have found that the money saved by seasonally appropriate coolness during the day allowed us to acquire many gloriously hand- or small-factory-knit sweaters, in a mutually beneficial cycle for us, their makers, and surrounding communities. Truly good sweaters, like silk longjohns, not only feel better indoors, but also make going outside far more of a pleasure, including ending any temptation to wastefully “warm up” a car. Dressing realistically for the seasons, whether summer or winter, creates problems only within all-too-typically overheated or cooled public and other buildings or conveyances, which more rational taxation or thoughtful operation could cure.

An echo effect of choices with clothing—where paying more is counterbalanced by wasting less fuel, and being able to buy from non-sweatshops and businesses with strategies to reduce environmental damage—also works for our older, lighter-than-currently-available vehicles. With them, instead of subsidizing huge factories or the other material flows that new machines require, and the dreary lives that are subsumed within both, our dollars go to small, mostly local shops for maintenance and parts. We respect our road-going tools, as we do our furniture and clothes. Adhering to Wendell Berry’s elegant arguments, we choose goods that are worthy of preserving for extended use. Our vehicles were necessarily created abroad, since American manufacturers have not bothered for many years to produce high-quality, lighter weight machines. However, by keeping our “foreign” ones so long, we have supported more and better American jobs through locally done repairs and American-made parts than those who routinely purchase newer, robot-built, road-damaging behemoths from Detroit or elsewhere.

The car can become somewhat of an ideal, by beyond being unusually capable and beautiful, and thereby being satisfying just to keep with care to use occasionally. By maintaining it mostly hands on, and with detailed records, I know how much it really costs to run. By being somewhat fragile, and through keeping no secrets about the world it passes through, letting in all the beauty with the top down brings with it all others’ noise and fumes, which are far worse than most drivers realize, further encourages me to not use it often, or for very long. No casual extended trips (though the ones made are always memorable adventures), and very certainly no commuting in it.



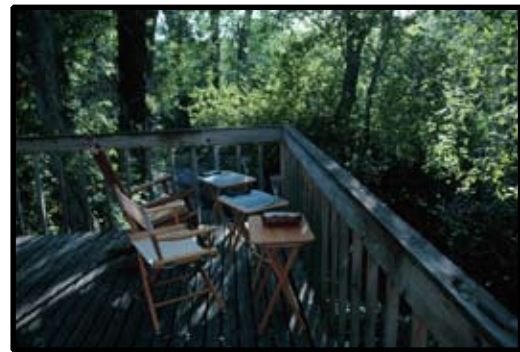
For everyone to do likewise would require many changes, but most of those would be advantageous in the long term. The many benefits of well-made, lighter-weight vehicles include reducing car- and life-dissolving road salt (which would allow for extended vehicle structure life, and becomes less necessary because greater individual vehicle control results from lighter weight), less other pollution, less noise, less energy debt, higher possible speeds (again from better control, with less danger if mistakes are made), and/or more enjoyment at every step along the way.

Another place we save is for exterior lighting. In Fort Collins, I know that before high intensity, inherently wasteful street lighting was put in place, there had *never* been a reported rape by a stranger. When the currently typical, purportedly safer lights were installed, the unpleasant quality of their glare kept good people from wanting to go outside at night, and their excessive brilliance quite literally spotlighted remaining potential victims. Rapes quickly became all too common, while other crimes multiplied as well. Harsh light is a criminal’s best friend, with overbright home and public fixtures killing not only the view of stars, but quite literally people as well. Soft, carefully directed night lighting can be a helpful joy, as was underlined by one publicly thoughtful Massachusetts town near where we lived, requiring far less energy than the hideous, falsely efficient glare that goes to places where it is unwanted more than 95% of the time. We have managed to get most of the unneeded street lighting turned off near us, and reduced the wattage of our neighbors’ fear-inducing (“safety”) lights, to mutual benefit of all around. As Anne McCaffrey wrote, “Of what use is light that no eye needs?”

By experiment, I long ago found that less wasteful lighting indoors makes less brilliant illumination needed outdoors, too. The frequency of the lighting is important: incandescent bulbs are supposedly less efficient, but the cell structure of the human eye means that we see better within the red part of the spectrum as light levels fall, which is the portion where incandescents produce the most. Fluorescent bulbs and televisions put most of their energy into the blue part of the spectrum, which eyes need least at night—or to see fine detail at any time—and which makes dark adaptation or seeing into shadows greatly delayed or impossible. Light meters and eyes have different needs. Not surprisingly, those who purvey energy and high wattage fixtures tend to ignore this difference. Typical contemporary lighting patterns not only use much more energy than necessary, and pollute more, indirectly by increased energy use and directly by hellishly brightening the night sky, but they also literally make it harder to see the things one wants to. The fun part appears because the gentler lighting in our home is not only less wasteful in sum and makes it easier to see comfortably, but is also both more romantic and notably prettier.

Meanwhile, irrigation water in the West, and lawn maintenance everywhere, are notable resource issues. By allowing native vegetation to repossess our property (and selectively removing invaders by hand), we have cut our water use (along with not wasting it in other household uses) to a small fraction of the local average, while having more innately beautiful, interesting, and satisfying surroundings, including more birds and other wildlife. Learning to watch for and recognize both desirable and problem plants has had some surprising intellectual and aesthetic satisfactions. By not applying more water to our remaining lawn than to keep it at the edge of green, which reduces growth when it is inappropriate for the species anyway, and by not mowing it during the hot dry season because roots are typically as deep as the tops are high, not only is much water saved, but the need to disturb neighbors, pollute, and waste energy with power mowers and blowers is also virtually negated.

Any lawn cutting and weed removal is almost always done without fuel, and we benefit from occasional extra exercise, but we usually spend less time working than our more typical neighbors with their only theoretically labor-saving, excessively noisy tools. Each of the tasks we chose to do is more interesting than exercising with any form of machine. How many horsepower should be needed to cut a blade of grass, anyway? Our collection of manual cutting tools have their own loveliness of design and inherent satisfaction in use, including the modest maintenance and care in use they need to work well. Without the noise, or pesticides and herbicides that are inevitably more poisonous than manufacturers wish users to believe, yard work becomes far less of an onerous chore. This lifelong choice has left much more of my hearing intact, while smarter (i.e., more natural) plants do most their own maintenance. Attention to the local flora and fauna can then extend to greater regard for natural areas, and the appreciation that the



larger the less-disturbed area is, the better it can function.

Not incidentally, all of our energy-related choices let us spend much less money overall than most contemporaries, which reduces pressure on us to continually need to earn more, especially by doing things that are uncomfortable, morally or physically. If everyone did as we do, there might be less financial and material goods circulating, but who would be hurt most by such a change? When one thinks about it, would it not be those with grossly inflated incomes, especially those based on material and energy flows? Is that really so bad? In the end, quantity is rarely correlated with either quality or satisfaction.

One last illustration from experience: on how small differences can make surprisingly important ones. The carefully aligned reflectors behind the fire and the adjustable dampers that I installed in a typically poorly executed original fireplace mimic the effects of the classically more efficient Rumsford design, but without a massive expense for changing existing masonry. For a very modest cost, these enhancements effectively doubled the output per unit of wood burned. They increased visual appeal, too, even when the fire is in the past or for the future.

