Equinox House Project

Preface – Personal Diatribe

Ty Newell – January 27, 2010

I asked Ben for some space to write about our Equinox House project. Among the many goals of these upcoming writings are analyses and assessments used to design a "zero plus" house. The "plus" refers to providing transportation energy as well as the energy to live comfortably.

This preface is meant to get things started. Then, as these writings evolve, we will pick things apart in a much more detailed manner. I'm not sure who is my audience, or if there will even be one, so I'm not sure if my target should be the general public, engineers, policy wonks, or whatever. I plan to target these writings to the general public, but that doesn't mean things will be interesting, clearly organized, or grammatically correct. Remember, I am an engineer. My lectures as a professor have been known to lower the metabolism of my students to dangerously low levels (which at least conserves energy), and I'm sure my written stuff is just as dull. I wish I could write with the scientific clarity of Edward Thorndike, the logic of Amory Lovins, and the conviction of Aldo Leopold, but unfortunately those are not skills I'm endowed with (see…I even ended my sentence with a preposition, something my English major/Librarian spouse, Deb, will be quite upset at…..she doesn't like sentences that end in "at", either).

Background

Maybe a bit of background regarding who I am may give you some perspective on my motivation to construct the Equinox House. If you figure out my motivation, please let me know. Why invest your life savings and take on a significant debt at this time in life (I'm nearly 60) for a project like this when Deb and I could comfortably live out our lives? I don't know the answer to that. All I can say is that since I graduated from college in the early 1970's I have spent my entire adult life working in engineering with an emphasis on solar energy, energy conversion, energy conservation, and resource conservation applications. My graduate degrees in mechanical engineering concentrated on solar energy. I just felt and feel it is important for our future generations' survival. We must return to living on our daily allowance of solar energy. Without significant efforts taken now to develop a sustainable way of life, our future generations will be faced with more war, famine and pestilence in order to make adjustments to survive in a world with diminished resources, overpopulation, and massive pollution. Leaving our children, their children, and beyond with to cope such hardships is something I find hard to live with.

So, the above is a bit gloomy, and I'm not by nature a gloomy, pessimistic person. If I were, I wouldn't put in the effort to work toward the changes we need to achieve sustainable lifestyles. So here's the optimistic side of things. I know that we can do more with less now. That is, I see the world as one that has plenty of resources for improving the quality of life for all people. Improving one's life does not have to be at the expense of others. When I began working in alternative energy in the 1970s, we were still developing the required technologies. Today, because of the hard work of a lot of stubborn people

like many of my faculty colleagues and industry friends, enabling technologies are available now at a cost that is affordable.

Beyond the philosophical waxings above, a bit more concrete description of my background may be of interest, especially if you're suffering from insomnia. In addition to being an engineer, I'm a hick. I am much more comfortable in jeans and tee shirt looking under the hood of a car or making stinkbait for catfish than going to a cocktail party in a suit and tie. Although my family moved around quite a bit as I grew up, I consider my childhood home to be Ballard Missouri (take a look in Google Earth; I fished all ponds and creeks within 5 miles of Ballard that I could walk to, bike ride to, or ride my horse to). My dad became a preacher late in life after working a couple decades in the auto industry. His first assignment was rural southwest Missouri, a place with hardworking, welcoming people. We had a shallow water well with rainwater collection as an essential part of our survival. As a fairly scruffy kid, being told I couldn't take a bath was not a hardship, but a rather welcomed restriction. I had animal chores everyday (20 hogs, 20 chickens, and a horse), twice a day, and developed an appreciation and admiration of our farmers who provide for all of us. Ballard isn't too far from Peculiar Missouri, and I often wonder if the Peculiar folks would get along with people from Normal Illinois (near where we now live)?

I'll skip some intervening years, but would like you to know that I didn't want to be an engineer. At the end of the 60's and early 70's, engineering was not popular. I went to the University of Michigan (Michigan is our family's ancestral home with Mom and Dads' family farms located near Marlette). The University of Michigan told me they would accept me into engineering, but not natural resources or liberal arts (my top two choices) because they were filled to capacity. So, I went into engineering figuring I would transfer into natural resources in a semester or so. Unfortunately (maybe fortunately?), one needed a 3.0 grade point for transferring to Natural Resources, and my grade point was never close to that. These were the Vietnam years, and dropping out of school meant immediately being drafted, so as much as I disliked the undergraduate engineering curriculum and the manner in which it was taught, I was stuck in engineering. I graduated in 1974, which coincided with the end of the draft, with a 2.1 grade point. Even a student with a probation riddled transcript could find an engineering job at that time. I worked as a project engineer for two years at a plastics manufacturing plant in Ohio. Of all the unexpected things, I found I thoroughly enjoyed engineering and I found that it would give me the tools and background to work in the alternative energy field in a manner I would enjoy.

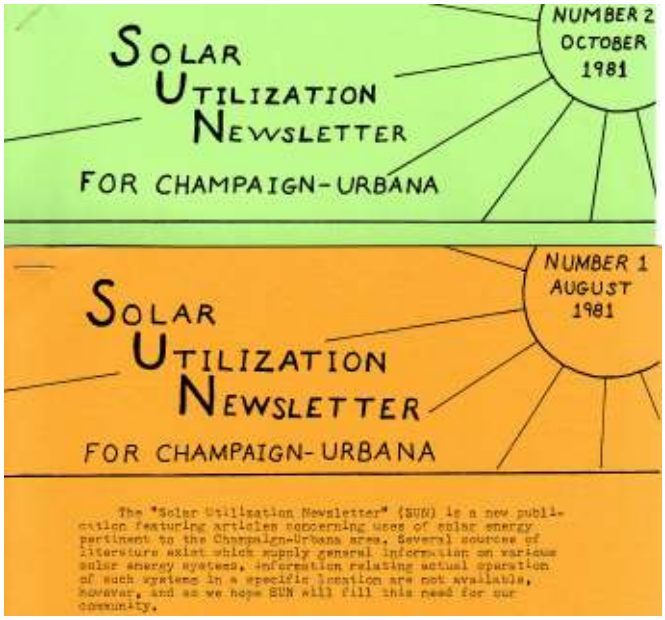
I also found that an undergraduate education was not sufficient for a career in alternative energy, at least one involved in research and development of the technologies needed for a sustainable life. I took a couple of graduate engineering courses at The Ohio State University (not an easy thing for a UMichigan grad to do), and had the great fortune to take a thermodynamics course from Michael Moran. Professor Moran was a young professor developing a thermodynamics textbook back in 1975. His book has been one of the most popular thermodynamics texts for many years now. Whereas thermo was one of my most dreaded classes as an undergrad (it was the only class where I received 0% on a test with partial credit grading…and 0% was what I deserved), I vividly remember walking out of Moran's classes thinking that this can't really be thermo because I felt I actually understood everything discussed…and I liked it, too. The main point is that teaching does make a difference and if I had

someone with less classroom skill and dedication than Professor Moran, I might have decided against graduate work in engineering.

Enthused that I could do well in graduate level engineering courses, I applied to a number of graduate engineering programs with an intention to work in solar energy. With my poor undergraduate performance record, I received many rejection letters (about 8), and only one letter, from the University of Utah, offering me admission and a teaching assistantship, too (getting paid to go to school!). We didn't know where the state of Utah was located, but if that didn't work out, on to Plan B, whatever that might be.

At the UofU, I worked with Bob Boehm (now, Distinguished Professor of Mechanical Engineering at UNLV) and Steve Swanson (Emeritus Professor at the UofU). My masters thesis was on solar heating systems for residential and industrial processes, and the results were used as the basis for a solar system design handbook for the state of Utah published in 1978. We monitored and studied several solar thermal energy systems scattered around the state: air systems, water systems, residential systems, industrial systems, agricultural systems, and solar ponds. Coupled with the experimental work were extensive computer simulation modeling of the processes in order to determine whether theory and reality matched, and if not, why not. I worked on solar ponds (a large scale solar thermal energy system primarily of interest for industrial and agricultural processes) for my doctorate, finishing in 1980.

With my usual lack of planning or direction, and being fortunate that Deb isn't overly distressed by our lack of certainty and security, I thought I would try an academic path for a while because it seemed to be a place where I could control the direction of my research activities. I accepted an offer from the University of Illinois, where I found the faculty I met during my interview to be collegial, invigorating and energetic. And to this day, for whatever reason or however it became part of our academic culture, the UI continues in this tradition across its many departments and colleges. I enjoyed my academic career and appreciate being a part of a great institution. Anywhere I travel from Beijing to Cairo to Buenos Aires to many other places around the world, I meet people the UI has touched. I enjoy living in Champaign-Urbana. The prairie and its environs are magical and it is home.


SOLAR UTILIZATION NEWSLETTER
FOR CHAMPAIGN-URBANA
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SOLAR UTILIZATION NEWSLETTER
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The "Solar Utilization Newsletter" (SUN) is a new publication featuring articles concerning uses of solar energy pertinent to the Champaign-Urbana area. Several sources of literature exist which supply general information on various solar energy systems, information relating actual operation of such systems in a specific location are not available, however, and so we hope SUN will fill this need for our community.

Deb and I began a short-lived newsletter (two issues) as we settled in Illinois to help people understand solar energy and energy efficiency improvements. Government support and public interest in solar energy waned as our memories of oil embargoes dimmed our nation's enthusiasm to gain energy independence. And we were only 30% dependent on foreign oil at that time.

I found that I enjoyed teaching in addition to the enjoyment of my research activities. At a large institution like the UI, you tend to have fairly large classes. I had over 3000 students in my engineering classes over the years, and hopefully many of these students had a positive experience in my classes. I used to worry that students who took my classes would be at a disadvantage in their succeeding classes. To my relief, there seemed to be no distinguishable statistical difference between my students' performances and those of other students in later classes, indicating to me that despite what I or my colleagues subjected them to, they would be alright.

My academic research was always a balance of basic research (eg, double diffusive convection) with an application I felt was important (eg, solar ponds). Advising 80 graduate students to their masters and doctoral degrees taught me that working with highly motivated people who are smarter than you (which was essentially all of my former students) is a really good thing. I just had to sit back and watch. The difficulty for my former students, as I would tell them, is that they are going to have a more difficult time than I had finding people smarter than them.

During the 1980s, solar energy research support went from bad to worse. The Reagan years saw the dismantling of Jimmy Carter's solar hot water system on the White House. The faze out of energy tax credits destroyed thousands of fledgling solar energy businesses in the US, while competing nations continued programs to foster the development and maturing of these industries. While research funds were minimal, I was able to continue solar energy research activities through most of the 1980s. We constructed some sizable solar thermal energy systems on the Mechanical Engineering Building along with the University of Illinois Salt Gradient Solar Pond, the largest solar thermal energy system in the State of Illinois. As a side note, the UI solar pond continues to chug along, providing valuable information on the cost effectiveness of the technology. We built the pond in 1986, and each year of operation provides valuable data regarding its longevity. I think our solar pond design has a projected lifetime of 50 years, but unfortunately development plans for that part of campus has it slated to become a water hazard for a new golf course. Interestingly, most of my solar research activities were sponsored by the US Army Corps of Engineers. Our military has been, and continues to be, one of the most aggressive promoters and developers of sustainable energy technologies.

Beyond the 1980s, my solar research continued on an unfunded basis, with primary funded research projects shifting to materials recycling and the "HVACR" (heating, ventilating, air conditioning and refrigeration) fields. I had been a longtime board member of the Community Recycling Center, a non-profit recycling organization that somehow survived many years of the vicissitudes of political will and market forces. Lots of dumpster diving research(most amazing find…a 600 pound ball of pizza dough), studies examining the correlations of collection costs to processing costs, deciphering the relation of corrugated materials (cardboard boxes) to other wastes, and the development of automatic sorting machines. One of the things you develop an affection for is the combined odor of stale beer, ketchup and laundry detergent perfume that is pervasive in any recycling facility. In the HVACR field, our research allowed me to work from the very basic level of refrigerant fluids flowing through a tube to highly complex refrigeration systems. This background has been an important piece of the puzzle as we developed the space conditioning system for the Equinox House project. A sustainable system requires efforts to balance the energy requirements with the methods for supplying the required level of energy and resources.

As the millennium approached, an interesting thing happened. Various student groups have always invited me to talk about solar energy, but from 1985 to 2000, my audience ranged between 1 to 4 people. As small as these audiences might be, and some really were only 1 or 2 people, if they are the right 1 or 2 people, they might be the ones who accomplish significant things. Around 2002, as I went to give a talk on solar to a student group, I entered the room and saw an overflowing crowd of people. I was sure it was the wrong room location. But it wasn't, and since that time, the audiences have been consistently full as our youth recognize the failure of older generations to address the problems that they will be facing. Will we rise to the challenge this time, or will we fade as before as the most recent energy price shocks become a distant memory? I don't know the answer, but as long as one person is interested in hearing about solar energy and energy efficiency, I'm happy to talk.

I was one of the advisors for the UI 2007 Solar Decathlon Team (www.solardecathlon.org), which was a wonderful experience as our students did a tremendous job designing and constructing a small solar powered house that was transported to Washington DC for an international competition. We "won"

two events (Comfort Conditioning and Market Viability), and received the BP Award for Innovation. The house is currently located at the Chicago Center for Green Technology, where you can visit it and see the CCGT, which is a great resource and interesting place to learn about many sustainability topics. The 2009 University of Illinois Solar Decathlon team put in a spectacular effort in the latest competition, placing second overall, and winning three of the ten decathlon events (the most of any team).

And that pretty much brings us up to date. I "retired" as an Assistant Dean in the College of Engineering in 2007 in order to work with my son Ben. Ben is also a mechanical engineer, and after graduation he decided he would like to take the risk to grow my basement located company (Newell Instruments) into a real business. Currently, our company consists of four engineers, with Ben as President and boss. He takes on all of the headaches required to keep a small corporation operating, and he allows me to have some freedom to explore and think. I have absolutely no idea about our finances, or how he makes payroll each month, or the incessant continuing headaches he endures from the various state and federal regulators that paralyze small businesses with inordinate administrative overhead.

Ben shares my interest in sustainability, and we have made the development of sustainable technology products a primary goal of our activities. We do this through our consulting with other corporations involved in energy related products such as refrigerators, and by the development of own products such as our CERV (pronounced "serve", Conditioning Energy Recovery Ventilator) multi-function conditioning system for superinsulated and supersealed buildings. We installed a solar electric system at our laboratory facility last year, which works as advertised, producing a significant fraction of our laboratory's energy requirements. And now the Equinox House project moves us to a new level of demonstrating the practical and economic viability of solar energy for providing all of our everyday living needs.