Fizix Korner

with Peter Lindemann

The sun has always been the greatest source of energy on this planet. But for many reasons, solar power has not made a major contribution to our modern energy usage. The biggest problem is availability. As a power source, the sun is there only half of the time on ideal days, and less during inclement weather. But there are other problems as well. Many involve a lack of innovative development.

Solar power really only became a viable product with the development of the photovoltaic cells used by NASA for powering satellites in earth orbit in the 1960s. But, while over 90% of satellites are powered by solar energy, very few homes or other buildings here on earth are solar powered. The reasons are clear. A $9,000 system from the REAL GOODS catalog (a very good source) produces only about 2.7 KWHs of electric energy on a sunny day. Here in Oregon that electricity, purchased from our friendly Utility, would cost less than 15 cents! I'd have to run the system for 60,000 days or 164 years to pay for it. What's more, 2.7 KWHs of electricity is only a fraction of what I usually use in a day. Let's face it, this is not being competitive.

But Tesla, in his masterful article "The Problems of Increasing Human Energy", first published in 1900, says that the sun's rays beat the earth with the equivalent of 4 million horsepower per square mile. Well, that sounds like a lot, but let's break this down so it is easier to see what it means in a practical sense. A mile is 5,280 feet. A square mile is this number squared, or 27,878,400 sq. ft. If we divide the 4 million hp by our 27+ million sq. ft. we get .143 horsepower per square foot. Using standard conversions (which we know are not absolute maximums) this comes to about 107 watts of electric power available per square foot. Our REAL GOODS system mentioned above, produces power at a rate of about 12 watts per sq. ft. That's only about 11% of Tesla's calculation. Surely, there must be something better.

And there is! What's more, you have one in your kitchen. It's called a heat pump. Usually these systems go by other aliases, such as "Refrigerator" or "Air-Conditioner", but really, they are just heat pumps. Have you ever noticed that it is warmer behind your refrigerator? That's because it pumps the heat out of the inside and gets rid of it on the outside in back. The inside of your refrigerator is used as the SOURCE of the heat and the outside is used as the SINK for the heat. As you might expect, the warmer the SOURCE area is and the cooler the SINK area is, the more efficiently the heat pump works. Even the casual observer may notice right away that the refrigerator is doomed to be relatively inefficient because it runs in a situation where the source area is cold and the sink area is warm. For the most part, heat pumps have always been used in these low efficiency situations. Even as a home furnace, the heat pump is drawing heat from the outside, usually when it is cold, and using it to warm up the house. But even in this less than ideal mode, the heat pump uses less than half of the electric power it would require to heat the same home with ordinary electric heat.

The question is, what would happen if we put a heat pump in a really efficient situation? What would that look like? Well first of all, the SOURCE area would be hot and the SINK area would be cold. To accomplish this, we could solar heat the source area and put the sink area about 15 feet underground where it is about 55 degrees and capable of absorbing tremendous amounts of heat. Next, we could devise a heat engine system that ran on the heat exchange process. All this sounds straight forward enough for someone to have tried already. The fact is, it has been tried.

Back in the old "Energy Crisis" days of the 1970s, an investment group was formed in the State of Washington with just such a plan. They raised a lot of money and assembled a technical team of highly qualified engineers, machinists, and heat pump experts. On a cold day in February, 1976, they tested the system for the first and last time. It was the most efficient solar energy system ever constructed, to my knowledge. Here is what they had. They used a newly developed parabolic reflector system to heat the freon, which is the working fluid in most heat pumps. The vaporized freon was used to power a specially built six cylinder radial engine to produce shaft torque, which was the output of the system. They had 12 solar parabolic panels of 8 sq. ft. each for a system total of 96 square feet of solar collecting area. On the day they tested the unit, the outside temperature was 20 degrees, but the sun was out. When brought up to full power, their specially built engine was able to deliver approximately 350 horsepower, measured on a dynamometer! That breaks down roughly to about 3-1/2 horsepower per square foot of solar collector, or 2,611 watts per sq. ft! They had demonstrated a practical way of powering a small neighborhood from the roof of a hot tub gazebo. This system was over 20 times better than Tesla had calculated was possible and over 200 times better than the photovoltaic systems commercially available today.

So, what happened to this technical breakthrough? Unbelievable, but true, the fund raisers of the group were siphoning off investment capital to buy land and the FBI had been watching them closely. The technical team couldn't understand why they were being delayed constantly by the fund raisers who could only raise funds during the research and development stage of the project. Finally, in a sneak move to finish, the technical team worked around the clock for days, culminating in the test of the system. The next morning, the FBI raided the installation with warrants charging the fund raisers with fraud. The equipment was confiscated and the technical team dispersed. I got this story from a former member of the technical team.

In spite of the intrigue involved, this solar assisted heat pump system is a proven method of large scale "Free Energy" there for the taking. It could be redeveloped for less than $250,000.

This brings me to the topic of a different solar assisted heat pump system being advocated by that notorious salesman named Dennis Lee and his company C.O.N.S.E.R.V.E. Financial Services. He has surfaced again, this time operating out of Seattle, Washington, after spending some time in jail in California. He is currently selling an information package for $59.95 that includes video tapes and printed materials of systems that were developed years ago. He has never delivered an operating free energy system to anyone, but he has raised million$ of dollar$ to do it. His literature looks great and all you have to do is call an 800-number to find out. Well, don't bother. The video tapes show nothing that is scientifically conclusive and the rest is just Dennis Lee ranting about all the injustices he has been subjected to. Having seen this man operate on a large crowd, I believe that most of the "injustices" he has been subjected to were self-induced. He is primarily a "sales type" of personality with only limited technical understanding about the systems he is promoting. I saw him constantly exagger-

ate, misstate, or otherwise garble most of the technical discussion involving specific efficiencies or timetables when the equipment would be available. Also, the technical package I bought from him did not contain all of the information he claimed it did. I personally believe that Dennis Lee has hurt the "Free Energy" movement in general and the interest in solar assisted heat pumps in particular. This is best illustrated by the fact that when I called one of the companies that build the "flat plate evaporators" that his system uses and told them that I was involved with Dennis Lee, they hung up! They didn't even want my business. Dennis Lee promotes the use of their product constantly, and they hate it. Either they are doing very well, or it says something about Dennis Lee. I've included this information because I hope to stir up interest in solar assisted heat pumps while helping you steer clear of Dennis Lee and his company C.O.N.S.E.R.V.E. Financial Services.

And if all this controversy is not enough, let's get into all the bru-ha-ha about FREON. As most of you may know, freon is one of those nasty chemicals, CFC's, that is supposedly destroying the OZONE layer in the upper atmosphere. While this may be true, it is not clear why the media continually ignores other potential sources of chlorine and bromine in the upper atmosphere. Confidential sources tell me that the solid rocket boosters used by the NASA Space Shuttle are a chlorine based compound and that each launch laces the upper atmosphere with large amounts of ozone destroying chlorine. To be sure, most of the destruction of the ozone layer has happened during the period of the Space Shuttle flights. While I haven't gotten to the bottom of this, it is interesting to see that just as the best use of freon is being discovered for use in solar assisted heat pumps, it is being rapidly withdrawn from commercial availability. If CFC's are contributors to the destruction of the ozone, their production must stop. In that case, I hope that other compounds can be developed with very low boiling points to replace them so that development of solar assisted heat pumps can continue.

Until that time, we may have to look elsewhere for efficient heat engine technology. For instance, back in the 1970s, Ford Motor Co. developed a four cylinder Stirling (external combustion) engine that out performed their 350 cubic inch V-8 in every way. It had 4 cylinders with a 200 cubic inch displacement and used hydrogen gas as the working fluid. It had only half as many moving parts and produced 190 hp at 1800 rpm. It got 75 miles per gallon on regular gasoline, but could be adapted to burn any combustible liquid, from kerosene to martinis. Ford even published a book on the test results which I have seen. As you may have already guessed, this excellent heat engine was never mass produced.

So, what is a heat engine? Heat engines are really very simple. The principles for their operation were first published by a French physicist named Nicolas Carnot in 1824. They run on a mechanical energy to heat exchange process known today as the Carnot Cycle. In general, it works like this. Some working fluid is heated and allowed to expand, delivering some useful work. Then the working fluid is cooled, compressed, and delivered back to the heater for re-expansion to start the cycle over. Some of the heat of expansion is "converted" to mechanical work as a useful output because the working fluid requires less work to compress when it is cool than the amount of work it can deliver under pressure when it is hot. This is essentially how the heat pump systems work. Heat engines usually operate with a working fluid that is repeatedly heated and cooled, expanded and compressed in a closed cycle. Heat is simply transferred to and from the working fluid from the outside of the engine. That is why they are sometimes called external combustion engines when run on fossil fuels, because the fuel is burned outside of the engine. But the internal combustion engine that powers your car is also a heat engine, and it operates on most of the same principles. The main difference is that the "working fluid" is a combustible air/fuel mixture that can only be used once and then discarded. This is an example of an open-cycle heat engine.

It is also possible to imagine an open-cycle heat engine that uses the sun as the source of heat and ordinary air as the working fluid. While the efficiency of such a system will be far below our solar assisted heat pump described before, it will allow us to get away from problem chemicals like CFC's and go "low tech" all at the same time. One example might look like this. A large chamber is created underground to cool incoming air. Air is then drawn from this cooling chamber and compressed 10:1 by a Tesla turbine style pump and delivered to an area that heats the air with solar energy. The hot, compressed air is allowed to reach a certain pressure and then is released through a second Tesla turbine for power production. The power turbine drives the compressor turbine and some other output appliance, like a combination starter motor and output generator. As a stationary power plant, size is not a significant factor, so the unit could be designed to move large volumes of air slowly to reduce losses to friction. This would also allow for efficient cooling and heating of the air. The system is mostly passive, uses air as the working fluid and has only two moving parts, the turbines. The efficiency of such a solar engine might be increased even more by further cooling the incoming air with a fine mist of water before compressing it. This would also help to increase the pressure at the hot end with the greater likelihood of added steam production. A typical 5 hp turbine uses about 40 cubic feet of 100 psi air per minute at 3000 rpm. If the cooling and heating areas had 200 cubic feet of capacity each, the air would have 5 minutes to cool off and another 5 minutes to heat up. The temperature difference between these two areas could easily attain 200 degrees on a sunny day to drive the system. I could go on and on describing this system, but I think you get the general idea.

There are lots of other possibilities for heat engines using solar energy that don't need special compounds like freon. Some are even "low tech" like the example just given. Well, that's enough for now. But, if any of you energy buffs out there have a good idea, let us know. We would be glad to evaluate your project, offer advice, or direct you to others who share your interests. 'Til next time, keep thinkin'.