

THE ACADEMY OF ELECTRICAL CONTRACTING

Paper presented by

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Conservation of Energy by Use of Sun Space

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CONSERVATION OF ENERGY BY USE OF SUN SPACE

An energy minded visitor to the Bloomfield headquarters of the Bross Utilities Service Corporation will witness a flat plate Solar Absorber Array, installed on the roof of the main office building that is providing heat during the winter months and will provide air conditioning in the summer months. This system is not a myth....it exists, and is to my knowledge, the only privately financed system presently in operation in the United States. After touring the facility and witnessing the dynamics of the system, the visitor will invariably raise the question.....
"Ted, how did you get interested in Solar Energy?"

I became acutely conscious of the energy shortage during a winter Florida vacation. "Why", I asked myself, "should Americans stand in long lines at filling stations to get a few gallons of gas when only 6% of the crude oil is imported from the mideast? In 1973 I published a booklet "Nations Energy Future - An Analysis" which explored the factors related to the shortage. Some of the highlights from the book are as follows, and I quote.....

"Our present energy crisis did not originate with the Arab oil embargo. The United States has 6% of the world's population and uses 35% of its energy. And demand for energy grows with population.

The shortage of energy sources could also be blamed on ecologists and conservationists. For five years they have been able to delay the building of the Alaskan pipeline. Their arguments were that it would interfere with the sex habits of caribou, damage the permafrost and finally, that there 'might' be oil spillage. I can not see what damage one pipe line could do to a state twice the size of Texas.

Similar arguments are being used to halt offshore oil drilling, including the sight of a rig which 'might' not be aesthetically pleasing.

Consider: In early December, 1973, the addition of two 1140 MW Nuclear units to an existing plant at San Onofre, California was denied by the California Coastal Zone Conservation Commission. The ruling by the 12 member board is believed to be the first

instance in the country where permission to construct a nuclear plant has been officially denied on purely environmental grounds.

The Conservation Commission said the expansion would deface sandstone cliffs and 'might' kill sea life.

It is true, of course, that small fish and other organisms are killed by 'entrainment' when they are drawn involuntarily into the intake system. Death by entrainment comes from the high velocity of the water flow, which smashes the fish into various parts of the system, and in the case of steam plants, by the sudden temperature rise of the cooling water, which causes thermal shock. The fish losses due to generating plants are minuscule in comparison to fish losses due to huge foreign offshore fishing fleets. Last July, the National Marine Fisheries Service reported sighting 210 foreign fishing vessels off the Middle Atlantic and New England coasts, some of them right at the edge of the 12 mile limit. In 1970 alone, Soviet and Japanese fleets caught almost five billion pounds of fish and shellfish in waters off the U.S. Pacific coast. And there is nothing we can do about it...

Our country has an insatiable appetite for electricity. In 1967 our peak demand was 25.3 billion kilowatt hours, in 1973 the peak demand was 41.8 billion kilowatt hours. It is generally accepted theory that demand for electric power doubles every 10 years in geometric progression.

Much of our shortages have been blamed on the oil companies. I can not agree with this theory. The root of the present energy crisis at the government level goes back to the first days of the Nixon administration. Those close to the problem traced its growth. Oil import quotas were devised in the 1950's to protect U. S. industry from cheap foreign oil. In early 1969, President Nixon set up a cabinet task force to review, and a year later, in March, 1970, this cabinet level group made its recommendations. They were declared to be unworkable by experts in Congress, in the energy industries, and within the Administration itself. The task force report was quickly buried. After the abortive attempt, the White House and Congress dueled over what should be done, but took only stop gap measures. Now we are screaming

because some of the flow of the import oil has been cut off. Last May, President Nixon relaxed import quotas, and a spate of oil companies announced plans to increase refining capacity. And prices began to rise.....

We are, actually, better off than most civilized countries in the world. We have the world's greatest deposits of coal, enough to last for centuries. We also have oil shale. Potentially, shale oil is a fabulous fuel. It requires no costly hit or miss exploration, no ocean rigs, no precarious negotiations with foreign governments. Instead, it is a U.S. resource, locked in immense quantities. Estimates range from 600 billion to 3 trillion potential barrels of oil in rock formations throughout the semi-arid Rocky Mountain States. But no major shale oil development could begin until the Federal Government, which owns between 70% and 80% of the oil bearing lands, decide to lease out its deposits. That decision, in turn, depends mostly on how serious the environmental effects of mining would be.

Another possible solution to the energy crisis,tap oil and gas lying under public lands, federal holdings account for 50 to 75 percent of all United States oil reserves.

Further research into alternative energy sources from the sun (solar energy) and under the earth's surface (geothermal energy) is a must in the very near future.

We should strive for immediate relaxing of the laws which hinder atomic plant construction, and for the time being, at least, allow coal strip mining without restrictions.

Conservationists and ecologists who, no doubt, will be critical of this analysis should consider the suggestions as a stop-gap measure. We must become self-sufficient in energy sources and stop our dependence on foreign oil imports."

You will note that only a minimal reference was made to solar energy. In the year to follow this publication I watched the beginning of violent price increases on fuel, and the attendant rise of utility's rates whose energy source is fuel, and I started to look at the cost effect on our Corporate Headquarters office, and my personal home, both heated electrically.

A book by Farrington Daniels entitled "Direct use of the Sun's Energy" led to the design and manufacture of our first flat plate solar collector.... a collector that brought water to almost the boiling point a collector that convinced me to seek more knowledge in the art of solar energy. Membership in the International Solar Energy Society followed by Seminars at the Colorado and Arizona State Universities convinced me that the finely turned theoretical presentations of the many PhD's in attendance, could be converted to a pragmatic set of hardware.

The two years of experiments to follow the decision to launch a Research and Development program generated many items which you may find of interest.

The purchase of a war surplus army searchlight gave us the opportunity to study not only the collection of energy in a parabolic receiver but also the collection of energy by continuous tracking of the sun. The parabolic collector, which is entirely dependent on constantly clear skies was quickly abandoned in favor of the flat plate collector.

The base on which the searchlight is normally mounted was converted to precisely and continuously position itself normal to the sun's rays. This equipment made possible the study of direct solar radiation as well as diffused solar radiation and allowed us to cut through tons of theory germane to the subject.

Various types of substrate (flat plate collector material) were tested with various types of flow geometry. Data collected on flow rate, flow area to surface area, and surface absorption coatings, to name a few items, dictated the selection of the three designs of panels to become part of the Solar Absorber Array.

Various types of glazing were employed and evaluated and tests were also run on single vs. double glazing.

Nova Scotia Redwood was selected for the containment box because of lightness in weight, inherent insulating qualities, and extremely long life when properly treated. This box, along

with its fiber glass and vapor barrier insulation, double glazing, and space age materials to render the assembly water tight, was chosen as the final test model.

Today we have installed on the roof of our Bloomfield headquarters, 12 rows of flat plate collectors, each with 9 units, or a total of 108 collectors. The support structure is inclined at 8° from the horizontal to avoid shadows from one row to the other and the collector panels face south and are inclined 52° from the horizontal. The temperature within each enclosure and the temperature of the inlet and exit water across each row can be monitored at a centrally located panel board. Since three geometrical flow patterns were selected as the most likely to succeed, the solar array consisted of four rows of each type with each unit being double glazed. The effects of solar flux, wind velocity, ambient temperature and system flow rate are evaluated on 15 minute intervals for two hours prior to, and two hours after, solar noon. The fluid used in the collector system is basically propylene glycol and water. A company brochure entitled "A New Concept in Energy Conservation" provides additional descriptive information.

The load system is designed to accept heat from the solar system through heat exchangers and to perform in any of three modes.

- (1) Heat or cool the building by totally utilizing available energy.
- (2) Heat or cool the building and directing surplus energy to a storage tank.
- (3) Heat or cool the building from energy available in the storage tank.

Our objective has been, and will continue to be, to produce the best possible collector at the lowest possible cost. Weight is an important consideration especially where roof assembly is required. We think we are well on the way to all of these answers. Test results from a desert test laboratory in the Arizona sunshine will generate volumes of data but will not forecast the performance of collectors that must function in the Northeast where frequent snow storms, blizzards, temperature inversions, cloud cover heavy with particulate emission

from industrial air pollution and great temperature swings in a given period are a reality. Our system has been exposed to an 18 inch snowfall in December, winds up to 60 miles per hour in the February 2nd, 1976 blizzard, and subzero temperatures over an extended period.

Our system became operational in Mid January and is expected to be shown publically in March. As we go through this shakedown and debugging period, we are gathering good old "New England" data.

The month of March will also see one of the collectors undergo testing in Florida.

Our objectives are clear. We expect to use the Solar Energy Absorber Array at our Corporate headquarters office to serve as a demonstration unit for those interested in Solar Energy, to continue the collection of data, and to reduce Bross Utilities Service Corporation electric bills from 50 to 70 percent. We expect to market a Solar domestic hot water heater, a compact heating and cooling unit that can be installed in new, or retrofit in older, residential buildings, and, larger units for commercial applications.

I think you can sense by now, the creation of a market not previously available to electrical contractors. As more and more pressure is put on the public because of price, and possible supply restrictions, you can expect these markets to come alive. Picture, if you will, the millions of solar domestic hot water heaters to be installed if only half of the present owners make the conversion. Certainly, the same picture holds true on retrofitting solar units to existing domestic and commercial installation. It is hard for me to picture new construction that will not include at least some portion of solar heating and cooling. The development and acceptance of solar units as a source of energy for both heating and cooling could truly become the greatest boon to electrical contractors that our industry has witnessed in quite some time.

There is nothing new under the sun.....its how it is put together.

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