THE CONSULTANT

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Chairman's Corner — ***John Dunn, President, Ambertec, Inc.***

I once went into a pharmacy to get heaven knows what and found myself on line behind this woman whose age I might guess to be late twenties to early thirties and who was DRESSED TO THE NINES!!! You just didn't see this kind of elaborate get-up everywhere you went; LOTS of makeup, a very elaborate hairdo and enough fragrance to set off a smoke alarm. I'm painting this picture to give you context for what came next.

It appeared that she had a small child at home who had developed a respiratory illness and for whom she was trying to select from among several different bottles of cough remedies that she had in her hands. The clerk was a young woman of whom the customer lady asked: "Which one of these is the most popular?"

There was a moment of stunned silence as the clerk seemed to realize that in this lady's mind, the decision of which item to buy was going to be based on following suit on which one most people other than herself would select.

The clerk was astute enough to say, "Let me ask the pharmacist." and then returned with his opinion of which one would actually be best for the child.

You may recall lines like "Go with the flow!" or "Ride with the tide!" or "Fifty million Frenchmen can't be wrong!" Oh yes they can and that lady was wrong.

I had the misfortune to discover that one project I was involved with would push the junction temperature of a power amplifier IC to 125°C while the device dissipated several watts. Its power derating curve went to zero watts at that temperature.

I called this to the attention of innumerable people, but it was for naught. Nobody in any position of authority would accept my word that there was a problem with this. Why not? I have some very cynical opinions about why not and in the interest of printability, I will withhold them. However, there were at least six managerial types who collectively and individually held the same bizarre position on the thermal problem; that there was no problem.

Eventually I was let go. Interestingly, the same thing happened to anther guy on that same project for a similar reason, but over a different issue. Some time later through the grapevine, I heard that the item had overheated and that "some changes were made". Do I regret opposing the flow or bucking the tide?

Believe me: AB-SO-LUTE-LY not.

Meetings

September 2007

Topic: "A Brief History of Cryptography."
Speaker: Jack Lubowsky, PhD, P.E.
Solutions To Fit, Merrick, NY

.
Regarding our new directory and/or alternatives, they will be in color, and the format(s) is/are yet to be chosen. We still must generate a mailing list.

We should inform the members about seminars and other items that might be of interest. E-mail: members@consult-li.com.

October 2007

Topic: A Brief Introduction to CAD and Solid Modeling

Speaker: Mr. Stu Senator, Dunton Design Associates, Inc.
Patchogue, NY
Time: 7:00 PM, Wednesday, October 3

Place: Briarcliffe College, 1055 Stewart Avenue, Bethpage, NY
See website for directions: www.consult-li.com

Admission is free (no charge), and no pre-registration is required. For more information, contact Chairman John Dunn at (516)378-2149 or e-mail ambertec@ieee.org.

Some free online programs will be available for those who want to try them, but there are no directions, phone support, or online support. A computer problem interfered with this presentation in August. We are taking new precautions this time!

Other Meetings

Consult the Events Calendars on the Section website: www.ieee.li and the LICN site: www.consult-li.com.

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New OTEC — ***Dr. Richard LaRosa, sealevelcontrol.com***

OTEC stands for Ocean Thermal Energy Conversion, which is accomplished in an engine that pumps warm surface water through a heat exchanger (the evaporator) to vaporize a working fluid (ammonia in this case) that expands in a turbine and exits at a lower pressure into another heat exchanger (the condenser) that is cooled by water pumped up from great depth. The efficiency of this engine is defined as the shaft power out of the turbine divided by the rate at which heat is supplied to the evaporator by the warm water. That's my definition. A proper thermodynamicist would say that some of the shaft output drives a liquid ammonia pump that pushes the liquid from the condenser back into the evaporator against a pressure differential, so its power shouldn't be considered to be part of the output. But in the upwelling application to be considered here, all of the turbine output is used to run the engine. Most of it goes into the warm- and cold-water pumps, with a lesser amount doing the housekeeping such as controls, navigation lights, data transmission, monitoring, bailing pumps, and other chores that will turn up as we try to get the thing going. So why accuse that poor little liquid ammonia pump of being different from all the other loads on the turbine?

Anyway, the turbine shaft output power divided by the rate of heat supplied by the warm water is approximated by the [isentropic efficiency of the turbine] times the [difference between the evaporation and condensation temperatures of the ammonia] divided by the [absolute ammonia evaporation temperature]. The surface water temperature of the tropical ocean, where we are going to put these upwelling pumps, can be considered to be 27°C. It might get warmer during summer, but we are designing for worst case, and 27°C will be the minimum temperature. The cold water pumped up from 1000-m depth will be 5°C. But these are not the ammonia temperatures. Using heat exchanger designs from "Renewable Energy from the Ocean - a Guide to OTEC", a book by William H. Avery of the Johns Hopkins University and Chih Wu of the United States Naval Academy, the ammonia evaporation temperature is 4.44°C below the warm water inlet temperature, and the ammonia condensation temperature is 4.44°C above the cold water inlet temperature. So we lose 8.88°C from the 22°C water temperature difference, leaving us with a 13.12°C ammonia differential. You can see how the efficiency is eroded by the heat exchangers, and this design puts a lot of water through the heat exchangers so that the water temperature change is held to 1.11°C.

The absolute evaporation temperature is (27 - 4.44 + 273 = 295.56)°C, so the thermodynamic cycle efficiency is approximately (13.12 / 295.56 = 4.44%) times the isentropic efficiency of the turbine. Based on designs in the literature, the isentropic efficiency could be 84%. This would give 3.73% for the cycle efficiency. A more correct thermodynamic calculation gives an efficiency of 3.66%. I still have to learn what isentropic efficiency means. I think it has to do with the orderliness of the vapor expansion through the turbine, the reversibility of the process. The approximate efficiency calculation is close enough, and is useful because you can see how temperature drops in the heat exchangers eat up the efficiency. I get the feeling that I should have divided by the absolute temperature of the warm water source to get the efficiency, but my thinking is too muddled at the moment, and it only makes a small difference, so let's get to the point of all this.

The point is that this mediocre thermodynamic cycle efficiency is the best we can achieve by using all the turbine output power to pump the maximum amount of water through the two heat exchangers to minimize the temperature drops. No power is exported, so the efficiency of exported power production is actually zero. There are many people proposing OTEC power plants that export electric power or some product that requires net power to produce. Since 1928 attempts to do this have been partially successful, but not encouraging enough to justify full scale development and deployment. Here's my understanding of what is getting in the way:

As soon as you try to sneak some revenue-producing power out of the machine you find you have to cut down on the power used to pump obscene quantities of water through the heat exchangers. So less water goes through the heat exchangers and the temperature drop in the evaporator and the temperature rise in the condenser increase. Whoops! There goes the efficiency. Now we need more heat exchange area to get the required heat transfer with less water flowing. This means the already big clumsy heat exchangers get bigger and clumsier. But now we have longer water passages with more resistance to flow, and that takes more pumping power.

Dr. Luis Vega of the Pacific International Center for High Technology Research (PICHTR) has probably had the most success in demonstrating net power production from an OTEC system. I used one of his proposed designs as a template for my upwelling pump calculations. After calculating a discouragingly low thermodynamic cycle efficiency, I wondered how anyone could pack the enormous heat exchangers into a structure that could be moored in an ocean area that would experience hurricanes. Some help from NASA's Space Alliance Technology Outreach Program enabled me to look at the design from the viewpoint of their partner, Professor Vincent Choo of New Mexico State University. My design was unacceptable. I had to put all the pumped warm and cold water through the heat exchangers and use simple tube-in-shell types with low resistance to water flow. Put all the power into running the plant. Zero net power production efficiency. Concentrate on the value of the cold water and the nutrients, something that has been examined in previous Newsletter articles.

I gained considerable understanding of funding and how to make programs work from a new book by Patrick Kenji Takahashi entitled "Simple Solutions for Planet Earth - Book 1". I have corresponded with Pat for more than a year, and our lives are quite different. I labor in the bottom strata trying to work out the scientific and technical stuff , but he deals with senators and other government officials and heads of universities and big companies. He was instrumental in the formation of PICHTR, where Dr. Luis Vega and his team have had some success with OTEC system feasibility demonstrations. Pat does a lot of golfing and socializing. Legislation has been written and passed, and big appropriations have been made. Quite a different lifestyle and point of view from mine and that of the guys who labored lovingly over the details of the heat exchangers in Avery's book. But we need money and clout, and maybe Pat and PICHTER and the University of Hawaii might be interested.

OTEC is the power source required for the upwelling pumps that can cool Earth's surface and provide nutrients to restore ocean food production. Leave the power production to wind, wave, and tidal power, which are now beginning to receive funding.