THE AVE CONCEPT: A Paradigm Shift on How Energy Resources are Evaluated

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Will Rogers said: "It's not what we don't know that gives us trouble; it's what we know that ain't so." If you'll indulge me a few brief paragraphs to provide some background I'll explain how this seemingly simple statement has such profound implications with respect to the energy/environmental dilemma which we are currently facing.

In the realm of thermodynamics, Carnot developed an equation that established the maximum efficiency for a heat engine operating in a cyclic mode (e.g., Rankine Cycle) that absorbs a quantity of heat from some source (heat input) at high temperatures and rejects (a portion of) it at a lower temperatures, with the difference being the potential for extracting work from the device.

That equation is: $n = 1 - Tc/Th$

where n is the efficiency (fraction of input heat converted to useful work—e.g. electricity)

1-n, is the portion of the input heat that must be rejected (discarded) at the lower average temperature

Th is the average (hot) temperature at which heat is absorbed by the working fluid

Tc is the average (cold) temperature at which heat is rejected by the working fluid

As one can readily conclude by inspecting the equation:

(1) The higher the temperature at which heat is absorbed, the higher the efficiency of the process, and

(2) The colder the temperature at which heat can be rejected, the higher the efficiency of the process.

(3) Any attempt to generate work from purely "terrestrial" sources (excluding geothermal) is doomed to failure because of the hopelessly low efficiencies that would result from the need to reject heat at virtually the same temperature at which it can be absorbed (Tc ~ Th)

Engineering science, by making metallurgical improvements over a period of years, has managed to slowly increase the temperature at which heat can be absorbed, Th. However, as one might expect after long years of research, the returns from this effort have diminished considerably.

Ever since we've been using heat engines to generate electricity, whether the heat input originates from the burning of fossil fuels or from nuclear ones, we have operated

under the assumption that the lowest temperature available to reject the unused portion of heat is the prevailing local temperature at the surface of the earth. All of our power plants do this, and, if we're lucky, there is a body of water available cooler than the air to assist in the removal of the heat at a temperature as low as possible.

A further problem with rejecting heat at the earth's surface is the fact that the temperature there is highest in the summertime. This causes power plant efficiencies to plummet in most locations at precisely the time of day or year when the demand for electricity to accomplish space cooling (A/C) is the highest.

This is where Will Rogers's profound statement becomes relevant. The belief that the surface of the earth is the coldest place available to reject waste heat simply **"ain't so!"**

Before revealing the location of this "colder sink", let's reflect on how this supposed "knowledge" that surface temperatures are the lowest ones possible, has given us trouble.

It has caused us to:

- Burn significantly more fuel than we would otherwise need to in existing power plants for a given electrical production rate.
- Discount the potential of significant amounts of waste industrial heat, and vast reservoirs of geothermal heat (50—150 C) because their temperatures are not considered to be high enough to produce economic electricity.
- Completely ignore the potential of low temperature heat sources (< 50 C) containing vast supplies of energy (warm seawater, "urban heat", seasonably warm lake water) due to the perception that none of the sinks available are cold enough to make it worthwhile.

The maximum work that can be produced by transferring heat from a hot source to the standard heat sink (the temperature at the bottom of the atmosphere) is called exergy. Reducing the temperature of the heat sink lowers the basis for exergy, increasing the work that can be produced from any heat source. In particular, it greatly increases the work that can be produced from low temperature heat sources.

Situated only a few miles above any power plant is a much colder location to which its waste heat can be rejected. It is the upper troposphere, or tropopause, which can be 60-90 K colder than the surface. The seasonal variability of this temperature is less than the surface variability. Therefore, the efficiency of a thermal engine using the upper troposphere as a sink to reject heat would not decline nearly as much during the summer months as current installations do which use sinks at the earth's surface.

The device which can provide access to this heat sink is Mr. Louis M. Michaud's (P. Eng.) Atmospheric Vortex Engine for which he has obtained Canadian and US Patent rights (others pending). Mr. Michaud has developed this concept and theoretical basis in work over nearly a forty year period, and participation by others in the technology is available by means of partnership with the AVEtec Energy Corporation which he has founded.

The key element Mr. Michaud's device is the creation of a" "vortex" at a fixed location on the earth's surface. The device "works" when the ascending column of air (which is the vortex), is more buoyant, on average, than the surrounding air through which it ascends. Since the rotating column carries angular momentum with it, which has the properties of a vector, its magnitude and direction is maintained as it is displaced upward making room for the air following behind it. Having vector properties apart from the simple velocity vector that any updraft would have, the rotating column does not degenerate into random fluctuations as easily as the latter does, which tends to entrain cooler air at much lower altitudes. A gyroscope imparts similar stabilizing properties to a guided missile.

Once an ascending flow of air is established, angular momentum is built up in the replacement air by physically deflecting the flow into a spiral pattern. Near the center of the confluence, when the tangential velocity has reached a maximum, the air is released through the "roof" of the device where it begins its ascent.

The best method (structure) to deflect the air, best turbine design to extract some of its energy, and best exchanger design to add additional energy from the sources mentioned above, are areas which are under active development. However, additional engineering expertise and refinements would be welcomed, I'm sure, to achieve the optimum configuration and scaled-up design. This design would vary according to the precise application and energy source involved.

With his decades of work, Mr. Michaud has provided us with the basic concepts needed to construct an "energy conveyor belt" which is able to access the beneficial colder temperatures and provide us with great possibilities to obtain additional electricity from the carbon-rich fuels we currently burn, or from nuclear fuels which are becoming increasingly short in supply. In any event, new supplies of power from the latter source would require that extremely expensive new facilities be built and would take decades to carry out. A much faster alternative would be to add AVEs to the back end of existing plants (the ultimate bottoming cycle) increasing their generating capacity by over 20%, while permitting the operating temperatures to be lowered somewhat to increase the safety factor and extend reactor life.

Eventually, the device developed by Mr. Michaud should be capable of generating power from “purely environmental” sources that could bring to an end, once and for all, the need to burn carbon-based fuels that contribute to AGW, or the generation of electricity from new nuclear plants when the spent fuel disposal problem from existing plants has yet to be solved in a convincing way.

With his invention, Mr. Michaud has developed nothing less than a “new way forward” that could achieve what we all hope for--to replace diminishing clean fuels used to generate power with carbon-free alternatives. For existing fossil-fuel based plants, it could provide the “efficiency boost” that would allow the economic removal of a significant fraction of the carbon dioxide from the effluents and be compressed so that it can be sequestered. This would prevent it from being discharged to the atmosphere and contribute to global warming.

What is needed now is to obtain the required financial support to move this technology forward. If scientists and engineers were to come together in agreement with respect to the validity of the claims made herein, and support the AVE’s development by attesting to its potential benefits, we could spread the news. The contacting of political representatives, or a “heads-up” given to key officials with whom you may be acquainted at your local power company, would be additional measures that could be taken to bring us one step closer to the eventual deployment of the AVE.

I know, it takes courage to speak out on behalf of a technology which has yet to be proven convincingly in a demonstration scale project--especially one which purports to “extract energy out of thin air”. Yet, interestingly enough, that is what the AVE accomplishes.

I say “bravo” to Mr. Michaud for his initial insight and persistence in getting this technology to where it is today. Let’s make sure that he doesn’t have to shoulder the burden of proving his concept “beyond a shadow of a doubt” without help from the scientific and engineering community of which he a part. Let’s get off our “half-moons” and aid him in this effort. Your children’s and grandchildren’s generations would be very grateful to you for any contribution you could make in this effort.