Emerging Innovation
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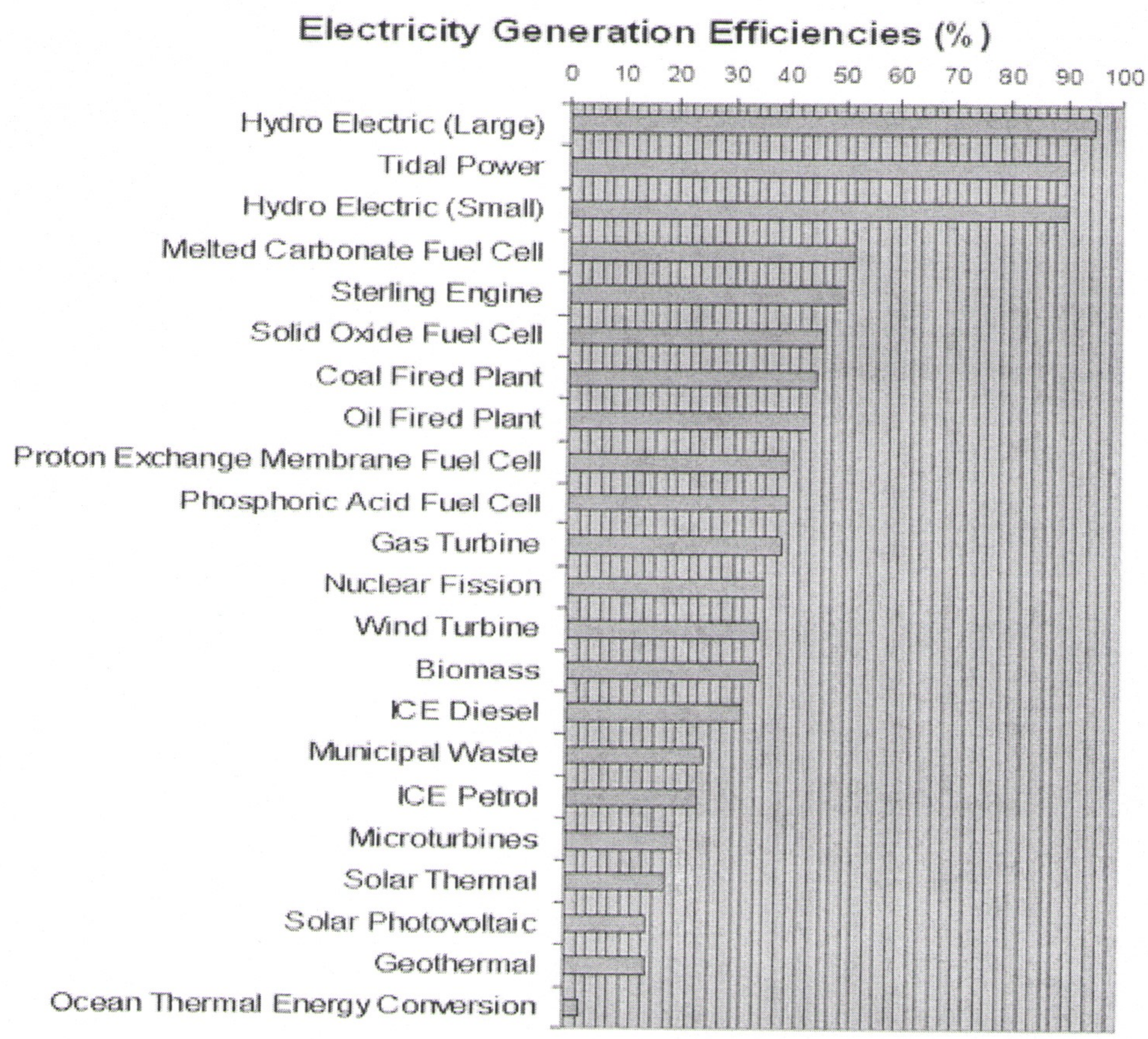
2.1 Company & Technology Overview

I am an independent researcher working on developing a direct heat-to-electricity conversion device of high power densities. My prototype generator of prior art has had a conversion efficiency of 94% electrical power, when using propane fuel as a heat source. This is the highest heat to electrical output of any thermoelectric Seebeck device ever discovered, as well as any conventional fossil fuel power generators. The science underlying my technology has recently been confirmed by academia; and is currently being applied in industry to other electronic devices. The advantage of this new type device far exceeds any technology available in the market today. A typical thermoelectric Seebeck device can produce only 7-8% efficiencies for use in small electrical devices, and has been more of a novelty. Larger thermoelectric generators can produce higher power densities, but at higher cost. The weight of these large thermoelectric devices makes their use restrictive, and limits their electrical power densities to only a few hundred watts. It is impractical for a conventional thermoelectric device to produce electrical power in the Kilowatt range as the device size and weight would be massive. Using my new heat-to-electrical converter is the first time basic low temperature heat can be converted directly to usable electrical power at efficiencies equal to or greater than conventional power generation, and is matched only by Large Hydro Electric Generation at 95% efficiency with only a one percent advantage. The efficiencies of all fossil fuels fall short at ICE Petro 24%, ICE Diesel 32%, Biomass 34%, Gas Turbine 39%, Oil 44%, and Coal 45%. This new thermo electrical conversion generator also has a 44% increase in efficiency over the Sterling Engine at only a 50% efficiency. Surprisingly, the Sterling Heat

Engine is the technology of choice, where long term power is needed in remote locations. The sterling engine is a mechanical device that could be prone to mechanical failures. My new electrical generator can produce high density electrical power for years without the need for service and repair because there are no mechanical parts that need replacement.

Efficiency Comparisons

The table below shows the theoretical efficiency of converting various energy sources by a variety of methods into useful electrical energy.



Source - Eurelectric

The technology is cost competitive with all small scale power generators on the market today. The technology advantage is in the fuel efficiency of operating the quiet solid state device that has no moving parts. The generator can be used with any heat source including waste heat of automobiles, home and industry as well as heat producing technologies. The weight to power density of the generator far exceeds any electrical power generator in use today, averaging approximately .004 lbs per watt. As an example, this averages out to be 80 lbs per 20,000 Watts

of electrical power. These weights are arrived at from prototypes, as this weight is expected to be even less in production units. The small size and high power makes this device suitable for any portable or mobile application.

The market potential for this type of electrical device in automobiles, home, industry and space is limitless, given the fact that it can operate at full power at moderately low temperatures; which is an advantage for waste heat recovery and solar applications. This device is truly the missing technology in the alternative energy market where low temperature heat is easily obtained; but until this technology, not easily utilized for electrical power generation.

The huge demand for this technology is the beauty of the market potential. The generator can easily sell itself and could be retrofitted to produce power in the Kilowatt range for any application imaginable. Although the generator does need a source of heat to operate, it is truly a flex fuel device. Taking into consideration the world need for such an electrical generator, it precipitates the most simple business plan available. Using minimal resources and manpower available, the launch of the manufacturing will start with the sale of the first prototypes. Then a second generator will be produced showing a profit significantly enough to produce 4 more generators and so on. This business plan has been used by America's most successful entrepreneurs and inventors. It is also possible to sell limited use licenses to manufacturers for specific applications of the technology.

2.2 Energy Security Value

In 2011, the United States gasoline consumption was 134 billion gallons according to the Independent Statistic & Analysis of the U.S Energy Information

Administration (EIA). The average efficiency of the internal combustion engine is 30%. Most of the energy that is consumed in the engine during operation is expelled through the engine exhaust as wasted heat. Another large percentage of loss is in the operation of the water pump, power steering, air conditioning, alternator and other auto accessories. The remainder is expelled as friction, producing heat of the moving parts in the drive systems of the automobile. An automobile equipped with my heat to electrical power converter could utilize this wasted energy to produce electrical power. The engine driven belt components, such as the water pump and power steering, would be eliminated and now driven by the electrical power produced in the new Seebeck thermoelectric converter, located in the engine exhaust system and making the alternator obsolete. The engine air condition belt system would be eliminated, as the passenger compartment air conditioning could be operated electrically. This could be achieved in one of two ways. First, as a standard electrically driven cooling compressor system, or second, using the Seebeck heat to electrical converter operating in reverse in the Peltier mode resulting in electrical power being fed to the converter device in place of heat, producing cooling air. The Peltier thermoelectric devices are currently used as passenger seat cooler and heaters in many late model automobiles.

My new thermoelectric converter could increase the fuel efficiency of the average automobile that wastes 70% of the fuel, mostly in the form of heat. The energy savings using approximate estimates if all U.S. automobiles were equipped with this new converter could be at 94 billion gallons annually, given 100% efficiency. A more realistic figure would be, if U.S. automobiles were made to be 60% efficient, rather than the present 30% fuel efficient. The yearly savings based on 2011 figures of U.S gasoline consumption alone could be 40 billion gallons annually.

Gasoline fuel savings for U.S. automobiles are the only fuel shown in this report, but the converter is not limited to fuels for passage cars. This technology can be utilized anywhere there is a source of primary or waste heat. The projections of annual U.S energy fuel savings could be tremendous if this technology is fully implemented by or before the years leading up to 2020. The many uses of this

technology and the result of energy savings in fuels when used in solar heat applications alone are incalculable.

Applicant: Anthony Paul Bellezza

2.3 Technology & Market Validation

This new type of heat-to-electricity technology has created a ground swell of interest for commercialization of the technology, from large electrical power generating companies to defense and space use. The most significant obstacle in the development of my technology for commercial applications has been in moving the technology from Phase One development into Phase Two, which then qualifies the technology for market investment. Phase One is where my technology has been for several years, which signifies the technology works as proved by laboratory testing and small operating prototypes. In many cases with private inventors, such as myself, this phase is done in basements and work shop garages using antiquated equipment and minimal research dollars. Most new "out of the box" revolutionary technology evolved in this way. Phase One development is defined as more of an art form that is in need of additional engineering. Phase Two technology development is when the technology is ready for commercial investment and production within months of funding. Phase Two development is the time large companies want to invest in the technology, as return on investment is usually within the same calendar year. I have come to call Phase Two as the "No Sweat, All Gravy" phase of the development, when companies line up for possible available markets. The interest in my technology has been overwhelming; however, companies who are interested in my device usually tell me to return when I am further along. Consequently, their research dollars will no longer be needed at that time, as I have the best and proven marketing plan available as summarized in part 2.1 of this application.

NASA scientists have also shown an interest in my technology. Their interest has been for good reason, as the United States has launched 26 missions involving 45 Radioisotope Thermoelectric Generators with efficiencies between 3-7%. The

total weight ratio to electrical power densities has hindered higher available electrical power, only achieving several hundred watts at best. I can only imagine the consequences of a manned deep space exploration to Mars with only a few hundred watts of electrical power available. The alternative, state of the art Radioisotope Sterling Heat Engine that operates using mechanical pistons rotating a conventional electrical generator within a multi-billion dollar space craft, is not the most efficient way for electrical power generation when compared to my technology. As a matter of speaking, a Ford Model T engine could be comparable and do the same. Unfortunately, lack of NASA funding has hindered and stopped any further inquiries into development of my technology.

2.4 Industry Interdependence

The most significant impact my heat-to-electrical technology will have is in making the electrical grid the secondary choice of power distribution. A densely populated city with a large amount of housing could become the newest power generating exporter as many homes in large cities have natural gas service for hot water and heating. Utilizing just one 5,000 watt heat-to-electrical power converter per home, could create hot water and heating for the average size living space with enough electrical power for all the family needs. The average electrical usage for a household in the United States is 1,200 watts 24 hours per day. This leaves an excess of 3,800 watts to be sold back to the power grid. This integrated power generation, makes black outs the thing of the past, as it becomes impossible to power down the city from any natural disaster or other eventualities. This type of new power generation is a true internet of power distribution, requiring no centralized hub to function. The use of solar applications with my new heat-to-electrical power generator is an added advantage in rural areas of the United States. Heat could be stored for use on cloudy days and night time, or electrical power could be purchased back from the grid distribution. Industries that utilize wasted heat could create a secondary revenue source, selling power back to the grid.

The infrastructure needed for this integrated power generating network is already in place in large cities. The increase in natural gas production primarily from new technologies is nicely creating this type of integration in power distribution. It has been said in the United States we have large deposits of natural gas able to last for decades. There would be no need for large power generating facilities that are vulnerable to natural environmental occurrences and other disruptions. The current research into heat producing technologies could possibly merge these technologies into the market; this may become another milestone in human history and survival. Government can also play a role in creating legislation that recognizes any Phase One level development in energy technology as being a public necessity. This would allow grants to be given continuously by nonprofit organizations directed to the same promising technology, without violating fair market competition laws. These legislative changes should allow this to occur, only while the technology is in the research and development stages that readies the technology for Phase Two and market investment. The success in America's farming and preservation in farm lands came about by changes in the tax code that recognized farming production in food as a needed public benefit. Securing a grant to grow strawberries is easily attainable, as opposed to a grant to advance a new energy technology that is equally important.

2.5 Risk Narrative

One of the biggest challenges in the development of this new technology is overcoming the disciplined mind set of engineers and scientists that have not been acclimated to these new discoveries. There have been many times I was required to introduce my work once again, after being rejected at first sight. Their deeply held beliefs based on prior knowledge are most difficult to overcome, and in many cases don't apply to my new heat-to-electricity converter. The learning curve in this introduction takes up precious time, and in many cases fails to overcome the institutional mind set brought to the discussion. A paradox is evident in the demonstration of the technology, as many professional people prefer to save face and characterize the testing results as an anomaly.

The tide is changing since the start of my heat-to-electrical converter research 14 years ago. The successful research in national laboratories and academia of the

scientific principles that underlie my technology has been published in recent years. These same principles can be found not only within my heat-to-electricity converter, but are merging into electronic instruments produced by many cutting edge manufacturers around the world and has been said to be the dawn of a new age in electronics, in size and capacities. The monumental task of educating and training engineers to an entirely new way of producing energy could be limiting for any technology in start up mode. The obstacles are greatest in the first years of production as independent contractor assemblers would need to be trained. This would create jobs in industry for implementation and retrofitting existing technologies for use with this new heat-to-electrical power converter. This impedance in the start up stages would move slowly into an asset, as more workers become accustom to the technology. New usages for this unique energy device will be discovered and implemented.

It is clear that the future has now caught up with my technology. Statements and claims that I have made for years about the operating functions of my technology that seemed so far outside of the generally accepted norms of science are now routinely talked about in scientific technical publication on a daily bases. It has been refreshing that there are so many scientists that are finally in agreement with all the possibilities of this new technology. I have taken great stock in the fact that my journey of discovery has come full circle and my technology will soon be a reality.