

# A Business Plan for Aeolus Technology, Inc.

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## Executive Summary

If a technology existed which could equip automobiles to achieve over 150 miles per gallon of fuel; what would that be worth? What if this technology was already evaluated by a disinterested, third-party, engineering firm who was so thrilled with the technology that it volunteered skilled labor, production space and equipment to assist in building a prototype? Aeolus Technology, Inc. holds a patent on just such an item called the Air Compression Hybrid Turbine Engine (ACHTE). This technology makes use of a rather simple pressurized air compartment, which spins a turbine to create electricity. The product is currently being designed for use in a hybrid electric vehicle.

Mr. Gus Tsatsis (the founder of Aeolus) is planning to build a prototype of an Air Compression Hybrid Turbine Engine, which will be used in the automobile industry as a fuel-efficient engine. The product has been by BCO's and we are currently seeking funding to develop a prototype. To adequately demonstrate the value of the breakthrough technology, a prototype has to be developed. Thermo craft engineering is ready to provide its engineers, space, and utilities to build the prototype. The expenses include material and start up costs for Aeolus has been projected at \$1,000,000. We will build a prototype with in one year and explore manufacturing and sales opportunities for the existing and future hybrid electric engine markets.

The possibilities for this technology are numerous but the most relevant use may be for the hybrid engine market for fuel-efficient cars. The model year 2014 is poised to be an exciting year for the automotive industry. the market experienced a strong rebound in new vehicle sales in 2013, and it appears that this positive momentum will continue in 2014. The U.S. economy is gradually improving, and rising auto sales are a contributing factor to continued improvement. Edmunds.com predicts that the auto industry is on pace to sell 16.4 million new cars this year, the most since 2006. <sup>1</sup>

Support for these emerging "clean technology" products is shown in legislation, which passed in 46 states for various alternative fuel vehicle incentives. The nature of these programs varies from industry based to consumer based monetary incentives but the trend and value are clear. Clean technologies benefit society. As a result, the federal, state, and local governments are supporting these technologies.

The electric generator market also poses a great opportunity if Aeolus can adapt the technology and create a more fuel-efficient electric generator. Reaching further with this technology it may be possible to adapt it to the aircraft engine, thus brining the fuel efficiency gains to the air travel industry. The Department of Defense has a number of programs aimed at improving military readiness with technological advances. A hybrid vehicle obtaining 157 mpg with a small 15-gallon tank could have an effective range of over 2,000 miles. Military vehicles typically carry larger tanks, require more horsepower and drive on rugged terrain. The result is that the current range is more like 250 miles per tank. Even taking the additional

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<sup>1</sup> [http://www.greenercars.org/highlights\\_mktrends.htm](http://www.greenercars.org/highlights_mktrends.htm)

load and capacity requirements, Aeolus's new hybrid technology could significantly increase the effective range for tactical vehicles.

## Product Description

The prototype, which Aeolus intends to build, is an Air Compression Hybrid Turbine Engine. The term hybrid means the combination of two or more sources of power to run an engine. The fuel initially powers the engine and gets it started, while the electricity generated provide power to run the vehicle. The system cuts emissions and decreases fuel consumption by automatically sharing the power to run the vehicle on electricity as well as gasoline. The battery pack is automatically recharged and surplus electricity produced is saved to provide energy for back up. The primary focus will be placed on product engineering and manufacturing processes to ensure the highest quality, a high level of product features, and the most efficient manufacturing process possible.

The prototype ACHTE has the capacity to run 156 miles per gallon, and is specially designed to be extremely precise when controlling movement of the various features of the machine. Also, as the product produces a huge amount of electricity it can be used in commercial and household generators.

The ACTHE will include features including a venturi valve and turbine to produce surplus electricity so that the vehicle can run on both fuel and electricity in order to be much more fuel-efficient. The rotation of turbine during the winds will enhance the speed with which it rotates and will result in producing higher efficiency. The concept of combining various parts like pressure tank, turbine and generator not only increases the horsepower to 23 but also makes it environment friendly.

The technology is now patented in the United States and will remain protected for another 15 years. The cost of our prototype is much less in comparison to the investments of companies, which are actually coming up with hybrid cars. For instance, Daimler Chrysler spent 3 billion dollars just to build a hybrid engine prototype. In addition, companies like GM, Ford, Toyota and Honda have spent billions of dollars in R&D to develop hybrid engines. The best part of our engine is that it is light in weight in comparison to present engines, which will decrease the wear and tear of the body of car. Moreover, our engine can also run on ethanol, which is considered as synthetic fuel that can be created artificially in the event oil reserves depletion.

Last but not the least, is that the US Government is insisting on carmakers to produce fuel efficient and environmental friendly cars. As of 2010 Congress allowed up to a \$7500.00 tax credit for purchasers of high-mileage vehicles such as electric and hybrid cars now on the market.

# Target Market

The target market for this hybrid engine would include any entity that uses energy to do a certain job. Essentially, the potential target markets for this product are the manufacturers of all kinds of vehicles, airplane manufacturers, industry and consumer appliances, commercial building and households, and government agencies such as the Department of Defense (DOD). In effect, the focus is to sell to anybody who can carry the product successfully into the respective markets and demonstrate the economic feasibility of it, along with demonstrating highly environmentally lucrative side of it.

Currently, there are more than 265 different cars<sup>2</sup> available in the US marketplace for the 2015 model year. We find it practical to segment this market into clusters of types of cars because ideally, the sizes of vehicles play a vital role in determining the mileage as well as influencing buyers purchasing decisions. There are many sorts of engines coming up with improvements in technology ranging from conventional gasoline powered engine to solar to electric and most recent, already in use, the hybrid engines that combine two or more sources of power to create combustion in engines. And companies are investing heavily too in this sector. Most popular domestic and foreign automakers offer some sort of hybrid vehicle, including the current Toyota Prius at a price of \$25,750.00 before state and federal taxes. Although this is a little overpriced, experts suggest that demand for these cars have been rising to some extent in the US; people have become more concerned with their up-surfing fuel expenses than ever before. In 1999, more than one-and-a-half million fuel-efficient cars were sold in the US only. The top ten most fuel-efficient cars, most of which include sedans and/or compact cars and most of which are made by non-US based companies, run up to 30 mpg in the city and 45mpg<sup>3</sup> on highways on average. Our proposed hybrid engine takes a step further to achieving incredible mileage in almost any kind of vehicle; it promises to give around 157 mpg on average on both cities and highways (refer to Appendix –A). According to the Electronic Vehicle Forecast<sup>4</sup> sales of fuel-efficient cars will grow at an amazing rate of 60% through the next five to seven years, and generate revenue of about \$45 billion alone for the automobile industry (refer to Table 2).

As with the developments in smaller cars, no such breakthroughs have been reported for the heavier vehicles. Big companies like GMC are investing in millions to come up with fuel efficient and cleaner cars, especially with SUVs. Although mentioned above that many consumers are getting more and more concerned with their gas expenses, on the other side of the coin, sales of these class vehicles have shown a sharp inclining trend since early 1990s. This is mainly due to the purchasing behavior of many US young professionals as well as the older group of consumers who earn or have earned handsome money look for big, fuel-guzzling SUVs and family cars and aren't as interested in fuel-efficient vehicles. According to a recent figure, for the quarter ending December 2013, Utility vehicles helped push the

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<sup>2</sup> <http://www.statista.com/statistics/200092/total-number-of-car-models-on-the-us-market-since-1990/>

<sup>3</sup> <http://www.fueleconomy.gov/feg/noframes/bestworstNF.shtml>

<sup>4</sup> <http://www.ibtimes.com/here-are-december-2013-big-eight-us-auto-sales-numbers-gm-ford-chrysler-toyota-honda-nissan-1525492>

Chevrolet (the third most popular brand in the U.S. after Ford and Toyota) to 1.95 million units for 2013, a 5.2 percent rise.

Another potential sector are the manufacturers of medium sized vehicles like bus shuttles, USPS and UPS trucks, tourism buses, etc in North America. The reason for targeting these independent vehicle companies is that major automotive companies concentrate on mass-producing more commercially viable passenger vehicles. Trends have shown that such companies have been the biggest buyers of environmentally friendly vehicles, partly for fulfilling their social responsibility, and partly to give their employees better tools to work with perhaps. For instance, according to Navigant Research's 2013-2020 Electric Vehicle Market Forecast, Electric Vehicles Speeding Toward 7% Of All Global Sales By 2020.<sup>5</sup>

How relieving would be if our product could save as much as one-third of the total electricity costs for someone? In the recent past, electric prices have risen quite sharply, to about 30 percent of what households used to pay six months earlier. Monthly bills are as much as \$70 now as compared \$50 till March 2001. Alone in 2011, the total electricity consumption in the US was 3,882.600 Kw/Hr. High costs and dependency on electric firms can be reduced dramatically if the cost of generators, with which current is produced, can be reduced. Currently, the generator industry in the US is worth about \$138.2 billion, more than 70 percent (\$90 billion) owing to the commercial (factory) generators and the rest 20 percent (about \$50 billion) used for residential purposes. Statistics show that sales of residential generators will be rising sharply at a rate more than 50% till 2016 and beyond.

This means that individuals find generators less costly than the charges imposed by the electric companies. One of the biggest buyers of generators is the small and/or privately owned businesses like a bakery or a pizza outlet who consume high amount of electricity to run their business. By using Aeolus technology, same amount of electricity can be produced with much less cost and hence will be immensely beneficial to commercial buildings, factories, small business, and of course, individuals.

Gasoline costs are one of the major operational costs for the airline industry. At a time when a few big airliners are struggling to survive, the aviation industry only in the US consumed total of 10,177,300,000 gallons of petroleum at a price USD 31,047,900 in 2013. Our potential target market, without much doubt then, are builders of both passenger and cargo planes. Despite downfalls in its complementary travel industry, the market is worth \$501 billion as of 2010, and expected to grow a total of 42% market by 2015. By installing this hybrid engine, it is expected that a conventional Airbus plane can fly the same with about one-third the oil required at present for the same distance.<sup>5</sup>

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<sup>5</sup> <http://www.reportlinker.com/ci02328/Airline.html>, <http://www.navigantresearch.com/wp-assets/uploads/2013/06/EVMF-13-Executive-Summary.pdf>

<sup>6</sup> <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=2&pid=2&aid=2>

# Industry Analysis

## *Automobile:*

Hybrid Electric Vehicles (HEVs) are vehicles that combine an internal combustion engine with a small electric motor and a battery. They are environmentally sounder than conventional vehicles; and they perform much better and less costly than the pure Electric Vehicles (EVs).

The HEVs were first commercially introduced in 1998 with much success by Toyota PRIUS. Though other car manufacturers have exhibited HEVs concepts for some time, Toyota PRIUS success inspires the momentum for other major car manufactures. Currently there are over 50 hybrid models available in the U.S.<sup>7</sup>

Hybrid vehicles achieve significantly lower emissions (and higher gas mileage) than internal combustion vehicles while eliminating range limitations and the need to recharge batteries regularly from an outside source. Battery powered vehicles, on the other hand, would appear to be doomed to continued life as a niche product only. While these vehicles are clean and quiet, storage battery limitations will prevent them from becoming a factor in the larger motor vehicle industry, or even in the much smaller electric vehicles market but Aeolus can overcome this problem. The Aeolus prototype has nothing to do with the concept of recharging. Because as the engine runs it produces electricity and this electricity is stored in battery provide near to engine.

The number of electric vehicles (which is also included in fuel-efficiency car) in use will advance more than 60 percent annually from a base of 65,000 vehicles in 1999 to 8.5 million vehicles (value at \$60 billion) in the year 2015. It is a potential for Aeolus to join the long-term growth and development in the industry. Sales of the Toyota PRIUS, introduced in Japan in 1998 and available there until 2000, totaled more than 33,000 by year-end 1999. Major producers such as Ford, General Motors or Peugeot; small numbers of hybrid and fuel cell test vehicles and a large fleet of privately owned cars manufactured by specialty producers and conversion companies will only manufacture battery powered electric vehicles.

The hybrid vehicles offer higher gas mileage at substantially lower emissions. It eliminates range limitations and the need to regularly recharge batteries from an outside source. There is a potential for Aeolus to join the long-term growth and development in the industry. The Aeolus prototype does not employ recharging concept. While Aeolus engine runs, it produces electricity that is stored in the battery placed near the engine. There are 50 to 100 companies worldwide engage exclusively in manufacturing electric vehicles. However, the major companies will quickly seize control since they have the advantage of established international name and capital.

The future of HEVs as a notable element in personal transportation (defined as production exceeding 2%, or more than 1 million units annually, of global Original Equipment Manufacturer vehicle output) will depend on:

1. Governments' determination to address global environmental issues and express the level of their commitment via mandates, incentives, and taxation. Fortunately, environmental issues have been the most important factor driving the growth in electric vehicle sales and availability. The regulations have been enacted in many nations to reduce air pollution. Government policy also has a major impact on prices and profitability – through mandates and regulations in the US and taxes in the EU. The EU government will soon launch a new regulation prohibit the machine to idle while parking. Moreover, US Congress is considering updates the country's 20-year-old corporate average fuel economy standards that could boost current rules from 27.5mpg to as high as 40 mpg in 10 years. Examples include specific EV sales mandates in a few states in the US, restrictions on the use of conventional internal combustion vehicles in a number of congested European city centers at certain times and government anti-pollution efforts in places as far-flung as San Jose, Costa Rica; Beijing, China; Mexico City, Mexico and New Delhi, India. These insist the brilliant future for the hybrid engine.

2. Consumer demand for advanced features, which will add further pressure to the need for a significant upgrade of the vehicles' electrical systems. A recent study in support of the IEA (International Energy Agency) Hybrid Vehicle Annex VII, whose objective was to identify global influence factors on the production and sale of hybrid vehicles, surfaced several important factors such as consumers' willingness to pay a premium for fuel economy and emissions improvements is limited. Studies by NREL (National Renewable Energy Laboratory) found that consumers in the US might pay 10 to 15% more for a 50% increase in fuel economy. They found that fuel economy has not been an important consideration since the mid-1980s for US market while EU consumers similar to elsewhere in the world - styling, utility, and other factors influence purchase decisions as much as fuel economy.

## Competitive Analysis

The comprehensive analysis conducted by B.O.C. indicates that a hybrid automobile equipped with the ACHTE could obtain over 150 mpg. Sales statistics indicate that the fuel-efficient class of vehicles made up sales of 1.5 million vehicles in the U.S. last year. With in this class there are 120 different vehicles. This classification includes any passenger vehicle with a rating of 30 mpg or better. For those committed to fuel efficiency, the ACHTE represents the greatest potential for the fuel-efficient, new car market.

The most relevant competitive products on the market today are the Honda Incite and Toyota Prius. Both of these cars are capable of greater fuel efficiency than common automobiles due to the use of hybrid engine technology, which combines the output of internal combustion engines and electric motors. The Insight shows the highest fuel efficiency rating at 68 mpg on the highway and 61 mpg in the city. The Prius with a close second place is rated for 52 mpg in the city and 45 mpg on the highway.<sup>6</sup>

Ford has several hybrid versions of popular model such as their popular Ford Fusion. Daimler Chrysler offers some hybrid versions of their larger SUVs and trucks. It is interesting to note that while these vehicles may be viewed as a threat in terms of competition they may also be potential users of the ACHTE technology. Consider the effect of Sony patenting and licensing the Compact Disc technology. There is no reason to assume that the ACHTE could not fit into any of these hybrid cars. In fact, it is likely that standard combustion engine car, as substitute products pose the greater competition.

In addition to the fuel-efficient automobile market, opportunities for this technology exist in the markets for electric generators and aircraft manufacturing. United Community Services of America is in the process of launching a "Free Electricity" program based on installing electric generators at residential homes which would exceed the average consumption by residential homes. The idea is that they would sell the excess energy back to the power grid company and generate profits for UCSA while providing free electricity to registrants and proving a new fuel efficient technology. USCA's pilot program is attempting to reach 1.6 million homes in the US and Canada.

The residential sector of the electric generator market has been valued at \$20 to \$30 billion with growth estimated at over 150% for the next five years. The commercial sector market has been valued at \$80 billion. If the ACHTE can be adapted to provide more efficient energy in electric generators the market penetration potential is enormous. Unlike hybrid vehicles, which are still relatively new to the market, electric generators represent a mature product & technology. Although many generators are used solely as back-ups in case of

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<sup>6</sup> <http://www.fueleconomy.gov/feg/noframes/bestworstNF.shtml>

power failure there is also a market segment that uses generators to defray the cost of standard electricity. This market, by definition, is sensitive to fuel efficiency. This is particularly relevant if Aeolus can market this product while riding on the success of the hybrid vehicle program.

Capstone is a successful competitor in the business of consumer electric generators. Capstone micro turbines will market to more than 2 billion customers in Chicago. Analyst said the demand for stationary power like this is going to be a big opportunity. Power-generating infrastructure has largely stood still over the last eight to 10 years while the demand for power has gone up. This technology would allow a business to hedge its energy costs when the price of power from the grid goes up. There must be a fair number of commercial customers in San Diego who would have enjoyed having the Capstone micro turbine as a backup in summer. In addition, there is a large market for micro turbines in developing countries that cannot afford to make large investments in power generation and distribution. Capstone is on track to have annual sales of about \$40 million in 2010. It shipped 552 micro turbines through the first six months of this year. That compares with 221 for all of 2009. Regular electric utilities charge about \$0.16 per kilowatt-hour -- around \$500 a month for a small company, while a 30-kilowatt fuel cell costs about \$150,000 in startup costs alone. The worldwide micro turbine market is expected to reach 396 Million by 2019.

As a long-term prospect, the aircraft industry is easily one of the largest and most concentrated industries with a few mega-corporations dominating the markets. The value of this market has been estimated at \$32.2 billion with a five-year growth rate of 131%. As another component of the transportation industry, airlines are dependant upon foreign oil. If the ACHTE can be adapted to the modern aircraft, the fuel savings potential is enormous. Research shows no aircraft currently on the market that runs on a hybrid or completely electric engine. Once again, if Aeolus can prove the value of its technology in the auto and / or generator market, and adapts it to the aircraft, the result could be revolutionary.

## Critical Risks

The on-site protected distribution monopolies, environmental rules, lack of uniform interconnect standard are some of the barriers to generate profits for on-site generation.

Although the fuel cell vehicles are available, they are limited to the lack of hydrogen infrastructure in the U.S. These manufacturers and other inventors may have held back their updated HEVs to avoid buying patent from Aeolus Technology, Inc. The solution may be to produce the first prototype as soon as possible to ensure the prototype can out-perform the new comers.

When environmental vehicles reach substantial production levels, the widely used incentive for production or sales of electric and hybrid vehicles could falter.

The size and feature of Aeolus may have problem fitting the standard of the commercially produced vehicle engine. However, the owner can amend this by making and adjusting the prototype to fit the standard engine.

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