

# The Cyclone Engine Empowers the Biofuels Revolution: Part 1

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First Licensee of the Cyclone Technology

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The new and revolutionary Cyclone Engine and related technology offers the ready opportunity to empower the growing biofuels production industry. Currently biofuels – be they ethanol or biodiesel, are very expensive to produce, and are not competitive with petroleum-based fuels. Many have even argued that it takes more petroleum to produce ethanol than the net energy provided. Biodiesel must be blended with petroleum based Diesel in order to run a Diesel engine. Both ethanol and biodiesel must be heavily subsidized by the government to attain any significant sales. Barring extraordinary increases in the price of oil, they are not likely to be cost competitive in the foreseeable future, unless there are radical changes. Both ethanol and biodiesel must be heavily and expensively refined to narrow specifications in order to run at all in current engines. The Cyclone Engine uses external combustion and is very insensitive to fuel formulations, the degree of refining, or the meeting of narrow performance specifications. If it can burn, the Cyclone Engine can burn it. That characteristic opens up a whole new realm of promising possibilities and likely revolutionary changes. The patented Cyclone engine is a brilliant invention by a brilliant inventor – Harry Schoell. That brilliance can empower a revolution in both engines and biofuels.

**The Urgent Need for Biofuels** – It is likely that we are now at or will soon be at a global peak production of oil. That is in the face of rapidly rising global demand for oil, especially from China and India. This demand/supply gap is having and will have a strong upward pressure on oil prices. As this article is written oil is over \$80 per barrel. Some professional analysts are predicting \$100 oil, or perhaps even \$150 oil given possible geopolitical and war shocks, in the not too distant future. The U.S. currently imports more than 13 million barrels per day of crude, and that figure rises every year. At \$80 per barrel that is \$1.04 billion per day, and a staggering \$380 billion per year. Directly and indirectly much of those exported dollars go to countries that are outright enemies or questionable allies of the U.S. In the midst of a major war, we are sending huge amounts of money to those who hate us and will do harm to us whenever and wherever they can. We have become addicted to oil, and that dangerous addiction is causing us severe problems already. Should there be significant disruptions to oil imports, our country and economy will be badly damaged. We will need to utilize every available energy approach to get out of the big mess we are in. Renewable energy, such as the production of biofuels is one way out of our problem, and it is a very promising way. We need to crank up biofuel production as fast as we can. Major production cost reductions will stimulate that heavily.

**The Biofuels Predicament** – Biofuels are expensive to produce. A major and growing market for them is only made possible by large government subsidies. For biodiesel, that is currently \$1 per gallon. While volume and learning curve improvements will over time reduce the production cost of biofuels, that is likely to take a significant amount of time. The requirement to blend biofuels with petroleum products limits their usefulness and applicability. It will take a radical breakthrough in biofuels production economics to make them truly competitive with petroleum on a non-subsidized basis. The use of the Cyclone Engine promises to make that possible.

**Some characteristics of the Internal Combustion and Diesel Engines** – Both the internal combustion engine and the Diesel engine have evolved over the last 100 years. While minor

improvements are still being made, these engines embody highly mature technologies. Each of these two engines has its own set of characteristics, advantages, and disadvantages. Among the disadvantages are that they tend to be relatively dirty engines, and thus need extensive procedures and processing to make them clean enough for emissions purposes. In the case of Diesel engines, engine manufacturers are having a fit trying to meet the upcoming 2010 standards. Each type of engine must burn a highly refined fuel that falls within a narrow range of specifications. Fuel outside those narrowly defined ranges causes the engine to sputter, cough, and stop. In some cases, the engine can be severely damaged or ruined. That means that both ethanol and biodiesel must also be carefully refined and processed to meet the exacting standards required for these engines. Meeting the rigid specifications is expensive both in terms of capital equipment and the processing requirements, energy usage, etc.

**Combustion Characteristics of the Cyclone Engine** – The Cyclone Engine uses external combustion to produce a hot gas. Fuel and air are injected into a centrifugal combustion chamber so that unburned fuel which is heavier stays to the outside until it is completely combusted. If necessary, the dwell time in the combustion chamber can be up to a minute or even more. This differs radically from the 4 to 20 millisecond dwell time available in an internal combustion or Diesel engine. That very short dwell time means that all the fuel in an internal combustion or Diesel engine can not combust before it is expelled from the cylinder where it does the useful work. This results in a dirty exhaust which needs to be cleaned up, and wasted fuel. By contrast, after complete combustion the hot gas in the Cyclone combustion chamber, in the 2,000 to 2,300 degree Fahrenheit range, passes immediately after combustion into the hot heat exchanger section of the engine where it heats water to supercritical temperatures. The Cyclone Engine combustion process is completely indifferent to the fuel used, as long as it will combust. It can burn well refined Diesel, sloppily refined Diesel, military standard JP-8 fuel, gasoline, kerosene, and a number of other fuels. They can be mixed together in the same fuel tank, as long as they don't chemically interact with each other, which the above named fuels do not. That means that ethanol or biodiesel can be burned in pure form in the Cyclone Engine, and does not need to be blended with petroleum based fuels. Furthermore, and more importantly, neither ethanol nor biodiesel needs to be as carefully refined as now, and it does not need to meet narrow specifications. Our preliminary estimate is that eliminating the last few refining steps from the production process of either ethanol or biodiesel would reduce their production cost by 20% to 40%. That would be enough to make them cost competitive with oil, and without subsidies. Because the fuel needed in the Cyclone engine can be much broader in its required specifications it may be possible to come up with production processes that are completely new and which could drop total production costs by 40% to 50% over current methods and processes. It will have the even further benefit of allowing additional biomass feedstocks to be considered than is presently the case.

**New Technology to the Rescue** – The Cyclone Engine is a brilliant solution to a series of vexing problems. Because of its indifference to most aspects of fuel quality or adherence to narrow specifications, it can enable and empower the bio-fuels revolution. It is one revolution empowering another. Advent, along with Cyclone Power, is pushing hard these two mutually supporting revolutions.

In future articles we will try to home in on greater specifics relative to the above topics.

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Dr. Phillip F. Myers, author of this article, has a five year Industrial and Systems Engineering Degree, plus an M.B.A. from The Ohio State University, with many honors and distinctions. As a three-time Ford Fellow at the Harvard Business School, his major was the management of advanced technology companies. He has over 40 years of experience doing that as a large corporation executive and as an entrepreneur. He has consulted and taught in those areas, and has given lectures around the world on various state of the art technologies which he helped pioneer. Dr. Myers is a former Air Force Captain, Engineering Officer, and War Planner. He formed Advent Power Systems, Inc. in March 2006 to develop and commercialize the Cyclone Engine and technology, after recognizing early its tremendous potential. Advent's website is located at: [www.advenflorida.com](http://www.advenflorida.com)