

## Max Plomer Maker Faire Application

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Title: Software for Clean Energy Fuels

### **Description:**

Programmed from scratch and reverse-engineered from industry software, my project models clean energy fuels, such as hydrogen methane and biodiesel, using the high-level programming language and numerical computing environment Matlab. The advantage of programming entirely in Matlab is that the code becomes much easier to read, allowing you to focus and experiment with the problem at hand instead of a computer science problem.

This project relies heavily on computer programming, math, thermodynamics and chemistry. Features a zero-dimensional diesel engine simulation with visual output. Open source technologies are presented as an alternative to the Matlab numerical computing environment.

### **Why Innovative:**

No one has ever programmed this type of software entirely in a high-level programming language. This innovation makes the fundamental science in the code much easier to understand, allowing greater collaboration. This lowers the difficulty of entry for engineers and scientists who want to approach the complex subject of fuel chemistry. All my accompanying documentation and derivations are aimed at an audience that is just learning this field. (Meaning no step is left out!)

It is really a very difficult task to make software that reads chemical mechanisms and then creates functions that calculate chemical reaction rates. The code is fully optimized using Matlab optimizer function, avoiding global variables, using vector operations where possible, etc.

Open source technologies such as Linux, GNU-Octave, Fortran ode solvers, are presented to recreate the capabilities of expensive numerical software. This is very important to avoid licensing fees.

It is an environmentally friendly project that promotes clean energy, as well as more efficient use of fossil fuels.

### **Interactive**

The audience gets to interact through learning about the code and the scientific principals behind it. They can choose their own parameters and monitor the output that is generated. Live solving will occur using Matlab's parallel computing package to create 3d surfaces of ignition across a given range of parameters. This allows us to know what range of parameters (compression ratio, air-fuel-ratio, engine frequency) will allow an engine to run.

I will not only teach the audience about the code, but I also have great simple examples to explain. Such as

an overly simple chemical system consisting of 3 chemicals and 2 reactions and constant reaction rates. I also have a wooden fire piston that works on the same principals of my code. I will have a great explanation of this emergency survival tool that the audience can take home with them. It uses conservation of energy as well as the equation for compression work of a gas in an adiabatic system.

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