Green Energy Engineering, Inc.

"Pay less for Energy and save the Earth"

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Quad-Gen Executive Summary

My invention (Currently called the Quad-Gen) has 1/2 carbon footprint of an electric air conditioner, can be operated for 1/4 the cost in the residential market, and can provide over 9% rate of return on invested capital into a specific[i] fund and 20% to 40% to the equity investor. This summary is 3-pages long with 5-pages of endnotes for the non-engineer who is unfamiliar with energy, fuel prices, carbon footprint, electricity generation, co-generation, economic studies, equipment performance, thermal cycle efficiencies, air conditioning, etc.

The problems of climate change, sea level rise, extreme weather, high electricity prices, inefficient central power stations, aging power grid, etc., are concerns for all Americans. My invention can address all of these issues, especially carbon footprint and high electricity costs using clean-burning natural gas, and provide an attractive return to both the "fund" investor and the equity investor.

Green Energy Engineering, Inc. (GEE)[ii] – founded by Eric Coffin[iii] P. E. - is building a prototype.[iv] of a three-ton[v] natural gas-driven air conditioner for residential applications that was featured in the local newspaper[vi]. This is an adaptation of the Thermo King equipment[vii] that is used worldwide for transport refrigeration. While other companies have tried to provide natural gas air conditioning, they have charged high prices for the equipment, provided no service, and exited the market within one or two years, with the customer holding the new technology. The typical residential carbon footprint would be reduced by 50% and the total.[viii] energy costs would be reduced to 25% of the former energy bills.

Cogeneration[ix] is well known in chemical, pulp & paper, oil refineries, and other large industrial users, and I have worked in all these sectors. It is very cost-effective and provides the smallest carbon footprint.[x] for the fuel burned and the two (co-gen) energy streams needed in the industrial process. While cogeneration has two energy streams, my invention is a quad-generation[xi] system with four useful energy streams. This invention will provide air conditioning, dehumidification, hot water, refrigerator assistance, and winter space heating from both the heat pump and the rejected engine heat.

The quad-gen system will be manufactured, installed, monitored, and repaired.[xii] over ten years in return for monthly customer payments. Payments are based on energy saved.[xiii] and will be split 20 / 80 respectively with the customer/company. This payment arrangement is known as performance contracting[xiv] and is undertaken by Energy Service Companies(ESCO). The USA ESCO industry is currently $7.6 billion and growing at a 9% annual rate, and its focus is on large

commercial markets. The customer enjoys enhanced (through 24/7 remote monitoring) reliability, low installed cost, low operating cost, and no maintenance.

Florida, like other hot, humid tropical areas on the Gulf Coast, is only populated because everyone has an air conditioner. In Florida, the air conditioner consumes 60% to 75% of the annual residential electric bill. For a typical 3-ton air conditioner here in Florida operating 4,000 hours per year, the electric cost is $3,600, and the natural gas cost of the quad-gen unit would be $780. The carbon footprint would be reduced from 54,000 pounds of CO_2 per year to 25,000, or just over 50% for one home.

There are currently 21,480,000 people in Florida, and 10 million homes[xv]. People are flocking to Florida at the rate of 600[xvi] per day, and 1.3 million new homes were constructed[xvii] in 2021. According to the World Data Atlas[xviii], Florida emitted 509,135,000,000 pounds of CO_2 in 2018. If the quad-gen machine were installed in just 10% of existing homes, Florida's carbon footprint would be reduced by 25 billion pounds of CO_2 per year, which would provide a 5% reduction in greenhouse gas emissions compared to 2018. While 5% may sound small, it is a start. Putting 5% into perspective, imagine 625,000 dump trucks (20 tons each) end-to-end in a convoy stretching 2,367 miles from Miami, Florida, to Billings, Montana – that's what 25 billion pounds looks like.

Here in Peace River Electric Cooperative – where I live- we pay 20.86 cents.[xix] per kWh, which equates to $58.60 / mm BTU[xx] meanwhile, TECO natural gas is $1.38 / Therm which equates to $13.80 / mm BTU. The $58.60 / mm BTU of electricity and the $13.80 / mm BTU of natural gas yields a "spark spread."[xxi] of $44.80 per million BTU, which is four times greater than that required for independent power generators. That leaves quite a wide margin for profit on a quad-gen machine that may cost just $1,000[xxii] t
build.

Floridians pay one of the highest electric rates in the nation and rank #6 in electricity consumption. Floridians are also tired of paying over $800 million for the two unbuilt nuclear plants slated for Levey County. This is on top of the broken Crystal River nuclear plant that required an early shutdown costing $1.2 billion and a decommissioning cost of $540 million. Money is wasted by the utility (Florida Power Corporation, now called Duke Power) and paid for by the user's aka ratepayers.[xxiii].

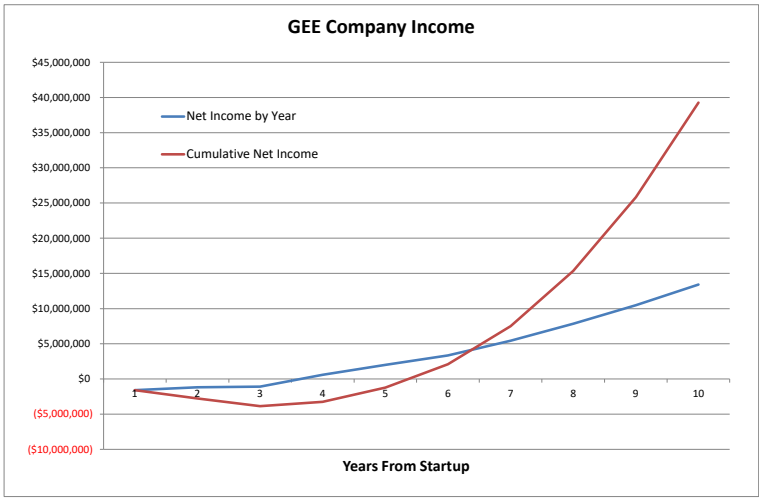
At this time, Eric is the only one working on the prototype and requires others to help develop the invention and fill out the other roles required of a manufacturing, marketing, sales, installation, monitoring, and repair company.

GEE is seeking an equity investment of $4,400,000 over two[xxiv] years to complete the proto-type (Alpha unit), finish the business plan, collect data[xxv] for the Beta unit, build and install 20 Beta units in actual homes, collect Beta unit (field) data, design the Gamma unit, build, install, and test Gamma units, etc. The objective is to earn money from the test units installed in actual homes and perfect the unit to ensure ten years of fail-safe operation. Research and development will continue throughout the life of the company, and other adaptions (listed in the three-volume business plan) will be developed for other markets.

The estimated cash flow looks as follows. Eric is the only one working on the quad-gen invention, as funds are limited to my income and savings. There are qualified people that I would like to hire when I obtain $4.4 million in seed funding.

The first task would be to work on the business plan with some professionals and also contract with an account to firm up the numbers and format them in a standard report.

Year	Net Income by Year	Cumulative Net Income
1	($1,587,581)	($1,587,581)
2	($1,178,129)	($2,765,710)
3	($1,099,267)	($3,864,978)
4	$607,494	($3,257,484)
5	$2,010,564	($1,246,920)
6	$3,326,960	$2,080,040
7	$5,421,118	$7,501,158
8	$7,850,119	$15,351,277
9	$10,479,177	$25,830,455
10	$13,426,470	$39,256,924



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[i] There are two types of investment. The first is equity in the quad-gen company, and the rate of return or exit money is given to the company's investors. The second is "project money," which can be used to fund the performance contracting model. This second return would be paid out to those "bond" investors who have put money into a specific fund. A fund would be defined as all quad-gen installed within a zip code, the next 100 units installed, or some other tangible group. This way, the "bond" investors of that fund would be linked to specific units located at specific home addresses. This investor would receive a monthly check for principal and interest, which is a portion of the customer's monthly payment.

[ii] Green Energy Engineering, Inc. is a C corp. engineering consulting firm registered in Florida. Eric holds 100% of the company's stock and 100% of its intellectual property. Website http://www.geeintl.com/ The upper right bar of the website has a box "Quad-Gen" which provides the following three links regarding the invention.

[iii] Eric Coffin PE can be seen here on YouTube explaining the invention, his experience, and certifications. https://www.youtube.com/watch?v=1Sb7Yem50Wg&ab_channel=EricCoffin

[iv] The prototype can be seen here on YouTube
https://www.youtube.com/watch?v=ENfRQVEKlW4&ab_channel=EricCoffin

[v] 3-ton is the most common sized a/c in residential use today. 2, 4, 5, and 6-ton and larger units can also be assembled. Commercial-size units greater than 10 tons can also be assembled.

[vi] This a link to the East County Observer Newspaper
https://www.yourobserver.com/news/2022/may/28/lakewood-ranch-engineer-wants-to-revolutionize-air-conditioning-industry/
Lakewood Ranch engineer wants to revolutionize the air conditioning industry
Eye on Business: *Eric Coffin seeks investors*
*for his "**Quad-Gen**" air conditioning system.*

[vii] Thermo King is one of three major companies that make self-contained air conditioners, refrigeration, and freezers that are used worldwide for transport refrigeration of trailers, trucks, buses, rail cars, and shipboard containers that contain meat, fish, produce, etc. Thermo King units are driven by engines fueled by diesel fuel, gasoline, or propane gas.

[viii] The total energy cost is the customer's current electricity bill, which would be significantly reduced, and the additional cost of natural gas. The customer would need to live in a neighborhood with natural gas.

[ix] Cogeneration is the simultaneous production of two useful forms of energy from one fuel. For instance, natural gas burned in a combustion turbine generator produces electricity, and the hot exhaust produces steam from a heat recovery steam boiler.

[x] "Carbon footprint is the total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our actions. The average carbon footprint for a person in the

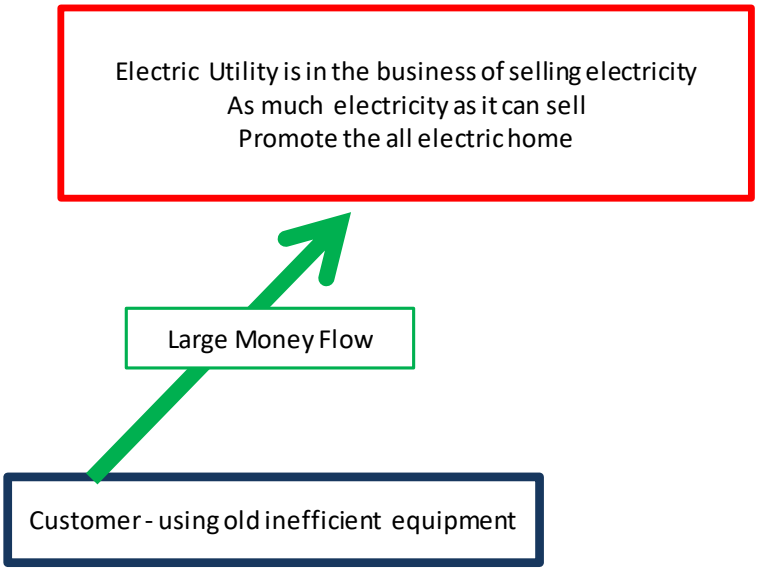
United States is 16 tons, one of the highest rates in the world. Globally, the average carbon footprint is closer to 4 tons. To have the best chance of avoiding a 2°C rise in global temperatures, the average global carbon footprint per year needs to drop to under 2 tons by 2050." Quote from www.nature.org/en-us/

[xi] Cogeneration has never been applied to residential homes under a performance contracting model until my invention/business model, which is a quad-generation system, valuable energy streams. Natural gas is burned in a small combustion engine that spins a (1) air conditioning compressor. Waste (2) heat from the compression of freon is used to regenerate a desiccant wheel that reduces the humidity in the home. Additional waste (3) heat is used to produce domestic hot water. The returning cold freon gas is passed (4) behind the refrigerator to provide cold air for the hot condensing coil. I call this refrigerator assistance as the power consumption of the refrigerator is reduced. Since the compressor has a reversing valve, the quad-gen unit will run as a heat pump in the winter, and waste heat from the engine is captured to also heat the house.

[xii] This is an existing technology for mobile food but a new technology for the homeowner, and as a result, the business model relies on performance contracting for cash flow. Moreover, neither the homeowner nor the existing a/c companies can remotely monitor and repair these new units. To ensure success, the quad-gen company must keep track of all units from a central monitoring center (like home security systems) and be proactive in repair to maintain a good reputation, as word of mouth will be the best advertising. Additionally, the monitoring and repair will allow quad-gen to see and fix reoccurring problems.

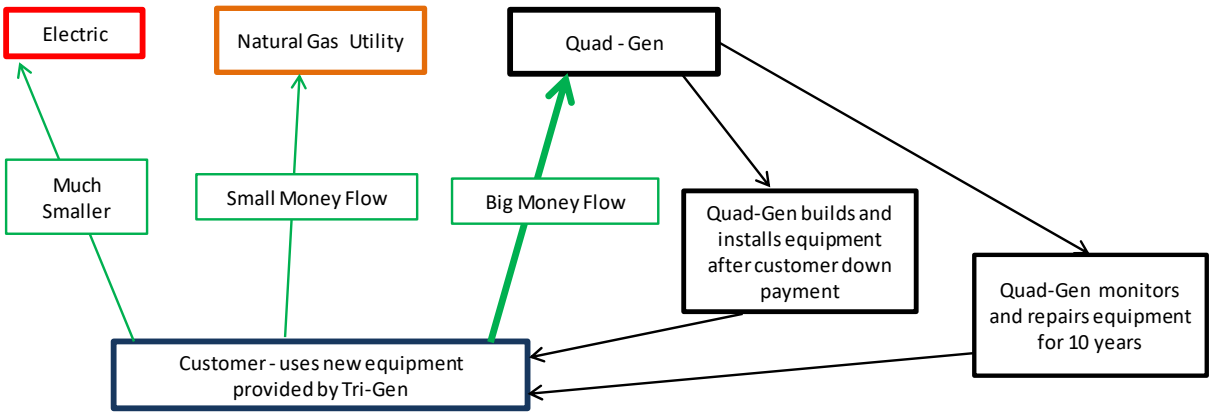
[xiii] A very large computer program has already been written that inputs 12 to 24 months of customer electric data such as kWh consumption and dollar amount paid. This is both a screening tool to determine if the quad-gen unit is an economic fit for the home and to determine the monthly payments.

[xiv] A few illustrations will help explain the cash flow behind performance contracting.



This figure represents the existing relationship between a bill-paying customer and the electric utility. The larger the money flow, the more money the electric company makes, and therefore, the utility has zero interest in the customer installing efficient equipment.

The figure below shows the relationship between the parties under a performance-contracting model. The Quad-gen company searches out customers who have large air conditioning-related electric bills and offers to install, finance, monitor, and repair the new a/c technology.



The total cash flow from the customer to the electric, gas, and Quad-gen companies is less than the original electric payment. Money is provided by investors or bankers who underwrite the initial build and install. An attractive rate of return is offered to these investors Bond" holders,

and that is what allows cash-strapped customers to benefit from lower bills and a smaller carbon footprint.

[xv] Homes are defined as stand-alone houses. Apartments, condominiums, trailers, etc., are not included in this number.

[xvi] See https://www.tampabay.com/news/business/2021/12/22/florida-texas-see-largest-population-increases/#:~:text=Florida%20grew%20by%20211%2C196%20residents,to%20a%20population%20of%2029%2C527%2C941. For the data and story of growth in Florida and Texas.

[xvii] According to the Florida permits issued database.

[xviii] See https://knoema.com/atlas/United-States-of-America/Florida/CO2-emissions#:~:text=Florida%20%2D%20Annual%20fossil%2Dfuel%20CO2%20emitted&text=In%202018%2C%20CO2%20emissions%20for,tones%20of%20carbon%20in%202018. For the 2018 emission report.

[xix] Florida's electric rates are 13% higher than the national average and Floridians consume the sixth most kWh per month in the nation given our hot and humid climate, which has many residents running the air conditioning for most of the year.

[xx] The mm BTU measurement is a common scale used to compare different fuels. The big difference between electricity and gas is that natural gas is in its "source" form while electricity has been converted from a "source fuel" such as coal, oil, or gas- through an inefficient power plant 35% process – to yield electricity – to say nothing of the transmission and distribution losses. My invention is 85% efficient.

The following table should help one understand the difference between the common price units for a particular fuel and the common denominator price of $ / mm BTU. Note that electricity is the most expensive form of energy available to the homeowner. As an aside, one can see that a natural gas-fired water heater could operate at 1/3 the cost of electric water heaters.

Fuel Type	Common Price	Common Units	Common Denominator Comparison Price $ per MM BTU
Wood	$10.00	Ton	$1.00
Coal	$90.00	Ton	$3.46
Crude Oil	$100.00	Barrel	$15.03
Natural Gas	$2.00	Therm	$20.00
Gasoline	$3.00	Gallon	$22.22
Electricity	$0.14	kWh	$41.02
Electricity	$0.21	kWh	$61.53

[xxi] Spark spread is the difference between the cost of buying natural gas and the price of selling electricity. A common rule of thumb in power plant development is a spark spread of no less than $12.00 per million BTU, and ours is four times greater – which means four times the minimum expected profit.

[xxii] The prototype machine has a $300 engine, two $70 compressors, one $300 coil, and miscellaneous pipes, valves, and electronics – all of which are commodity items available from many suppliers.

[xxiii] See St Petersburg Times, now called Tampa Bay Times for many stories of Florida Power Corporation, (FPC) now called Duke Energy, and the broken nuclear power plant. This newspaper has written many stories about the shady dealings of FPC. Go back and look up the Daisy Chain oil sales of the 1970s to get a picture of self-dealing.

[xxiv] The current shop/office on Lena Road (This shop has been closed due to lack of funding) has served me well, however, a larger shop and office are needed to add people and most importantly allow shop room for the dissemble of existing equipment. To learn from others, I plan to buy gas-driven heat pumps from Japan and Germany, as well as over-the-road tractor-trailer units.

[xxv] The Alpha unit is a proof of concept and a live demonstration of economic performance. The development of the Beta unit will include information learned from the Thermo King unit and the other two mobile a/c units whose patents have expired. In addition, the six units sold in Japan and the one unit sold in Germany will be examined in the shop to reverse engineer the lesson learned by others. Those seven patents have also expired. The GEE office holds two banker boxes of approximately 450 patents that deal with aspects of air conditioning, refrigeration, and freezers in both a stationary setting and mobile setting. These printed-out documents provide great insight into the means and methods of constructing a rugged machine that can operate for 100,000 hours. In the early 1980s, the units could operate for 10,000 hours without maintenance, which would have provided over two years of trouble-free operation in Florida.