

ORIGINAL



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BEFORE THE ARIZONA CORPORATION COMMISSION

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IN THE MATTER OF THE)
APPLICATION OF ZELANI L.L.C.)
TO CLARIFY APPLICABILITY)
OF ENVIRONMENTAL PORTFOLIO)
STANDARD TO WASTE GAS-TO-)
ENERGY TECHNOLOGY)
_____)

DOCKET NO. RE-00000C-00-0377

PLEASE TAKE NOTICE THAT Zeleni, L.L.C., hereby files the attached
Application for Clarification of Applicability of Environmental Portfolio Standard to
power generated by the Zeleni Power System.

LAW OFFICES OF DOUGLAS V. FANT

By:
Douglas V. Fant
Attorney for Zeleni, L.L.C.

THE ORIGINAL AND 13 COPIES
OF THE FOREGOING FILED

This ___ day of _____, 2004, with:

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Arizona Corporation Commission
1200 W. Washington
Phoenix, AZ. 85007

I. INTRODUCTION.

Zeleni Power Systems, L.L.C. (Zeleni), through 18 years of research and development, has developed a unique system that can generate power from exhaust gases, waste heat, or steam. The Zeleni "Green Power Unit" (GPU) is fueled and propelled solely by the energy the GPU recovers from the waste stream. The GPU then connects to a standard electrical generator to produce power.

The GPU also acts as a miniature heat exchanger or cooling device since it uses the incoming waste heat stream to power the GPU. After waste energy stream passes through the GPU the temperature of the exit flows are usually reduced by 50%.

II. STATEMENT OF ISSUE

Zeleni seeks clarification as to the applicability of the Environmental Portfolio Standard requirements or waiver of those requirements, as is appropriate, to the electrical energy produced by the GPU.

III. TECHNICAL SUMMARY.

The GPU is a radial type expansion gas motor. The motor is a fluid-actuated reciprocating motor. Waste gas or exhaust gas flows function as a "pass-through propellant" which is directed from a source to an intake manifold. The intake manifold distributes the flow to each of four double action cylinders. See Attachment A for a picture of a GPU which has sets of opposed, double acting power cylinders. The GPU has less than 150 parts and employs self-lubricating non-load polymer bearings and stainless steel sleeves to withstand pressure and corrosion associated with some waste gas/fluid streams.

The GPU then uses the waste energy contained in a thermal or pressurized fluid stream and converts the energy into "work" which powers the pistons. A central yoke

assembly converts the radial motion of the power pistons into a rotational motion, which develops drive energy/shaft horsepower.

The GPU can run at varying capacities and will operate as long as a low pressure thermal fluid stream, gas, or exhaust stream passes through the motor and provides the “propellant” to power the pistons. The torque produced by the motor then turns a drive shaft that actuates the valve pistons which completes the standard “work cycle”. The torque/shaft horsepower of the GPU can then be matched to a generator to produce electricity or directly power large motors, extruders, conveyors, or similar devices with a wide load range.

The low pressure thermal waste gas propellants that may be used to power the GPU can vary extensively in characteristics, making the GPU versatile. The GPU is also easy to install and its “instant on” characteristics makes operation of the GPU simple. The GPU also needs no external water source or other source of fuel to function and creates no solid residue from operation. The GPU recovers energy from waste gasses and converts it into electrical power.

IV. ENVIRONMENTAL PORTFOLIO STANDARD

The Environmental Portfolio Standard (EPS) requires “any Load-Serving Entity selling electricity or aggregating customers for the purpose of selling electricity under the provisions of this Article must derive at least .2% of the total retail energy sold from new solar resources or environmentally-friendly renewable electricity technologies, whether that energy is purchased or generated by the seller”. R. 14-2-1618A.

The EPS had its genesis in the 1990-1996 Integrated Resource Planning Process. IRP Decision No. 57589. The initial decision focused exclusively upon solar issues (then called the Solar Portfolio Standard), ordering the regulated electric utilities generally to look at solar power plants as potential alternatives for intermediate and peaking facilities; and also to study the use of photovoltaics in transmission and distribution systems.

“Costs, Benefits, and Impacts of the Arizona Environmental Portfolio Standard”, Cost Evaluation Working Group Report, June 2003 at Page 7.

Subsequently the ACC decided in 1999 to broaden the EPS to include other renewable technologies with similar clean fuel characteristics. *Id.* at Page 8.

The EPS expanded to include “environmentally-friendly renewable electricity technologies”: “[a] Load-Serving Entity shall be entitled to meet the portfolio requirement with electricity produced in Arizona by environmentally-friendly renewable electricity technologies that are defined as in-state landfill gas generators, wind generators, and biomass generators, consistent with the phase-in schedule in R14-2-1618(B)(3)”. R. 14-2-1618L.

V. ZELENI TECHNOLOGY AND THE EPS

In 2001-2002 the Commission Staff chaired a Working Group on Portfolio Standards and Operating Procedures. The group included a number of subcommittees, including subcommittees on biomass and landfill gas *inter alia*. The minutes of the Group’s meetings appear on the ACC website. However reports for landfill gas and biomass generators do not appear in the posted materials. Specific clarification of what constitutes “environmentally- friendly renewable electricity technologies”, if any, does not appear to have been completed or if completed, then yet posted by the Group.

However the minutes of the February 2, 2002 Working Group meeting do indicate that the Group favored inclusion of municipal wastes within the definition of “biomass”:

Question #1: Should the "biomass" definition include "municipal wastes"?

The group was generally in favor of including municipal wastes in the biomass definition. A concern was expressed that municipal wastes might preclude other sources. *Id.*

Applicant notes that exhaust gases are also a form of waste that constitutes a residue from a mechanical operation. Their "disposal" similar to solid municipal or agricultural wastes is regulated usually by the relevant state environmental agency.

However other than the above reference to municipal wastes, the Working Group did not apparently address the issues of exhaust gases. The June 2003 Cost Evaluation Working Group Report, though, does specify nine factors that the Group expects to accrue or should accrue from a renewable resource under the EPS. Those factors include: "(1) avoided costs of conventional energy. When energy is produced from renewable resources, LSE's can reduce consumption of natural gas or coal at power plants, [and] reduce wholesale purchases of electricity...." Here the Zeleni GPU is powered solely by exhaust gases or waste heat, and no other fuel is needed. The GPU may also be connected to the grid without affecting the primary process. See attached Testimony of Jason Solomon at p. 4.

"(2) Avoided costs of conventional capacity"; (3) Avoided air emissions. By reducing consumption of fossil fuels...LSE's reduce emissions of carbon dioxide, sulfur dioxide, nitrogen oxides, carbon monoxide and particulate matter." Here as noted, the Zeleni GPU produces no new air emissions or solid or liquid residues itself. Solomon Testimony at pp. 6-7.

"(4) Meeting federal pollution mandates. The EPS is one of the key pollution prevention measures that will be included in the Arizona State Implementation Plan". (5) Price stability. ...Energy from renewable resources ... is not subject to commodity market price variability because the costs are largely upfront, fixed capital costs, and for solar electric there is no fuel cost." The Zeleni GPU's main costs are essentially the same, upfront fixed capital costs and operating costs are very low. In addition the Zeleni GPU has zero fuel cost. Solomon Testimony at p.5.

"(6) Cost reductions in renewable energy technology; (7) Cost-effective substitution of renewable energy for distribution and transmission line upgrades. In some instances grid-

connected solar generating stations are a cost-effective alternative to distribution and transmission line upgrades". In a similar but even greater fashion, a Zeleni GPU may be installed wherever a heat source may be found, creating the opportunity for many distributed generation projects and also reduce site grid demand. Solomon Testimony at p 6.

"(8) Reduction in water use. As conventional energy generation is offset, associated water withdrawals and consumption are also reduced". The Zeleni GPU needs no external source of water to operate, and thus helps conserve water resources. Solomon Testimony at p. 6.

"and (9) Creation of beneficial partnerships. LSE's can develop partnerships with municipal governments and other agencies to create mutually beneficial renewable energy projects and leverage EPS funds".

The Zeleni GPU's ability to convert exhaust gas or waste heat to power satisfies almost every Working Group requirement noted in the June 2003 Report.

VI. STATUS OF HEAT RECOVERY IN OTHER JURISDICTIONS

Generating electricity from exhaust gases is a relatively novel technology. However one state, the State of Nevada has already revised its statutory renewable resources portfolio standard in 2003 specifically to include recovered energy within the definition of a renewable resource:

Sec. 6. Chapter 704 is hereby amended by adding thereto a new section to read as follows:

1. "Qualified energy recovery process" means a system with a nameplate capacity of not more than 15 megawatts that converts the otherwise lost energy from:

(a) The heat from exhaust stacks or pipes used for engines or manufacturing or industrial processes; or

(b) The reduction of high pressure in water or gas pipelines before the distribution of the water or gas, to generate electricity if the system does not use additional fossil fuel or require a combustion process to generate such electricity.

2. The term does not include any system that uses energy, lost

or otherwise, from a process whose primary purpose is the generation of electricity, including, without limitation, any process involving engine-driven generation or pumped hydrogeneration. AB 429, Nevada.

Nevada state law classifies waste heat recovery systems generally of under 15 MW in capacity as a renewable resource. Only waste heat sources specifically excluded from classification as a renewable resource are waste heat from electrical generation processes and from pump-back hydro projects.

Similarly Pennsylvania's legislature recently approved SB1030, the Alternative Energy Portfolio Standards Act. Under the bill, 18 percent of Pennsylvania's energy will come from alternative sources by the year 2020. This brings to 16, the number of states that now have renewable portfolio standard (RPS) legislation that requires a certain amount of power generated by the utilities to be derived from renewable energy sources

The bill divides the requirements into two tiers: Tier 1 sources include solar, wind, low-impact hydro (below 50 MW per project), geothermal, biomass, biological and coal-mine methane, and fuel cells. Tier 2 sources include waste coal, distributed generation systems, demand-side management, large-scale hydro, municipal solid waste, wood byproducts, and integrated combined coal gasification technology. Waste heat recovery falls within more than one of these categories.

Finally the States of North and South Dakota putatively have credited waste energy recovered from a pipeline compressor stations with renewable energy credits. *See:* http://www.basinelectric.com/NewsCenter/News/NewsReleases/Basin_Electric_to_bu.html However counsel has been unable to confirm the pipeline's press release to date.

VII. CONCLUSION AND REQUEST FOR RELIEF

Waste heat recovery is a source of potential distributed renewable generation capacity that requires no new fuel source or energy. The phrase "environmentally friendly technologies" contained in the EPS does not specifically include "recovered energy" as a renewable resource. However technical data related to waste heat recovery suggests that the process satisfies the criteria listed in the June 2003 Working Group Report for classification as a renewable resource.

Petitioner Zeleni LLC requests that the Commission recognize waste heat recovery projects as a qualifying form of biomass technology under R. 14-2-1618L of the EPS. Alternatively Petitioner seeks a waiver of the definition of "environmentally friendly technologies" so that the definition may be interpreted to include waste heat recovery.

RESPECTIVELY SUBMITTED this __ day of December 2004



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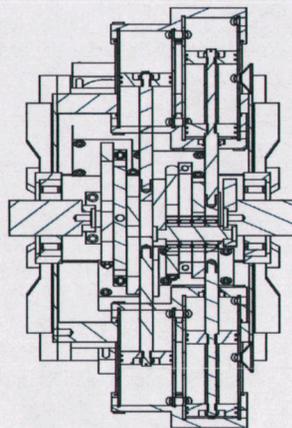
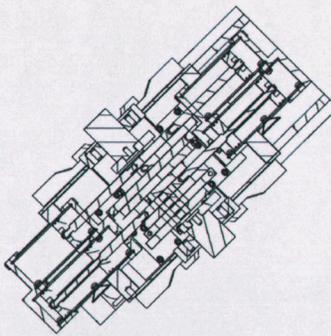
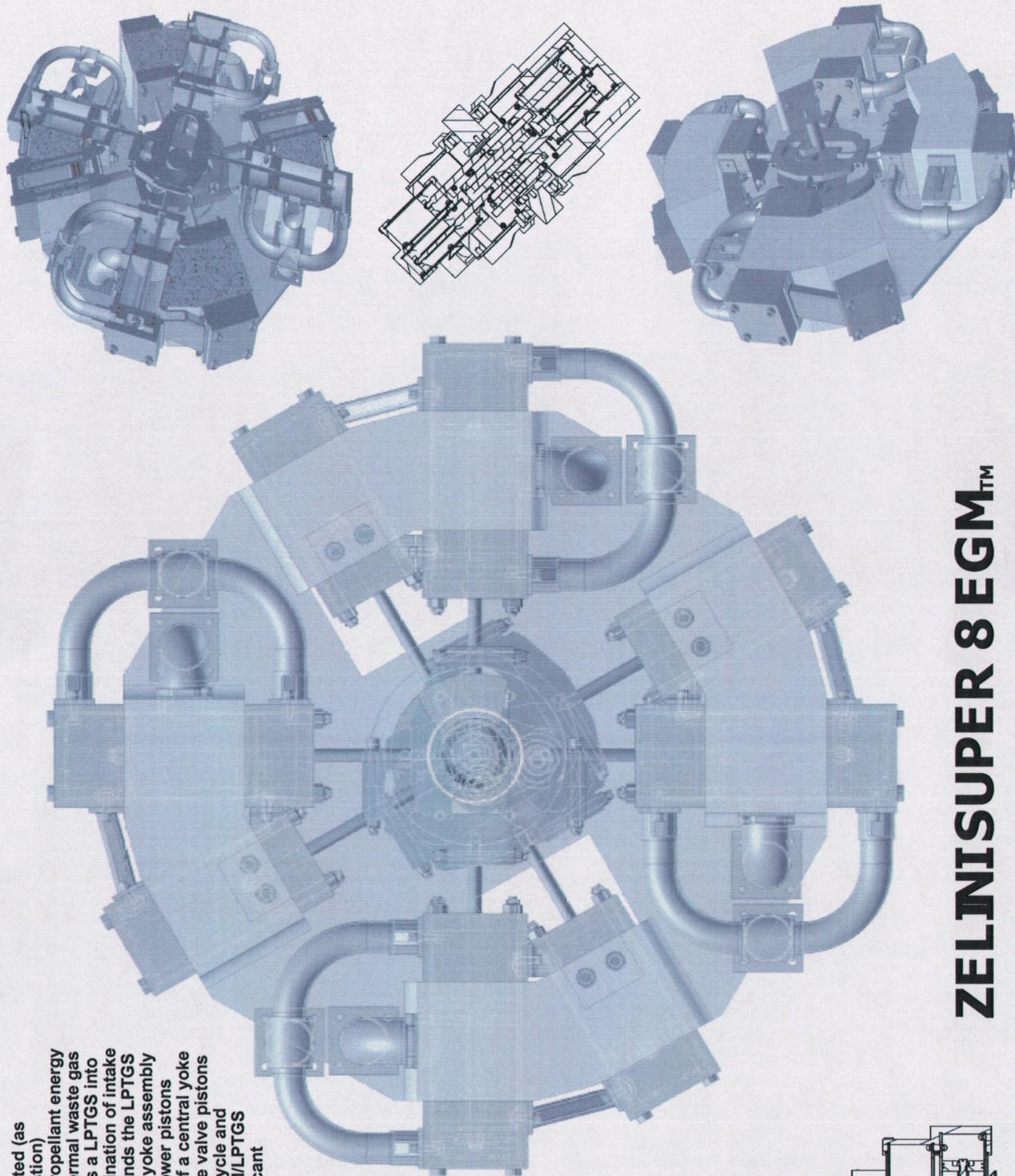
Attorney for Zeleni, L.L.C.

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Filed this __ day of December 2004

Docket Control
Arizona Corporation Commission
1200 West Washington
Phoenix, AZ. 85007

The EGM is a radial type fluid actuated (as distinguished from internal combustion) reciprocating motor that extracts propellant energy exclusively from a low-pressure thermal waste gas fluid stream (LPTGS). EGM converts a LPTGS into torque/work through a unique combination of intake and piston motion that rapidly expands the LPTGS to power moving pistons. A central yoke assembly converts the radial motion of the power pistons into a rotational motion by means of a central yoke assembly. A drive shaft actuates the valve pistons to complete the expansion/torque cycle and release the expanded gas. The EGM/LPTGS conversion action produces significant torque/work potential and dramatically cools and reduces the pressure of the waste stream.

The conversion from LPTGS to EGM torque/work only occurs as the result of some other combustion or manufacturing process that produces the LPTGS emission or waste stream. The EGM/LPTGS conversion process does not require water, coolants or oxygen and is not affected by altitude, ambient heat or cold temperatures. The conversion potential of EGM torque/work is limited only by the quality and continuous flow of the LPTGS and engine/piston size. Currently two EGM sizes are available for implementation. The EGM 3 (3 inch piston and bore with 8 power strokes) and the EGM Super 8 (6 inch piston and bore with 16 power strokes).



ZELINISUPER 8 EGM™ FLUID ACTUATED EXPANSION GAS MOTOR

BEFORE THE ARIZONA CORPORATION COMMISSION

MARC SPITZER
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STANDARD TO WASTE GAS-TO-)
ENERGY TECHNOLOGY)
_____)

DOCKET NO. _____

TESTIMONY OF JASON SOLOMON

ZELENI, L.L.C.

December 27, 2004

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Docket Control
Arizona Corporation Commission
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Attachment B

INTRODUCTION

Q. Please, state your name, occupation and business address.

A. My name is Jason Solomon. My office address is: 11611 North Meridian Street, Suite 110, Carmel, Indiana 46032. I am representing Zeleni, L.L.C. in this matter.

Q. Please state your background and expertise.

A. I have worked in energy-related fields worldwide for over 25 years.

My formal education was in mechanical engineering and refrigeration at the University of Miami.

My business background includes the development, engineering and construction of the first of its kind "island" refrigeration system technology for the "salad-bar", as it is known today. I worked as an independent contractor for the Sizzler Steak House franchise. My company built most of the company franchise and company owned "salad-bars and oyster-bars" steak house restaurants throughout the nation.

In 1991, after the break-up of the Soviet Union, I was recruited to work on fluid flow and energy conservation technologies in the new nation of Uzbekistan. I was employed by several Uzbek organizations during my eight years in that nation.

The majority of the work was spent working with the prestigious Uzbek Scientific and Technical Institute and Uzbekneftgaz (Uzbek Oil and Gas Company) on such initiatives as enzyme and hydrophilic reduction of waste streams and materials; compression and fluid-flow of water, natural gas and inert gases; expansion gas technologies for recovery of waste streams generated by oxidation of fossil fuels in industrial or electricity generation; advanced refrigeration heat exchange technologies; distributed electricity generation and micro-grid implementation; and advanced films and computer processes for passive solar energy generation systems.

I was enticed to return to the United States by my brother-in-law to finish an expansion refrigeration concept that I had first designed and built a prototype of in 1984 and had

1.

worked on the idea on and off since that time. This is the genesis of the expansion gas motor. The expansion gas motors were to be built by and employed in his transportation company and many others.

I was also recruited to work as the Director of Technology for the Parishes of south Louisiana, with the particular interest to attract and build new technologies to support gas and oil prospecting, transportation, storage, and distribution oil & gas both on- and off-shore.

Q. Please state your relationship to the Zeleni Expansion Gas motor.

A. I am the inventor and patent holder of the Zeleni Expansion Gas Motors (EGM)s, the first commercial model of which will be installed here in Arizona on a biomass facility. In 2003, I was recruited to serve as engineering consultant on the development of a diesel powered commercial work/duty vehicle that was to be moved by a continuously variable transmission powered by hydraulic fluid and movement. The truck was to reduce toxic and greenhouse gas emissions. That included reducing incomplete hydrocarbon oxidation and 2.5 sub-micron particulate ash in the emission stream by electronically controlling the engine heat and friction together with hydraulic control of the drive train.

While working on this initiative the application of expansion gas technology was discussed with several of the principals of the company. After a demonstration of the prototype, we decided to form Zelini (Green in Russian), L.L.C. and develop the Zelini Expansion Gas Motor. We have now moved from engineering/manufacturing to application.

Q. How does the Zeleni EG motor function?

Orientation:

The Zelini is an entirely new non-combustion prime-mover system for transportation or stationery applications that produces torque/horsepower from low-pressure thermal waste stream gases (LPTGS).

Background:

The Zelini EGM technology has advanced from concept to manufacturing over the past 18 years. The development process has included many model designs and prototypes, laboratory evaluation and field-tests in domestic and international locations.

The Technology:

The EGM is a radial type fluid actuated (as distinguished from internal combustion) reciprocating motor that extracts propellant energy exclusively from a low-pressure thermal waste gas fluid stream (LPTGS). EGM converts a LPTGS into torque/work by rapidly expanding the LPTGS to power moving pistons. A central yoke assembly converts the radial motion of the power pistons into a rotational motion. The EGM/LPTGS conversion action produces significant torque-horsepower potential and dramatically cools and reduces the pressure of the waste stream.

The conversion from LPTGS to EGM torque-horsepower only occurs as the result of some other combustion or manufacturing process that produces the LPTGS emission or waste stream. The EGM/LPTGS conversion process does not require water, coolants or oxygen and is not affected by altitude, ambient heat or cold temperatures. The conversion potential of the EGM is limited only by the quality and continuous flow of the LPTGS and engine/piston size. Initially two EGM sizes have been developed, the EGM 3 with 3 inch pistons and bore, and the EGM Super 8 with 6 inch pistons and bore.

The Product:

The Zelini EGM 3 (3 inch pistons and bore) produces low-cost and significant amounts of environmentally safe prime-mover torque to move a matched generator. The EGM 3 for e.g., may be combined with a new LI generator set and a solid-state control system, and is capable of generating up to 17 kilowatts of electricity for vehicle parasitic use. The EGM 3 mounts at the back of the exhaust manifold and is 5 ½" X 29 ½" in size and weighs 278 pounds.

Engineering:

The working EGM components are sealed and constructed of alloys with stainless steel piston sleeves. The bearings are non-load and self-lubricating manufactured with space-age polymer. The crankshaft, yoke assemblies and other components are constructed of hardened steel and composites.

The ECM 3 is equipped with a solid-state microprocessor to monitor the LPTGS, heat, and pressure relief systems. The EGM Super 6 prime-mover is controlled by a solid-state microprocessor and Continuously Variable Hydraulic Transmission (CVHT) for grid quality electricity potential. The EGM is relatively silent in operation.

Installation:

EGM 3 may be installed in OEM or retrofit applications pancake or up-right to assist with space considerations.

Service:

EGM is engineered for extended and continuous work service. The working components are simple to service with traditional tools/mechanic's skills in the field. The EGM may also carry a warranty for parts and service.

Environmental:

An EGM does not itself produce NO_x, SO₂, CO, CO₂, HC, mercury or Particulate Matter or any other airborne or water toxins traditionally associated with electricity generation.

Q. So then the Zeleni EG basically uses no fuel?

A. No fossil fuel is burned to produce work in the Zelini EGMs as fuel is understood in a conventional sense such as coal, oil, natural or biogas or biomass to serve as propellant for a Zeleni EGM motor. The "fuel" for an EGM is actually a "propellant or pressurized fluid stream." The EGM works exclusively by the rapid expansion of a pressurized fluid stream gas, such as steam, that releases the energy from the heat that is traditionally lost or wasted by fossil fuel combustion.

The first law of thermal dynamics states that energy cannot be produced in amounts greater than the energy employed for the production of that energy. In the case of oxidation of fossil fuel, only about 28% to 35% of the fuel burned is actually used for direct production of work. About 50% of the fuel burned is released as heat. The remaining 15% to 22% of the energy must be used to remove the heat from the work process. The Zelini EGM captures those otherwise wasted energy streams and converts them to torque-horsepower.

Q. So then the Zeleni EG motor takes a regulated waste or pollution fluid stream and converts it into a valuable product?

A. Yes, or perhaps more properly stated the Zeleni EG motor captures fugitive energy entrained in exhausts through heat recovery and then creates torque-horsepower with that fugitive energy (i.e. produces torque to turn the motor's shaft).

Q. So then the Zeleni EG motor is essentially a waste-to-energy technology similar to other biomass technologies?

A. Yes and no. The Zeleni EGM functions similar to a biomass facility, in that it is a waste-to-energy technology. However, the EGM unlike a biomass fuel consuming process, does not release any toxic or greenhouse gases, un-burned hydrocarbons or particulate ash for the work produced. Additionally, the Zeleni does not employ any external sources of oxygen or water to produce its work, so it is an inert environmental solution to the employment of traditionally wasted energy. A traditional biomass facility produces energy from a solid, gaseous or converted organic waste stream. The Zeleni EGM motor produces energy from the pressurized fluid or inert gas waste stream emission that results from the oxidation of a fossil fuel in an industrial, brewing, fossil fueled pump, compressor or motor. The EGM also will produce work from traditionally non-commercial geothermal release steam, landfill biogas prior to flare or combustion, or from release of pressurized gases from mining or drilling. Additionally, the EGM can provide substantially increased potential from passive energy sources such as solar or wind by storage of compressed air and can produce distributed energy from a servel heat source provided by a propane or butane tank in a condenser/evaporator rankine cycle. The Zeleni EGM simply "piggybacks" and recovers energy from an existing process of another source or alternatively employs pressurized fluid streams released from man-made or natural sources.

Q. Will the Zeleni EGM motor also reduce the amount of air emissions from fossil fueled fired steam generation boilers and other combustion emissions?

A. To date, Zeleni has conducted no formal tests as to the impacts of use of a Zeleni EGM motor with NOx or SO2 emissions from a gaseous waste stream. But the answer is probably yes, both in relative and absolute terms.

That is because the Zeleni EG motor also acts as a substantial cooling device as the rapid expansion of the fluid gas releases much of the heat to work by converting the heat back to energy. After a pressurized fluid waste stream that has been produced by oxidation of a fossil fuel passes through a EGM, the gas has the same chemical characteristic as when it entered the EGM, but the rapid expansion of the gas has significantly reduced the temperature and the pressure of the waste stream. The significant cooling of the waste gases may reduce the dependence on cooling towers. This can also have an affect on the production of NOx post combustion. We have not yet developed hard test data on this possibility as yet, but look forward to this prospect.

Now in relative terms the Zeleni EGM motor will also probably reduce air emissions. That is because the motor will make the process to which it is attached a more efficient user of energy, and thus require less energy to operate the process. Less fuel burned should equate to less emissions, if not onsite, then at the process energy source.

Q. Can you please summarize your conclusions?

A. Yes.

- (1) The Zeleni EGM motor operates by rapidly expanding almost any fluidized natural or man-made waste gas or heat stream. The EGM works in a thermodynamic manner to recover much of the energy wasted from the production or dissolution waste heat entrained in emission.
- (2) The recovered pressurized fluid stream is channeled into the intake of the Zeleni EG motor thereby producing substantial torque/horsepower from the waste streams (i.e., turns the Zeleni's PTO shaft for compression, pumping or to drive a generator). The torque horsepower is therefore created from a 100% waste commodity.
- (3) The Zeleni EGM motor functions the same as any environmentally inert or passive energy generator in as much as it requires no fossil or biomass fuel for combustion, uses

no water or oxygen (the EGM can operate underground) and releases the propellant gas in exactly the same chemical form less substantial heat and pressure.

Q. Does that conclude your pre-filed testimony?

A. Yes it does. Thank you..