Phoenix POWER

March 13, 2013

TO: Energy and Technology Council

FROM: Daniel Lessard
President, Phoenix Power, Inc.

RE: ***HB 6535 – AN ACT REDEFINING CLASS I RENEWABLE ENERGY SOURCES***

Senator Duff, Representative Reed, and Members of the Energy & Technology Committee:

I regret that I was not able to attend the March 7, 2013 public hearing at which HB 6535 was on the agenda. I am submitting this written testimony for your consideration, and am happy to meet with committee members to discuss the issue further.

As noted, my name is Daniel Lessard and I am the founder and President of Phoenix Power, Inc. (PPI). PPI is a Connecticut company founded in 2011 and incorporated as a Connecticut corporation on March 7, 2012. PPI's Phoenix TEG 100 is the first in a family of generators and a building block for megawatt systems that produce electric power by direct energy conversion. Like solar photovoltaic cells, the thermoelectric module (TE Module), which is the core technology of the Phoenix TEG 100 and a semiconductor made from materials with high Seebeck Coefficients, converts a source of energy into electricity. For a solar PV cell, the source of energy are solar rays. For a thermoelectric module, the source is a temperature gradient or heat flux. Thermoelectric direct energy conversion is a mature technology with a long history including the powering of our earliest satellites and dozens of industrial, defense and consumer applications. Extensive research funded by both private industry and government is underway to develop higher efficiency and lower cost modules and expand the applications that touch most industries.

BCS, funded by the United States Department of Energy, identified thermoelectric direct energy conversion as ideally suited for waste heat recovery, with the recoverable portion in the United States sized at 192 GW (WHR_DOE ITP.pdf "Waste heat Recovery: Technology and Opportunities in US Industry" sponsored by US Department of Energy, Industrial Technology Program, prepared by BCS, Incorporated, March 2008). The challenge or issue was low conversion efficiencies which resulted in poor economics.

In 2011, I made an innovative discovery that enables operating the Phoenix TEG 100 at its optimum temperature range for highest conversion efficiencies and a near 100% thermal efficiency. The benefits to the power plant include higher output with less fuel consumption, lower emissions and less waste heat. In addition, the levelized cost of energy is significantly less than conventional technologies by as much as a factor of two (2) and when compared to other renewable technologies such as solar and wind has an even greater cost advantage.

PPI's plan includes targeting waste heat recovery and waste heat reduction applications at utility and industrial power plants which offer a consistent source of underutilized thermal

energy. The Phoenix TEG product line has the potential to become standard equipment in current and future power plants around the world and to make a positive contribution to Connecticut's renewable energy, fuel conservation, environmental, and economic objectives. The technology generates clean electric power, produces no pollutants and unlike non-dispatch technologies like solar and wind, is available when the power plant is operating, which for base load plants is near continuous (capacity factor: 80-90%).

Key metrics for this application include the ability to increase plant nameplate capacity or output by as much as 2%, reduce fuel consumption rates and stack gas emissions by up to 1.5%, and reduce waste heat by as much as 3.75%.

The elegance of PPI's "patent pending" solution is that it utilizes a high temperature fluid, enabling a high temperature gradient that maximizes the conversion efficiency of the thermoelectric module, and then captures and reuses any energy not converted to electricity to provide an effective thermal efficiency of near 100%, well above the thermal efficiency of a conventional Rankine Cycle plant, which has a thermal efficiency generally in the range of 28-35% and where 60-70% of the heat flowing to the Turbine Generator is not converted to electricity or recaptured but instead exhausted to the atmosphere by the condenser as waste heat. Therefore, by operating at an optimum temperature gradient, the thermoelectric modules operate at their maximum efficiency resulting in a smaller generator with fewer thermoelectric modules and therefore lowest cost. In addition, by integrating a Phoenix TEG into a Rankine Cycle as described, there is a significant impact on overall plant thermal efficiency, and therefore fuel consumption, stack gas emissions and waste heat, all which contribute to the cost of electricity for the plant.

The Phoenix TEG is an innovative clean energy generating technology that converts readily available and under-utilized thermal energy in a power plant into electric power and at the same time reduces the rate of stack emissions, waste heat and fuel consumption. The Phoenix TEG Power System is compact, easily retrofitted into an existing plant without the need to modify existing high capital cost equipment at the plant, add staffing or significantly change the operation of the plant and therefore provides an attractive option for industrial, merchant and utility power plants to help Connecticut and other states meet their current renewable energy power needs and environmental goals.

This technology deserves the advantages that come with designation as a Class I Renewable in Connecticut. Thermoelectric conversion power generation is, in fact, a clean, renewable energy technology, with the added benefit that it utilizes and reduces waste heat.

I therefore urge the committee to amend ***HB 6535 – AN ACT REDEFINING CLASS I RENEWABLE ENERGY SOURCES,*** to include *thermoelectric direct energy conversion.*

I would be happy to discuss this further with committee members. I can be reached by email at lessard4d@gmail.com or by phone, at (203) 650-0849.

Thank you.