

# Synergetic Power Systems Executive Summary

## Ignite Clean Energy Competition *Igniting Massachusetts' Energy Future*

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## General Information

### Revision History

Version	Date	Editor	Notes
1.0	2/28	Elizabeth Wayman	Initial Release: too long (word count = 1400+, should be 1200), needs work on the business strategy

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### About Synergetic Power Systems

In recent years, renewable energy has seen exciting growth in the share of the total energy market. Many renewable energy technologies have come online to provide clean sources of electricity. However, few options exist for the provision of clean energy for heating, cooling, and water heating. Over 700,000 commercial buildings in the Northeast alone have no option but to rely on electricity, natural gas, fuel oil, or propane to fulfill their HVAC and water heating needs.

Synergetic Power Systems offers a solution to these needs through a modular, distributed renewable energy system that combines concentrated solar thermal energy and biogas fuel with a micro-scaled thermodynamic cycle to provide water heating and HVAC functions. The energy inputs and outputs of the system are orchestrated by a unique control system to maximize efficiency while providing energy that is tuned to the customer's needs.

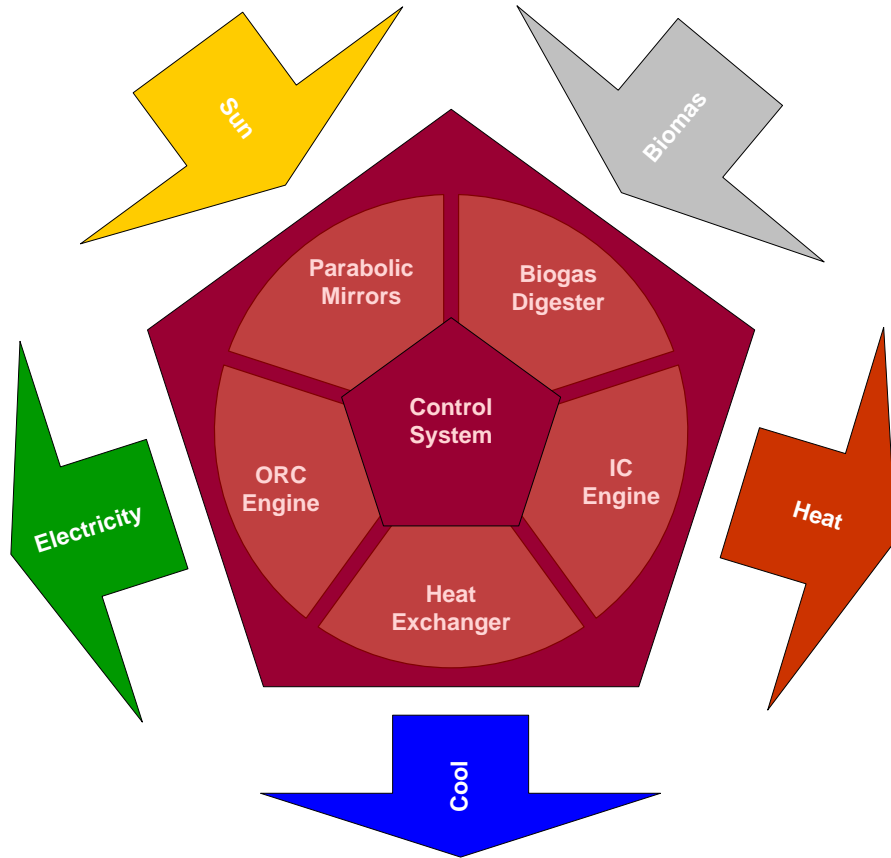
Corporations such as Wal-Mart and The Home Depot have projected substantial financial savings from employing renewable energy sources to provide electricity for their stores. Synergetic Power Systems will appeal to these and other organizations by offering an alternative energy source for energy needs other than electricity that will further reduce their expenditures on energy while avoiding the use of fossil fuels.

### Product Overview

Synergetic Power Systems technology couples renewable energy sources such as solar thermal energy and compost-generated biogas with a micro organic Rankine cycle (ORC) and an internal combustion engine to provide electricity, heating, cooling, refrigeration and running hot water. The optimization of the system is achieved through a unique control system that orchestrates the energy inputs and outputs to suit the customer's resources and needs while maximizing efficiency. The product can be used as a stand-alone unit to provide a blend of hot water and space heating and cooling tailored to the customer's needs.

Versatility, scalability, and synergy are unique attributes and distinguish this technology as a reliable, affordable, sustainable, distributed renewable energy system. The range of system capabilities are summarized in Figure 1.

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**Figure 1.** System modules, inputs, and outputs

Synergetic Power Systems' modular design will allow us to eventually develop 6 types of products by mixing and matching the above components to meet the needs of different markets. These products summarized in Table 1.

**Table 1.** Synergetic Power Systems Product Line

Model	Description	Functional Fit
A	power generation system using solar concentrators and micro-ORC generator	Buildings with large flat roofs or other open areas and abundant sunlight
B	Power generation system using biomass digester and internal combustion engine	Buildings with minimal space and available organic material for composting
C	A combination of both A-type and B-type. This integrated system	Buildings with space, sunlight, and compost material

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	provides maximum efficiency due to better waste heat recovery	
A++	Array of model A units	Buildings with no space constraints and abundant sunlight that require additional power
B++	Array of model B units	Buildings with minimal space and widely available compost material that require additional power
C++	Array of model AB units	Buildings with space, sunlight, and compost material

The modular design lends itself to scalability. Our system architecture will allow us to configure arrays of multiple A, B or C units to increase the output capacity for heat, electricity and cooling. Additional units can be integrated with existing units allowing us to deploy small systems at first and upgrade them later as the community needs evolve.

### Competitive Advantages

Synergetic Power Systems provides renewable energy for heating cooling and water heating. The products would compete with technologies that provide either of these services; wind turbines and solar photovoltaics as renewable energy systems, and natural gas, fuel oil, and propane as sources of energy for heating, cooling, and water heating.

Synergetic Power Systems' clear advantage lies in its provision of these services through renewable energy. Although some products exist that provide water heating through solar thermal energy, Synergetic Power Systems is unique by providing heating and cooling in addition to water heating through renewable energy sources. Synergetic Power Systems also provides a suite of services tuned to the customer's needs. Furthermore, the modularity and scalability of the systems makes them appropriate for a wide range of applications.

As our team name implies, the output of this synergetic system exceeds the simple sum of the output of each system's component. The system uses components that have been proven over the years to be efficient and reliable. This significantly reduces risk and complexity, and makes the system more viable. The micro-ORC is a novel development that brings this proven technology to the levels necessary for a small, distributed energy system. In addition, the biomass digester is designed to provide increased efficiency compared with existing units on the market. Additional competitive advantages are the system architecture and the control system. The system architecture is based on the integration of these modular, standardized, low cost components working in concert with a control system to optimize energy flows and supply user-defined energy needs. Patentable technologies include the micro-ORC, the biogas digester, the system architecture, and the control system.

### Target Market

Synergetic Power Systems will target the owners of the 700,000-plus commercial buildings in the Northeast of the United States. The 726,000 non-mall buildings in the Northeast have currently

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have no option but to rely on natural gas, electricity, fuel oil, or propane for their HVAC and water heating needs. Many owners of these buildings have considered employing renewable energy technologies to provide electricity, and constitute an excellent market for renewable energy sources for heating, cooling, and water heating.

For example, in 2005, Wal-Mart opened two experimental stores that use wind turbines, solar PV panels, and a bio-fuel boiler to reduce the consumption of natural resources and the generation of greenhouse gases. The two experimental stores are expected to decrease their energy consumption by 30% to 50% as compared to stores not using any type of renewable energy. According to Wal-Mart, this would reduce the typical store energy cost by \$100,000/yr or more, while reducing carbon dioxide emissions by 50,000 to 60,000 lbs/yr.

Wal-Mart goal is to design a store that will use 30% less energy and produce 30% fewer greenhouse gas emissions than the 2005 designs within the next 4 years and Synergetic Power System can help Wal-Mart to achieve this goal.

Another example is The Home Depot. Since 2003, The Home Depot has been implementing number of changes in their design and construction process for new stores. These new stores use 34 percent less energy than the old Home Depot buildings. And thus, in September of 2005 The Home Depot announced its firm commitment to use renewable energy in all its stores. While wind turbine and solar photovoltaic panels can contribute to the provision of electricity by renewable resources, Synergetic Power Systems can also contribute heating, cooling, and water heating.

A statistic about how much ENERGY is consumed in HVAC would be good here. Can't find one so far, I'll keep looking.

## Business Strategy

Synergetic Power Systems' business strategy consists of three phases; 1) prototype development and testing, 2) small-scale deployment and demonstration, and 3) direct sales to commercial building owners and corporations.

A prototype of the Type A model has been developed and deployed in Lesotho in Southern Africa, and provides electricity and running hot water. Our next step will be to build a prototype for further testing and demonstration of the technology here in United States. This will be a Type A unit that uses solar thermal energy for input heat. In parallel with this effort, we have already started researching and developing the biomass digester for a Type B unit.

To penetrate the local market, we will also develop the architecture for model A++, an array of Type A units that could be installed on flat-roofed buildings in the domestic market to provide hot water and cooling capability during hot summer days. We plan to install this system at MIT or another local business to showcase the potential for such a system.

## The Team

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The team behind Synergetic Power Systems consists of the two original founders who have developed the project over 2 years. Their expertise lies in electrical and control engineering, systems integration, and relations with developing countries. They are joined by two students of the MIT System Design and Management Program who are jointly sponsored by Sloan School of Management and the MIT School of Engineering, one graduate student in mechanical engineering at MIT, and one undergraduate student in Electrical Engineering at MIT. These team members bring with them complimentary business and engineering skills including entrepreneurship, thermodynamics, systems integration, and electrical engineering. The team also has accumulated working experience in foreign and developing countries, and almost 20 years of working experience in relevant engineering fields.

### Conclusion

Synergetic Power Systems offers a unique product to meet the heating, cooling, and water heating needs of the commercial building market through renewable and clean energy. The commercial building market in the Northeast alone amounts to over 700,000 buildings, many of which are seeking renewable energy sources. Due to its capability to produce energy for heating, cooling, and water heating instead of just electricity, Synergetic Power Systems stands to capture a substantial portion of the building market seeking to use renewable energy.

Synergetic Power Systems' next step is to build a prototype in the Boston area for improvements and testing. This endeavor will require ###, and will advance Synergetic Power Systems toward its following step of full-scale demonstration with a local business within 1 year.

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