

## **ClearSign and Grandeg Announce Development Agreement** **Companies to collaborate to develop combustion and emissions control solutions for Grandeg biomass boilers.**

MINNEAPOLIS, April 10, 2013 /[PRNewswire](#)/ -- ClearSign Combustion Corporation (NASDAQ: CLIR), an emerging leader in combustion and emissions control technology for industrial, commercial and utility markets and Grandeg, an 20-year-old European market leader in commercial wood pellet boiler systems, today announced their intention to enter into a development agreement for the integration of ClearSign's proprietary ECC™ technology into Grandeg's line of commercial wood pellet boilers.

The companies announced at the International Biomass Conference and Expo in Minneapolis, MN, that they intend to collaborate to develop and bring to market, combustion and emissions control solutions that will be suitable for both retrofit into existing Grandeg biomass boilers, as well as for integration into new product designs.

Grandeg has indicated its intent to provide up to \$500,000 in funding to support a phased initial project that is expected to begin in the current quarter with the goal of releasing a first commercial solution to the market during 2014. The companies also intend to explore the possibility of further extending their collaboration as the current program progresses.

"For 20 years Grandeg has been committed to staying on the forefront of technological innovation, building products that meet the highest standards of both quality and performance," said Andris Lubins, President of Grandeg. "ClearSign's ECC technology represents an opportunity for Grandeg to add unique and compelling new features to biomass boilers that can deliver valuable benefits to our customers and enhance our market position. We believe that by affording elegant and powerful solutions to the management of multiple types of emissions while improving overall energy efficiency, ClearSign's technology may help us to redefine the state of the art for solid fuel combustion. Further, we believe that it may be possible to introduce a next generation of industry-leading biomass boilers that are not only much cleaner, but also more energy efficient, more compact, more cost-effective and more reliable."

ClearSign CEO Rick Rutkowski said, "We are gratified to partner with a company like Grandeg that has such a strong reputation for innovation and excellence in product design. Grandeg's products are known throughout Europe as among the best and most reliable pellet boilers available in the market. Our companies have developed a shared vision of how ClearSign's technology can be applied to the design of both retrofit solutions and new systems to extend the environmental performance of pellet boilers and other solid fuel combustion systems into new and exciting territory while also improving energy efficiency."

The market for wood pellet combustion systems is large and growing. Currently, over two million stoves and inserts are sold annually in the EU in 27 countries. In the United States, more than 600,000 homes use wood pellet heating systems. Additionally, demand in Europe for residential systems grew at an annualized rate of over 25%. Between 2007 and 2010, the global wood pellet market experienced a dramatic increase and this trend is continuing with global production increasing from almost 8 million tons per year to over 14 million tons in 2010. By 2020, global production is projected to reach between 35 and 50 million tons in the EU alone.

ClearSign recently announced that it had constructed and fired a new test furnace, capable of firing at a rate of over 1.2 million Btu/h per square foot, and dedicated to development activities related to solid fuel combustion. This continuous-feed furnace expands the company's development and testing capabilities, enabling it to test fuels similar to those used in Grandeg's systems and at a similar scale to commercial units.

"The clean and efficient combustion of solid fuels has far reaching implications that relate not only to biomass boilers and heaters, but also to the operation of many types of industrial heaters, waste-to-energy (WTE) systems, and coal-fired power plants," Rutkowski commented. "We are actively exploring significant business opportunities with prospective partners and customers across these market segments with a common interest in solid fuel combustion. In order to facilitate the pace of commercialization going forward, we have also aligned ourselves with several of the most respected research institutions in the field of solid fuel combustion whose resources and capabilities complement and extend our own."

"What is especially promising about our work with solid fuels is that the dominant model for emissions control is the use of post-combustion or after treatment systems that try to trap, filter or scrub the waste out of the exhaust gases. Our goal is to prevent or inhibit the formation of pollutants by better controlling the combustion process itself. If we're successful, we can reduce or eliminate the significant capital, operating and maintenance costs typically associated with after-treatment systems."

According to Rutkowski, the timing is good. There are, he says, major global challenges and corresponding opportunities associated with the use of solid fuels. In the US, coal remains a major source of power generation by electric utilities despite strong growth in the use of natural gas. However, system operators are facing the introduction of new EPA regulations such as MACT (Maximum Achievable Control Technology) and MATS (Mercury and Air Toxics Standards), that govern emissions of multiple pollutants including ultrafine particulate matter (PM 2.5), NOx and CO, with rapidly approaching compliance deadlines in the next 18 months to two years.

In China, coal is the primary source of thermal energy for both power generation and industrial processes, but its pervasive use there is a key contributor to critical air quality challenges including persistently hazardous levels of particulate matter and PM 2.5.

"We believe that ClearSign's ECC™ technology may enable a powerful and cost-effective set of solutions to address a broad range of fundamental challenges associated with solid fuel combustion," Rutkowski said. "It's pretty humbling to think that if we are successful, not only can we deliver tremendous economic value, but that our technology may fundamentally improve the quality of life for many millions of people."

Comprising multiple fuel types including so-called "opportunity fuels" such as biomass, municipal solid waste (MSW) and tire-derived fuels (TDF), solid fuel combustion faces several common issues.

According to ClearSign CTO, Joe Colannino, combustion of solid fuels is especially complex, owing to its highly variable nature. These variations include differences in chemical and physical composition, moisture content, and other characteristics.

"All of this variation means that it's harder to get uniform mixing or uniform heat distribution," explained Colannino "and that's why you tend to see multiple kinds of emissions from solid fuel.

"However, our early testing has shown that in the presence of a pulsed electrostatic field we can achieve dramatic reductions in particulate matter, carbon monoxide (CO), and total hydrocarbons and that we can distribute temperature more uniformly, improve flame patterns and reduce hot spots.

"We have also used patent-pending electrode configurations to shape and shorten flames and to anchor them at ever larger scales. These experiments were conducted using methane and propane, but with slower flame types similar to those found in many industrial solid-fuel combustion systems. We have also conducted numerous experiments in which flame speed appears to be dramatically increased. These effects may prove very important for solid fuel combustion, because solid fuels actually burn in two phases with the evolved gases burning at a much faster initial rate than the residual solid or 'char' component of the fuel.

"I'm excited to get underway with this important effort."

#### About Grandeg

Grandeg, an ISO-9001 certified manufacturer of industry-leading biomass combustion systems, has focused on the design and manufacture of modern, automated wood pellet boilers for twenty years. Grandeg's product line features both semi-automated and fully automated boiler and furnace systems for residential, commercial and district heating customers. As a technology leader, Grandeg is a pioneer in the use of robotic manufacturing processes, resulting in boilers with excellent energy and emissions profiles as well as long operational life. For more information about Grandeg, please visit <http://grandeg.com>

#### About ClearSign Combustion Corporation

ClearSign Combustion Corporation designs and develops technologies that aim to improve key performance characteristics of combustion systems including energy efficiency, emissions control, fuel flexibility and overall cost effectiveness. Our Electrodynamic Combustion Control™ (ECC™) platform technology improves control of flame shape and heat transfer and optimizes the complex chemical reactions that occur during combustion in order to minimize harmful emissions. For more information about the Company, please visit [www.clearsign.com](http://www.clearsign.com)

#### Cautionary note on forward-looking statements

This press release includes forward-looking information and statements within the meaning of the Private Securities Litigation Reform Act of 1995 and the provisions of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. Except for historical information contained in this release, statements in this release may constitute forward-looking statements regarding our assumptions, projections, expectations, targets, intentions or beliefs about future events that are based on management's belief, as well as assumptions made by, and information currently available to, management. While we believe that our expectations are based upon reasonable assumptions, there can be no

assurances that our goals and strategy will be realized. Numerous factors, including risks and uncertainties, may affect our actual results and may cause results to differ materially from those expressed in forward-looking statements made by us or on our behalf. Some of these factors include the acceptance of existing and future products, the impact of competitive products and pricing, general business and economic conditions, and other factors detailed in our Quarterly Report on Form 10-Q and other periodic reports filed with the SEC. We specifically disclaim any obligation to update or revise any forward-looking statement whether as a result of new information, future developments or otherwise.

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