The University at Buffalo Helps Enable Next-Generation "Green Energy" Heating Systems for Homeowners and Businesses

Econoburn, headquartered in Brocton, NY, is an industry leader in the design and manufacturing of gasification wood boilers. These renewable green energy systems provide businesses and homeowners with an all-natural heating system that is the cleanest and most cost effective way to burn wood.

Econoburn is designing its next generation wood boilers with the aid of complex and computationally expensive numerical models developed by Dr. Paul E. DesJardin, a professor of Mechanical and Aerospace Engineering at the University at Buffalo. By simulating combustion and air-flow in alternative boiler configurations these models are leading to improved designs that squeeze every BTU possible out of a wood boiler while simultaneously minimizing harmful emissions.

Econoburn
Wood-Fuel Boilers

Company: Econoburn
Industry: Wood-Fuel Boilers
Location: Brocton, NY
Website: http://www.econoburn.com

Econoburn utilizes over 60 years of experience in manufacturing high-quality steel to create leading-edge, low-emission two-stage wood boilers that have revolutionized the heating industry. Econoburn is designed in Brocton, NY by Dale Furman who holds the patent.

THE CHALLENGE

Since its introduction in the US marketplace in 1976, the downdraft wood burning technology known as "gasification" has provided customers with an all-natural and low-maintenance solution for heating homes and businesses. These heating systems use a renewable resource (wood) and are eco-friendly alternatives to burning coal and other fossil fuels. They also help reduce America's dependence on foreign oil.

Today, Econoburn, is a leading manufacturer of heating systems that employ gasification technology. This company is relying on the engineering expertise and computing resources at the University at Buffalo to design next-generation systems that are more efficient and produce much lower emissions. Facilitated by the HPC NY industry outreach program, this industry-academic partnership will ensure that these New York companies remain at the forefront of the industry.

NEW SOLUTIONS

Dr. Paul E. DesJardin and the University at Buffalo Center for Computational Research (UB CCR) partnered with Econoburn to provide access to CCR's 3,400-processor high-performance computing infrastructure. Professor DesJardin developed detailed numerical models of Econoburn's proprietary heating system. These numerical models were specially crafted to take full advantage of the CCR facilities.

This allowed Prof. DesJardin to quickly run hundreds of simulations aimed at developing a complete understanding of various components and processes that make up a gasification boiler system. Of particular interest are the twin processes of turbulent mixing and combustion within the small air nozzles that feed the combustion chamber of the boiler. Understanding and controlling these processes will allow for further emissions reductions and increased BTU output.

This is all made possible through funding from NYSERDA and the Division of Science Technology and Innovation (NYSTAR) of the Empire State Development Corporation (ESD) through its High Performance Computing Consortium (hpc-ny.org) and the New York State Regional Economic Development Council.

ECONOMIC IMPACTS

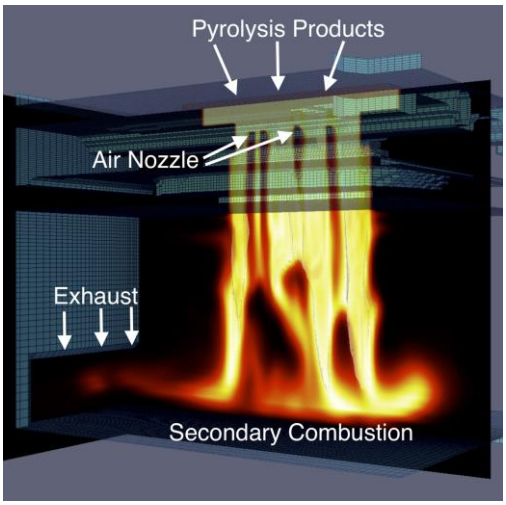
Econoburn is currently a small company owned by Abasco, Inc. located in Hamburg, NY with a total of 50 employees, 11 of which are primarily dedicated to Econoburn. Recently becoming one of only three companies worldwide to receive approval from New York State Energy Research and Development Authority (NYSERDA) for their energy efficiency incentive program, Econoburn is predicted to continue its growth.

Research results provided by UB look to aid in the advancement of Econoburn boiler technology by saving them valuable resources by eliminating the need to contract privatized research and development companies. Collaboration between UB and Econoburn has resulted in the support of 4 Ph.D. students, preparing them to be leading contributors in the field of renewable energy.

RESULTS

Modeling air inlets within a combustion nozzle requires extremely fine scale resolution and results in a computationally demanding model. In fact, a typical simulation uses millions of grid nodes and has a wall-time of 72 hours running on over 1,000 processors. ***Running just one of these simulations on a modern quad-core desktop PC would take over 2 years.*** In this way, the high-performance computing resources of UB CCR are dramatically accelerating the R&D efforts of Econoburn, enabling them to bring new products to market much faster than the competition.

Each simulation generates around 200 gigabytes of data. This data is analyzed using UB CCR's remote visualization resources – a combination of high-end graphics hardware and client tunneling software. These services allow UB CCR to offer web-accessible remote desktop environments that run state-of-the-art visualization applications like ParaView and TecPlot in a hardware accelerated mode. This results in an extremely responsive application that is free from jitter, latency, and buffering. In fact, application performance is often better than a conventional local installation. The image at right is from a recent analysis performed by Professor DesJardin in support of this project. It depicts turbulent combustion of pyrolysis products mixed with fresh air provided by the inlet small inlet nozzles of the boiler.



"We have been so pleased to be a part of this unique collaboration between industry, academia, and government to reach the common goals of enhanced performance and reduced emissions in not only our product, but the advanced biomass combustion industry as a whole. Personally, the greatest aspect has been the interaction with the students and seeing the detailed work, experiments, and modeling they have conducted. The UB MAE Department is playing an integral role in pioneering the legitimacy of this industry. " -- Mark O'Dell, Vice President

ABOUT HPC[NY]

Funded by ESD and NYSTAR, HPC[NY] is a partnership between NYSERNet, a private not-for-profit corporation created to foster science and education in New York, and three supercomputing centers: the Rensselaer Polytechnic Institute Center for Computational Innovations, Stony Brook University/Brookhaven National Laboratory's New York Center for Computational Sciences, and the University at Buffalo's Center for Computational Research.

HPC[NY] provides businesses and research organizations with access to world-class advanced computing expertise through accelerating the engineering and development path of complex, ground-breaking designs to reliable, accurate, innovative product and process performance that can provide a distinct competitive advantage.

ABOUT CCR

The Center for Computational Research (CCR), part of the University at Buffalo (UB), is a leading academic supercomputing facility. CCR maintains a high-performance computing environment, high-end visualization laboratories, and support staff with expertise in computing, visualization, and networking.

The mission of CCR is to (1) enable research and scholarship at UB by providing faculty with access to high-performance computing and visualization resources, (2) provide education, outreach, and training in Western New York, and (3) foster economic development and job creation in Western New York by providing local industry with access to advanced computing resources, including hardware, software and consulting services.

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