CASE STUDY
Intel® Cluster Ready
ClusterVision
High-Performance Computing

Speeding Time-to-Market with a Simple, Powerful Cluster

ClusterVision and Intel® Cluster Ready help Ceres Power accelerate design and improve quality for transformative new power and heating products

CeresPower

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Euan Freeman, Manager
Computer-Aided Engineering
Ceres Power

Ceres Power is developing products that could ultimately change the world by moving power generation away from giant centralized plants and into every home. Challenges remain and success requires getting high quality products to market in volume to stay ahead of the competition and meet the needs of investors.

To answer these challenges, Ceres Power worked with ClusterVision to quickly deploy a 7+1 node computing cluster. Certified as Intel Cluster Ready, the new cluster was up and running within a day and in less than a week was speeding time to results by eight to ten times for the company's key design, simulation, and analysis applications.

CHALLENGES

- **Get new residential power and heating generators to market** faster to attract more investment and realize "first-mover" advantages.
- **Optimize designs and processes** for efficiency, functionality, durability, and manufacturability to ensure fast, reliable, high-volume rollout.

SOLUTION

- **Work with ClusterVision** to quickly deploy a powerful, easy-to-use cluster based on the Intel® Cluster Ready architecture.

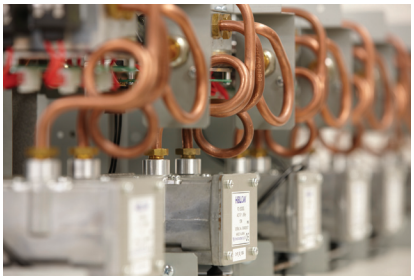
IMPACT

- **Eight to ten times faster performance** for simulation and analysis applications.
- **Better and faster design iterations**, saving weeks on critical project timelines.
- **Rapid time to value** with a turnkey solution that was deployed in just one day and worked as expected right out of the box.

clustervision

Intel® Cluster Ready

Changing the World One House at a Time



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Christopher Huggins, Sales & Marketing Director ClusterVision

Imagine a compact, cost-effective micro-generator that would reduce home electricity and heating costs by 25 percent, reduce greenhouse gas emissions, and ease the load on today's overburdened electrical grids. Ceres Power, a leading alternative energy company in the UK, is developing just such a device. The company's combined heat and power (CHP) unit has the potential to become the new standard for energy provisioning in millions of homes. It also provides a foundation for smart grids, which could eventually improve efficiency and reduce emissions on a global scale.

The CHP product from Ceres Power allows home owners to generate all their heat and hot water and most of their electricity. It replaces a standard water heater or boiler and can run on natural gas or packaged fuels. At the heart of every CHP unit is a fuel cell module based on solid oxide fuel cell (SOFC) technology developed by Ceres Power. This patented technology opens the door to mass market implementation by enabling efficient power generation at the relatively low temperatures required for residential solutions.

The savings can be compelling. The fuel cells not only generate power very efficiently, but also at the point of consumption, which eliminates the transmission losses that occur over electrical power lines. Compared with traditional energy delivery models, a Ceres Power CHP unit improves the total system efficiency of energy delivery from 35 percent to around 90%.[1] Home owners save money, CO2 emissions are reduced substantially, and the load is lightened on today's overburdened power grids.

Challenges of the Marketplace

Being first to market with such a transformative product offers tremendous advantages, so rapid development is important. However, for Ceres Power to fully capitalize on its position as a first mover, the transition into the marketplace must be smooth. The CHP products must be reliable, durable, and easy to install and use. They must deliver fully on promised value to establish credibility in the marketplace. They must also be optimized for high-volume production, so the company will be able to scale its operations quickly to serve potentially massive markets.

Improving Speed and Quality with a High Performance Cluster

To meet its tough market challenges, Ceres Power needed to accelerate development while simultaneously ensuring the highest levels of product quality. Euan Freeman, the Computer-Aided Engineering (CAE) manager for Ceres Power had an answer: deploy a high performance computing (HPC) cluster. "Our engineers were relying on workstations to perform digital simulation and analysis," says Freeman. "Our models and analyses were effective, but they took a long time to run, even on our largest eight-core workstations."

Freeman had worked with clusters before, so he understood how dramatically an HPC cluster could speed time to results and accelerate design iterations. He knew a cluster would allow engineers to focus on more complex experimental designs, achieve greater detail and accuracy, and run larger and more complex models. He also knew a cluster would be able to support the heavy computational loads of 3D modelling applications, which would help the engineering team optimize designs more thoroughly and with less need for costly, time-consuming physical prototypes.

However, Freeman was concerned about the challenges inherent in implementing an HPC cluster. "We had tight design schedules to meet and we couldn't afford to devote a lot of time and resources to purchasing, deploying, and managing a cluster."

A Cluster without the Complexity

After exploring options with several vendors, Freeman turned to ClusterVision, a company that has built some of the most powerful computing clusters in Europe. Importantly for Freeman, ClusterVision is also focused on making cluster computing easy for users through two key elements.

The Intel Cluster Ready Architecture.

Designing and building a traditional HPC cluster is a complex and time-consuming task, requiring hardware and software components to be selected, integrated, and extensively tested to ensure interoperability for each individual cluster. The Intel Cluster Ready Architecture establishes a standards-based hardware and software architecture for clustered computing systems. This common architecture helps to reduce cost, risk, and complexity for new cluster deployments by assuring that components work together and that registered applications run reliably on any certified cluster right out of the box. Intel Cluster Checker software is included as part of the software installation in every Intel Cluster Ready certified system, and is executed as a standard component in the ClusterVision service solution. It provides additional, easy-to-use tools for testing, troubleshooting, and certifying systems based on the Intel Cluster Ready architecture.

Bright Cluster Manager*

ClusterVision implements this all-in-one cluster management solution from Bright Computing to further simplify the installation, management, and use of its HPC clusters. Instead of multiple applications that were never designed to work together, users can provision, monitor, test, manage, and use their cluster from a single application with a unified interface. Bright Cluster Manager also performs automated health checking to quickly detect and resolve problems before they impact performance.

ClusterVision was one of the first HPC vendors to join the Intel Cluster Ready program, and the company's feedback has been instrumental in optimizing the Intel Cluster Checker software to deliver higher value. According to Christopher Huggins, ClusterVision's Sales & Marketing Director, "We've integrated Intel Cluster Ready into our cluster development processes. Our engineers were initially reluctant to add an additional certification requirement, but they've found that Intel Cluster Checker software actually simplifies the work of building a cluster. They can detect faulty hardware and software components more easily. That can be a significant advantage when you have hundreds or even thousands of components per cluster."

Intel Cluster Ready has helped ClusterVision deliver higher value to many of its customers, especially those, such as Ceres Power, that haven't had previous experience implementing a cluster. "With the Intel Cluster Ready architecture and Bright Cluster Manager, customers can get their cluster into production within days, and without a lot of tuning, testing, and management overhead," said Huggins. "A lot of smaller companies and research organizations now have a viable path for implementing HPC."

Up and Running on Day One

ClusterVision helped Freeman configure a 7+1 node cluster based on the Intel Xeon processor 5600 series (seven 2-socket compute nodes with 12 cores each, and a 2-socket head node with 8 cores). According to Freeman, "I chose the Intel processors because of their number crunching superiority. Intel just seems to be ahead of the game in that respect."

The system was designed to handle the full range of the company's existing workloads and to enable fast performance for new 3D modelling and simulation software. "A ClusterVision engineer arrived with the system, and had it set up and running our applications within a day," said Freeman. "He spent a couple more days with us, teaching us how to use and manage the cluster, and then we started to use it for analysis. The process was simple and seamless. Everything worked the way it was supposed to."

Order of Magnitude Gains in Design Speed

Freeman and his engineering team use the cluster for a number of applications, including:

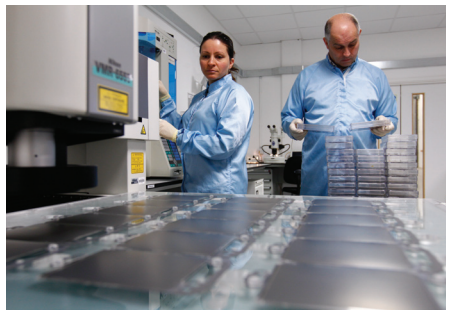
- **gPROMS** from PSE, which provides 1D simulations for exploring fuel cell chemistry and performance within specified environments.
- **DYMOLA** for the rest of the company's 1D simulations. The ability to program simulations enables the engineering team to match specific needs very precisely.
- **ANSYS 3D Design and Analysis tools**. ANSYS Fluent provides computational fluid dynamics (CFD) modelling to better understand the flow of fluids, gasses, and heat. ANSYS Abaqus enables finite element analysis (FEA) for understanding and optimizing solid components. A typical model run by the Ceres Power engineering team will include millions of cells. The resulting workloads are computationally demanding and the power of the cluster is essential to obtain results within a reasonable time frame.

According to Freeman, "The cluster has sped up our simulation and analyses runs by eight to ten times. Combined with the ability to run larger 3D models, we're orders of magnitude quicker in our design iterations. We also have the computational capacity to include more complex experimental designs. Instead of studying just one variable per run, we might study 16. This has allowed us to be more systematic in our design processes and get the answers we need more quickly. We've seen dramatic improvements in the quality and performance of our prototypes."

On Track to Transform Residential Power Delivery

The cluster has quickly become a critical resource for Ceres Power. All the company's 3D analyses are run on the cluster, along with an increasing number of large 1D simulations. Freeman and his team are moving toward 90 percent utilization of the system as they continue to fine-tune their queuing model to more closely match cluster availability with design workflows.

Freeman and his engineering team consider the Intel Cluster Ready certified system a clear success for Ceres Power. "ClusterVision told us the system would run all our workloads and perform seamlessly right out of the box," said Freeman, "and they were right. We're on track to meet our aggressive product launch schedule, and we've significantly improved performance and quality for key components of our CHP product. I'd recommend this approach to any company that wants to use digital simulation and analysis to improve product quality and accelerate time-to-market."



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Find an Intel Cluster Ready solution that is right for your organization. Contact your Intel representative or visit **intel.com/go/cluster.**

Intel® Cluster Ready

SOLUTION PROVIDED BY:

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[1] Source: http://www.cerespower.com/ProductOverview/DistributedGeneration

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