COLORADO STATE UNIVERSITY ENGINES AND ENERGY CONVERSION LAB

HP Workstations power modeling for clean, energy-saving technologies

"We can't afford to be behind the curve in technology. We need both leading-edge processing power and extremely high reliability. HP Workstations meet our needs on both counts."
—Bryan Willson, Founder and Director, Colorado State University Engines and Energy Conversion Lab, Fort Collins, Colo.

HP customer case study: HP Workstations speed research, deliver reliably at CSU's Engines and Energy Conversion Lab
Industry: Research

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Objective:
Equip a lab to run complex testing and mechanical engineering simulations

Approach:
Colorado State University's Engines and Energy Conversion Laboratory has standardized on HP xw4000- and xw6000-series Workstations

IT improvements:
- Models can be manipulated and graphically displayed in real time to gain new insights into the dynamics of a process
- Improved support
- Easier maintenance through standardization

Business benefits:
- Extremely high reliability ensures testing doesn't have to be repeated due to computer issues
- Time required to run complex models has been cut from days to hours

In an era of unpredictable energy prices and rising eco-awareness, finding ways to make engines more efficient and cleaner is a goal everyone can applaud. That's the focus of Colorado State University's Engines and Energy Conversion Lab (EECL), where researchers run enormously complex computer models to investigate new ideas.

Powering those computer models and the research behind them: HP xw4000-series and xw6000-series Workstations. The lab standardized on HP Workstations after years of struggling with a patchwork quilt of hardware that was sometimes unreliable and poorly supported by vendors.

"We work in a very dynamic R&D environment. We can't afford to be behind the curve in technology," explains Bryan Willson, Founder and Director of the EECL. "We need both leading-edge processing power

and extremely high reliability. HP Workstations meet our needs on both counts."

EECL: Cleaning engine technology, boosting power
At any given time, the CSU Engines and Energy Conversion Lab (www.eecl.colostate.edu) has researchers working on multiple projects in the field of applied clean energy research. The lab works closely with the industry—from large engine manufacturers to major oil companies. Its research has also given birth to small startup companies that commercialize or deploy the technologies it develops.

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Kirk Evans, Manager, Colorado State University Engines and Energy Conversion Lab

One of the lab's biggest success stories is a technique for high pressure fuel injection used in the natural gas pipeline industry. High pressure fuel injection reduces engine emissions by 80-90 percent, while improving fuel economy. The technology has been retrofitted on roughly 8,000 engines on the natural gas pipeline system. "There's probably not a pipeline in the U.S. that doesn't have some technology that was either developed or tested here at the lab," notes Morgan DeFoort, Co-Director of the EECL.

Another major accomplishment of the lab is direct injection technology for small engines. Direct injection yields a 35 percent increase in fuel economy, coupled with a 95 percent reduction in carbon monoxide and hydrocarbon emissions. The technology is being applied by Envirofit International, a non-profit spin-off of the lab, to clean up some of the 50 million two-stroke vehicles in Southeast Asia that each emits 50 times the pollution of a modern auto.

For several years, the lab worked with another computer vendor that was anxious to establish relationships with universities. As the company grew, though, support suffered. Over time, the lab also acquired some one-of-a-kind, hand-built computers from throughout the university. "We had a lot of reliability issues with those computers," recalls Kirk Evans, Manager of the EECL. Eventually, the lab decided it needed to upgrade several of its machines all at once, and turned to HP.

HP delivers: reliability, speed, support
"I've been very happy with our relationship with HP," says Evans. "We've had very, very few problems and when we did need help, HP provided support quickly and professionally, and always to our satisfaction. We've even had people from HP here hand-deliver parts when we're really in a hurry."

HP experts evaluated the lab's needs and considered various solutions. The staff determined HP Workstations would be the best match.

"We do a lot of elaborate CAD modeling, and some of those models get very large. Rendering them involves being able to rotate, tilt and pan around the model; it requires quite a bit of video power," Evans notes. "We felt the graphics performance would be more responsive on Workstations."

CAD and Computational Fluid Dynamics modeling, and stress analysis, all are routinely run on HP

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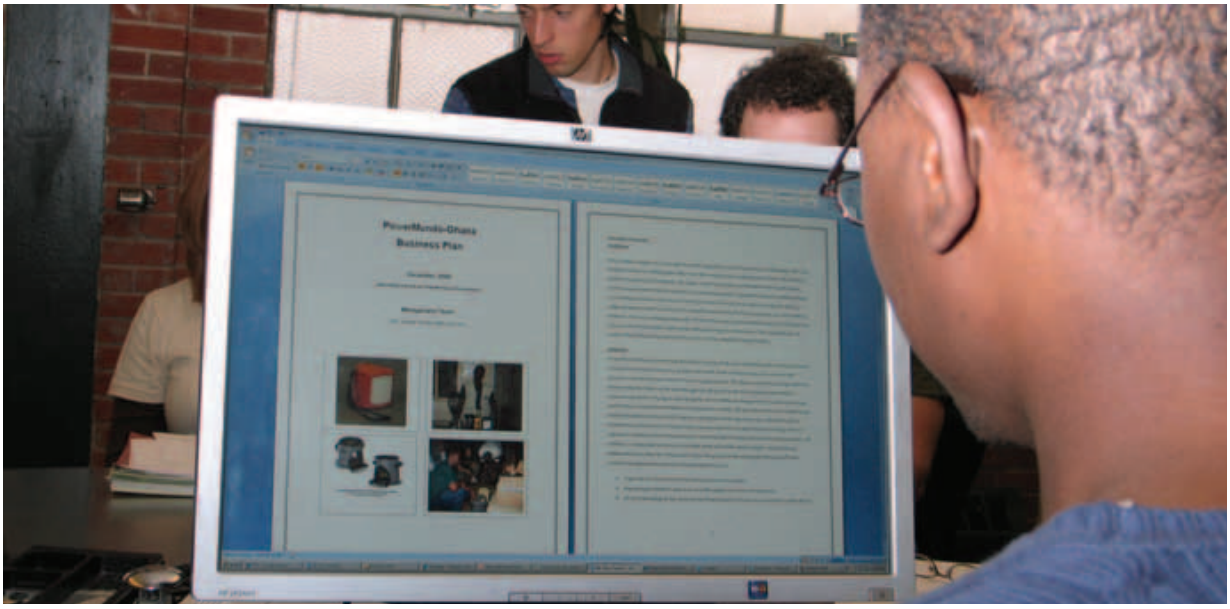

xw6000-series Workstations. The most recent deployment is HP xw6600 Workstations with Intel® Xeon® Quad-Core™ processors, 4GB of RAM, ATI or NVIDIA Quadro graphics cards, and 24-inch displays, running either Microsoft® Windows® XP Professional (32-bit) or Genuine Windows Vista® Business 32. Among the software run on those Workstations are elements of the PTC Pro/ENGINEER suite, MathWorks MATLAB, Fluent, and Fire Dynamics Simulator.

The processing challenges vary from one project to another. One current project requiring computational fluid dynamics modeling on HP workstations is aimed at using algae to produce renewable biofuels. The lab's participation in developing that technology is being done through an EECL spinoff called Solix Biofuels. "With the run up to $150-per-barrel oil, there was a lot of renewed interest in algae as a renewable energy source," says Willson, who also serves as Chief Technology Officer of Solix.

For the lab's Clean Cook Stoves Program (which works to eliminate indoor air pollution that causes over 1.5 million premature deaths each year in the developing world), researchers run computational fluid dynamics models that might require 10-20 hours of processing time. Other models are complete in 30 minutes or less. "But they all require a lot of processing speed and high-quality graphics capabilities to look at the data visually. The HP Workstations really do a fabulous job in both areas," says DeFoort.

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Customer solution at a glance

Primary applications
Engineering modeling

Primary hardware
- HP xw6600 Workstations
- HP xw4000-series Workstations

Primary software
- Microsoft® Windows® XP Professional (32-bit)
- Genuine Windows Vista® 32
- Pro/ENGINEER
- MATLAB
- Fluent
- Fire Dynamics Simulator

The three-dimensional models show particle flow in great detail. "We will sit around the Workstation in meetings and have a grad student who has built the model present the results. We'll ask to see a specific slice or angle, and he can bring those up and re-display the animated model while we're all sitting there."

"The nice thing about the HP Workstations is … they just work. The performance is great, but they're also robust and worry free."
Dr. Morgan DeFoort, Co-Director, Colorado State University Engines and Energy Conversion Lab

Many of the models generate dozens of gigabytes of data. The time required to run them has been cut from days to hours with the deployment of HP xw6600 Workstations. Equally important, the results are made more meaningful through real-time, graphic display. "Being able to manipulate the model in real time, and to visualize the things that are important to us, makes the model dramatically more useful in understanding the dynamics at work," adds Evans. "And that's only possible now because of what the HP Workstations do for us."

Reliability is paramount

The lab's other major use for HP Workstations is to control the testing equipment and hardware. For that, the lab uses xw4000-series Workstations. "For that function, the Workstations don't need as much computing power, but reliability is paramount," says Evans. "The engines we test are often very expensive to operate. We need to make sure that everything's functioning well while we're performing tests, and that we're not going to lose data or compromise the results in any way."

The 4000-series Workstations typically are used to run National Instrument LabVIEW, a graphical programming language from which ECCL builds its control applications. Often, the Workstations are configured with two or three video cards. "We'll have multiple pieces of equipment running at once. To monitor all those, we'll have multiple applications running and have a different application up and maximized on each screen," explains Evans.

Standardizing on HP Workstations delivers a variety of other benefits to the lab. It's easier to deploy new Workstations, and to maintain older ones, and less costly to maintain an inventory of spare parts. DeFoort comes back to reliability as a critical differentiator, though.

"Most people doing research don't want to have to think about the hardware. They want to concentrate on the research itself," he notes. "There's nothing more frustrating than having to put everything on hold while you work on solving a glitch in the hardware. The nice thing about the HP Workstations is … they just work. The performance is great, but they're also robust and worry free."

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