Accelerate Wind designs more efficient rooftop wind turbines with Amazon EC2 Instances powered by AMD

Higher performance and flexibility for computational fluid dynamics using Amazon EC2 Hpc6a instances featuring AMD EPYC™ processors

AMD EPYC

CUSTOMER

AccelerateWind

INDUSTRY

Renewable energy engineering

CHALLENGES

Increasing computational fluid dynamics modeling performance for faster wind turbine design development

SOLUTION

Deploy Amazon EC2 Hpc6a instances powered by AMD EPYC™ processors

RESULTS

15 times faster simulation performance than previous on-premises solution

AMD TECHNOLOGY AT A GLANCE

3rd Gen AMD EPYC™ CPUs

TECHNOLOGY PARTNER

aws

TotalCAE

Renewable energy has the potential to provide both environmental benefits and considerable energy cost savings for commercial and industrial building owners. But, so far, the focus has been on solar panels. While wind turbines have the potential to deliver even more renewable energy, they are more complicated to make cost effective. This is where Accelerate Wind saw an opportunity. When the company's on-premises fluid dynamics compute facilities were proving to be a bottleneck for rapid development, Amazon EC2 instances powered by AMD EPYC processors provided the power and flexibility Accelerate Wind wanted to take its turbine technology to the next level.

"I wish we had switched to Amazon EC2 instances powered by AMD EPYC processors a long time ago. We could have sped up our design process a lot and saved our company time."

Erika Boeing, CEO, Accelerate Wind

Compute-intensive wind modeling

"We are a startup developing affordable wind turbines for commercial buildings," says Erika Boeing, CEO, Accelerate Wind. "Solar had been doing well but wasn't able to produce a building's entire energy load. We saw an opportunity for other energy sources to provide value, but wind wasn't affordable. We thought we could take advantage of the fact that wind speed naturally increases at the edges of roofs, compared to other areas. We wanted to harness that to produce more affordable power compared to other rooftop wind turbines."

Optimization is the key here, and that's where the need for processing power comes in. "We've done a lot of computational fluid dynamics (CFD) modeling to design effective turbines," says Boeing. "The core of our tech has been about how to take that faster wind speed and draw it down to the edge of the roof so that we can produce power in a way that's affordable and looks good. So we've done a ton of CFD modeling, testing different modern airfoil shapes."

This is a complex CFD problem. "With modeling wind at the building scale, you need to have a huge meshing domain," says Boeing. "You need to be able to model something that's 10 times the height of the building and 15 times the length. It's a huge model but you also need to have tiny cells resolved right around the airfoils. We were doing all of that with on premises computers, but we needed more computing power as the CFD models got more advanced."

"When you do 3D CFD models, they're huge," says Adam Bennett, Aero-Mechanical Engineer at Accelerate Wind. "They have tens of millions of cells and are very difficult to run on a workstation that only has a couple of dozen cores. We must model lots of different variables, too. It's not just that a single simulation is huge. You also have to do lots of simulations to model the many environments and building structures."

"That's why we ended up looking to TotalCAE, which manages HPC clusters for engineering, and the AMD EPYC CPU-powered Amazon EC2 instances," says Boeing.

Faster and more flexible than on-premises

"We had a 32-core machine and a 16-core machine that we were using on two different Ansys Fluent licenses," says Boeing. "We knew we had access as a startup to a certain number of AWS credits. We didn't want to do any of our own programming to get that set up, so the representative at AWS matched us with TotalCAE as one of their network partners. TotalCAE recommended Hpc6a instances."

"TotalCAE helped us migrate and do some benchmark testing," says Bennett. "We ran a few different types of simulations, 2D, 3D, with different sizes, different core numbers. Our 384-core Amazon EC2 Hpc6a instance powered by an AMD EPYC processor was 15 times faster than the 32-core on-premises system, with just 12 times more cores, taking a four-hour simulation on the workstation down to 12 minutes."

Having this kind of performance on tap when required has been a huge advantage. "Our computational needs vary from time to time," says Bennett. "Our projects are constantly changing. One day we might have very low computational needs and another we're running large models."

"We often need to run a whole bunch of iterations of different simulations really quickly," says Boeing. "It wouldn't make any sense to buy a 384-core system to keep on premises for the months or weeks of iterations we need, unused the rest of the time. But having the Hpc6a instance when we need it lets us get answers quickly. We have been able to run through hundreds of different simulations in a week, whereas before, that would have been a multiple month process."

"Our 384-core Amazon EC2 Hpc6a instance powered by an AMD EPYC processor was 15 times faster than the 32-core on-premises system, with just 12 times more cores, taking a four-hour simulation on the workstation down to 12 minutes."

Adam Bennett, Aero-Mechanical Engineer at Accelerate Wind

Turbines with more power and reliability

"This flexible performance has allowed us to evolve our design much more quickly," says Boeing. "We can get much more of a systemic understanding, which helps us make better design decisions.

Fluids are so unpredictable, sometimes you don't know until you test. We can run through a lot more of those potentially unpredictable scenarios. Before we moved to the Hpc6a solution, we were mostly only able to iterate in 2D simulations, and the dynamics changed completely in 3D.

Once we were able to model in 3D, we were able to understand a lot more about how wind hitting the building at different angles was going to affect our performance and how different length turbines would perform across the roof. We can create designs that produce more power."

"In the space that we're working, cost is everything and the margins are tight," says Bennett. "Being able to increase performance has a big impact on the cost of the energy produced. This can really push something from being an unviable technology in the commercial space to a viable one. The computing power lets us optimize that."

"I wish we had switched to Amazon EC2 instances powered by AMD EPYC processors a long time ago," says Boeing. "We could have sped up our design process a lot and saved our company time. We're able to increase our power output by running through more iterations and doing a lot more refinement on the technology. Having more powerful computing lets us run through many more turbine loading scenarios. This means we can reduce the cost of the turbines. We can increase the certainty of our prediction of what the power output will be in different building and terrain scenarios. We can improve reliability, which is essential for commercial customers. Overall, we can scale more quickly, putting wind turbines on more commercial buildings across the world. This will allow buildings to get closer to net zero energy production using Accelerate Wind's turbines."

About Accelerate Wind

Accelerate Wind is an early-stage startup that is working to revolutionize rooftop wind energy in the commercial and industrial spaces by drastically lowering the cost of small wind turbine technologies. This includes development of a patent-pending powertrain concept that drastically reduces the cost of wind turbine power electronics, and development of a system to capture increased wind flows at the edges of commercial building rooftops. The technology is being developed in collaboration with scientists at Argonne National Laboratory as a part of the Chain Reaction Innovations incubation program. For more information visit acceleratewind.com.

About Amazon Web Services

Amazon Web Services began offering cloud computing IT infrastructure services in 2006, enabling businesses to replace up-front capital infrastructure expenses with low variable costs that scale with their business. Today, Amazon Web Services provides a highly reliable, scalable, low-cost infrastructure platform in the cloud that powers hundreds of thousands of businesses in 190 countries around the world. The company had $62 billion in revenue in 2021, with over 40,000 employees and over a million users worldwide. For more information visit aws.amazon.com.

About TotalCAE

TotalCAE on AWS is a fully managed turnkey HPC simulation for engineers that reduces simulation time from days to hours in just a few clicks, without any IT knowledge. TotalCAE software and services alleviates the need to worry about how to maintain, manage, and update your HPC and CAE applications in your AWS subscription, so engineers can focus on engineering, and not IT complexity. For more information visit totalcae.com.

About AMD

For more than 50 years AMD has driven innovation in high-performance computing, graphics, and visualization technologies. Billions of people, leading Fortune 500 businesses, and cutting-edge scientific research institutions around the world rely on AMD technology daily to improve how they live, work and play. AMD employees are focused on building leadership high-performance and adaptive products that push the boundaries of what is possible. For more information about how AMD is enabling today and inspiring tomorrow, visit the AMD (NASDAQ: AMD) website, blog, LinkedIn, and Twitter pages.

All performance and cost savings claims are provided by Accelerate Wind and have not been independently verified by AMD. Performance and cost benefits are impacted by a variety of variables. Results herein are specific to Accelerate Wind and may not be typical. GD-181