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Thinking "Outside the Box" Could Play a Crucial Role in the Future of Substation Automation

The future of power system substations may be redefined by the application of virtualization. At least that is what an increasing number of utilities are envisioning as they explore the opportunity for increased virtualization in substation design. In this future, there would be a significant reduction in the hardware used in substations. Instead, tasks will be carried out on cloud servers, marking a noticeable shift from the current reliance on extensive racks of hardware.

The appeal for utilities is the significant cost reduction for substation design and engineering, reduced usage of copper wiring, and the ability to easily replicate substation designs for future expansions.

"Consider that today's substation can have 200 or more independent [hardware] boxes each performing a dedicated task," says Jeremy Anderson, Senior Vice President of Product Development at NovaTech Automation, a leading U.S. provider of automation and engineering solutions for power utilities headquartered in Quakertown, PA. "That's a tremendous amount of wire to pull, hardware to maintain, and it continues to become more and more congested. In a virtual digital substation, two or three servers run everything."

With a vision for an intelligent grid of the future that is adaptive and resilient requiring less hardware and leveraging more virtualization, the utilities industry has formed the Virtual Protection and Control Alliance (vPAC) to explore how to do this. The focus is to accelerate the creation of a standards-based, open, interoperable and secure architecture to host protection, automation, and control solutions for power system substations. NovaTech is one of its over 20 member organizations.



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"From our standpoint, we wanted to help define the future of substation automation," says Anderson. With this in mind, NovaTech has spent the past year creating a virtual version of its Orion Substation Automation Platform to run on any server. The system is hosted on a host machine known as a hypervisor and servers powered by Intel CPUs.

The company's flagship product, the Orion is a communication and automation processor that can connect to nearly any substation device in its native



protocol, perform advanced math and logic, and securely present the source or calculated data to any number of clients in their own protocol.

The Orion can be integrated with any equipment, including competitors, and is often connected to microprocessor-based relays, meters, event recorders, IEDs and RTUs. It is then connected to an existing enterprise network or SCADA system.

An emerging substation model

According to Anderson, there is a coordinated push by some large investor owned utilities in the United States and globally to move to what is being called the "digital substation." Still, not all utilities are ready to pull the plug on the traditional substation design quite yet.

"Most utilities aren't moving in this direction at this point," explains Anderson. "But they are certainly investigating it thoroughly with the plan to move in this direction in the coming years."

Cost savings is a leading driver of utilities' interest in virtualization.

"It is a lot less expensive to build multiple substations once a virtual design is established because you're not pulling tons of copper wire everywhere," says Anderson. "When it is based on the ethernet, you can buid a substation that is somewhat cookie-cutter in design and easily replicatable. This represents a significant cost saving in substation design and engineering.

The cost outlay for hardware is also reduced. "Consider that two or three servers that cost \$10,000 each can potentially replace up to 200 hardware devices that average \$10,000 per device. The savings are significant even if you factor in licensing fees for virtual machines," says Anderson.

Recent supply chain challenges are also increasing the appeal of hardware agnostic solutions.

"The pandemic certainly tested the supply chains in our sector," says Anderson. "There were massive issues around the world trying to buy hardware, especially custom-built devices. With virtualization, if a server ever fails, it is easier to find a replacement and the utility is not limited to proprietary



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Designing the virtual system

In creating the virtual Orion, NovaTech wanted to ensure the system functioned identically to its current hardware-based system.

"The biggest challenge was taking a system that was developed over many years as embedded software for purpose-built hardware and make it run on any server," says Anderson.

He adds that in some ways it was easier than initially thought. "The virtual Orion looks and operates the same as every unit we have sold," says Anderson. "It just happens to run on hardware that we didn't build."

Anderson adds that NovaTech was intent on ensuring the customer experience was unaltered.



"Our customers know the Orion, how to program it, and how to interact with it. So one of our major goals was to ensure that whatever we do in this virtual environment, the Orion would operate identically from the customer's perspective."

The virtual Orion system is currently in beta test at a utility in Arizona with the full release planned in





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Looking ahead "We are still in

"We are still in the early days of the deployment of the virtual digital substations," says Anderson. "There are some early adopters, but I anticipate that we are at least five years away from broad-based market adoption."

February. The company plans to debut it at the DIS-TRIBUTECH conference in Orlando, an annual event for showcasing cutting edge technologies in power

transmission and distribution.

However there is an opportunity to solve a more immediate issue in substation environments. As more IoT devices are installed in utility distribution systems, a single virtual Orion on a server could be used to collect and manage data from thousands of sources. When all these devices must be hardwired, it can take several racks of Orions to collect all the data.

A similar scenario could drive the use of the Orion beyond the substation environment and into any enterprise where thousands of devices are collecting data.

With cloud computing and virtualization changing the contours of many industries, momentum continues to build behind virtualizing more of the work of a substation. The blueprint for tomorrow's power system substation has yet to be fully written, but it is only a matter of time that we will see more virtual environments emerge through the collective expertise of industry stakeholders.

For more information on the vPAC Alliance, visit www. vpacalliance.com. More information on Orion substation automation solutions can be found at the NovaTech Automation website, www.novatechautomation. com/solutions/substation-automation, or by contacting (484) 812-6000.

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How To Keep Vacuum Excavator Jobs Productive And Profitable

Vacuum excavators have become a popular option for landscaping jobs thanks to their ease of use and compact size, and their ability to take on a wide range of jobs.

These machines are a practical solution when you need to excavate near sensitive areas or in tight spaces, such as when opening a trench near a house, fence or shed. They can also help with specialized tasks, such as working in a flower garden or mulch bed. Using the machine's suction tool, you can clear out mulch and debris without worrying about damaging flowers, grass or vegetation on a customer's property.

Vacuum excavators are also often used for potholing or daylighting existing utilities. Underground environments have become so congested, there's always a risk of hitting a utility if it's not exposed. Some landscapers rely on hand-digging to expose utilities, but many utility strikes in residential jobs happen with a shovel. Vacuum excavators can provide a safer, more efficient option for exposing utilities.



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Necessity: the Mother of Invention

HingePost is based in Dahlonega, Georgia and established in early 2023 by Bobby Anderson. The concept was motivated by the desire to accelerate loading times and, also, to contain the payload safely. HingePost uses aluminum, mild steel, and high carbon steel—all 3/16in thick. **The first of its kind**, this new stake post defines a new direction in combining side gates with flatbed platforms.

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Still, while vacuum excavators are designed for simple and safe excavation, every job is different. Factors such as job type and soil conditions will shape key decisions, such as if you should use a hydro or air vacuum excavator, what pressure settings to use, if you'll need heated water, and more. That is why it's important to understand and follow best practices.

Get The Most Out Of Your Machines

Knowing how to choose, configure and use vacuum excavators for different jobs – and how to maintain them for maximum reliability – can help you realize the full benefits of the machines on every job, make you more productive, and reduce the risk of unplanned downtime over the life of the machines.

Best practices can be broken down into three categories: job preparation, machine operation and maintenance.

1. Job Preparation

Whether you're planting shrubs at a shallow depth or digging deeper to remove a tree, you must always call 811 before any digging job to confirm the location of existing utilities. Even after markings are down on a jobsite, err on the cautious side and verify the markings with your own locators.

Another crucial step before any job is to identify the ground conditions of where you're working. Keep in mind that ground conditions can change not only from one jobsite to the next, but also within a single jobsite. Often, a vacuum excavator operator can begin a job in topsoil and then soon find themselves hitting clay.

Local dealers can help you understand what conditions you'll encounter on a job. You can also look for visual cues, such as changes in soil patterns, to help identify ground conditions. Getting



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a glimpse of the natural landscape – even if it's on Google Maps - can also provide clues. For example, valleys often contain clay, while hills typically have harder formations.

Knowing a jobsite's ground conditions will help you decide if you need air or hydro excavation or both - and the size of your water tank. Some tips for working in common ground conditions include:

Topsoil and sand: Hydro excavation is more efficient in these conditions, making it the go-to choice when you want to do a job as quickly as possible. However, air excavation provides greater accuracy and doesn't generate slurry, making it an ideal choice when you want to keep a hole clean or are working on a sensitive jobsite.

Clay: Again, hydro-excavation is the more efficient option here, although it should be done with a boiler package.

Rock and sandstone: Always use hydro excavation with a boiler package to cut through these difficult conditions, and consider investing in larger water tanks to reduce trips. Also, make sure you're familiar with local slurry-dumping regulations and your nearby water-refill options. Using a machine that has a higher horsepower and greater capabilities can also help you more easily excavate in tough, rocky conditions.

2. Machine Operation

After you have the right machine, following best operating practices can help make sure you effectively and efficiently operate it, and reduce the risk of damaging it.

Before starting a job, make sure you're using the proper nozzle configuration. For example, use a rotating nozzle, or oscillating nozzle, for hydro-excavation jobs. This nozzle delivers a circulating

prevents excessive pressure from consistently hitting one area.

When excavating, start small and expand as needed. This can help make sure you only make a hole as big as what's needed.

To avoid downtime, constantly move the nozzle around within the excavation area and keep the spray nozzle 8 inches from the ground or from the utility that's being exposed. Holding the nozzle any closer, or directly applying the excavator to a specific area, could result in the nozzle becoming clogged or damage to an underground utility.

For pressure settings, keep hydro excavators below 2,800 psi and air excavators below 360 psi. If potholing, consult the utility owner. They may have their own requirements for using hydro or air excavation. For instance, some gas-line owners seeking to protect their lines recommend a maximum of 2,200 psi when using a hydro excavator to expose utilities.

3. Maintenance

A key benefit of vacuum excavators is that they are low maintenance - and in some cases nearly maintenance free.

The machines do have simple maintenance needs, such as standard oil and filter changes. But some vacuum excavators are intentionally designed to help reduce maintenance, such as by eliminating grease points, using liftoff power-pack doors to ease maintenance access and using filtration systems that minimize filter cleaning frequency. This helps ease burdens on your crew and keep your machines ready for the next job.

One important task you should do at the end of every day is dump and clean your machine's debris tank and empty its freshwater tank. This can help prevent complications in a vacuum excavator that can impact its productivity.









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CORNING, IA 50841 www.youtube.com/c/Brownbearcorp Also, routinely check the machine's cyclonic, debris and water filters for obstructions. In some cases, crews find they aren't getting enough pressure from their vacuum excavator, and it's because they have a clog in one of these filters.

Additionally, remember that proper machine usage can help prevent maintenance issues. When using an air excavator, for example, avoid putting the nozzle on the ground. This can lead to dirt getting into the nozzle, which can be difficult to clean out.

Also, never use the nozzle as a shovel. Putting the nozzle into the dirt can damage the wand and lead to costly downtime. If you're struggling to excavate through hard ground conditions, use a hot water heater package to help break down the soil without applying additional water pressure. As a best practice, water temperature should stay below 150 degrees Fahrenheit.

Maximize Your ROI

With their high versatility and low maintenance, vacuum excavators can help you take on a wide range of landscaping jobs. And by following best practices, you can operate the machines more efficiently, increase your bottom line and ultimately take on more jobs.

Chris Thompson is a product manager at Ditch Witch with responsibility over the vacuum excavation product line. Thompson focuses on providing customers with innovative, customer-driven products and solutions with the goal of damage prevention and jobsite solutions. Before taking on the vacuum excavation product line, he covered the CUE and utility locator product lines. He holds a BA in Organizational Leadership from the University of Central Oklahoma and an MBA from Oklahoma Christian University.

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A home insurance crisis is forcing builders to rethink designs. This has some looking at concrete where a trend is breaking ground and alleviating some drawbacks of wood-framed homes

Homeowners across the U.S. are running out of options when it comes to protecting their homes. The problem is that climate change has increased the risk of catastrophic damage due to windstorms, flooding, and wildfires. With the cost of rebuilding after a disaster rapidly increasing, insurance agencies are passing along the burden to homeowners, with no end in sight. In fact, according to a report from First Street Foundation – a nonprofit research group – almost 1/3rd of all homeowners in the lower 48 states are already struggling to find affordable insurance. Without cost-effective coverage, the housing market's future is in peril.

While governments and the insurance industry grapple with viable solutions, there is growing discussion as to the future of residential construction and the pursuit of a more durable alternative to wood-framed, single-family homes. This is of particular importance to those living in areas where natural disasters like hurricanes, tornadoes, and wildfires devastate thousands of wooden structures every year in the US.

While looking for an advanced technology for the future, some home builders are looking to improve upon a design that has been used in other parts of the world throughout history; namely concrete. The ancient Romans and Greeks were very successful in constructing just about everything from homes to stadiums out of concrete – some of which are still standing centuries later.

There are a number of advantages to utilizing concrete over wood. Most notably, of course, is its durability which greatly outperforms wood-framed homes. Additionally, unlike wood, concrete is not vulnerable to external factors like insects, moisture, mold, fire, or wind - all of which can result in structural damage and pose safety risks.

Yet, even with the advantages to utilizing concrete there are some significant reasons for the lack of wide-spread adoption. Chief among them is the high cost of construction. Other drawbacks include concrete's poor insulation, less appealing finishes and designs, and the added time required for construction.

Recent innovations, however, are not only eliminating



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these drawbacks, but promise a huge reduction in initial cost, making them comparable to wood-framed structures. In fact, when lifetime upkeep, insurance, and other expenses are factored in, concrete homes are expected to greatly reduce the total cost of ownership.

Driving down construction costs

"What we are seeing in the concrete industry today is incredible. The things we thought would be horribly expensive just five years ago, we're doing every day now," says Mark Sinicrope, Precast Specialist at Master Builders – a provider of chemical solutions for concrete construction.

Sinicrope has more than 40 years of experience working with precast and prestressed concrete products in applications ranging from bridge beams to parking garages. While most of the advancements and cost cutting to date has been on the commercial side, Sinicrope is starting to see those innovations flow into residential concrete home construction. For example, Sinicrope recently helped Texas-based Nonquit Homes with a concrete mix design used to develop tilt-up, prestressed concrete panels for residential construction.

"What they are doing is pretty much the same thing we are seeing for large-scale commercial buildings," explains Sinicrope. "In fact, the new Tesla plant in Austin has a very similar sandwich panel design, and they go up like a big Erector Set."

However, the residential concept from Nonquit Homes is also aiming to eliminate some of the traditional shortcomings of commercial concrete construction. To begin with, the prestressed sandwich panels can be poured on site, thus eliminating the need to be transported in from a precast manufacturer – which reduces both cost and time.

Time

"In construction, it is all about how fast you can go," adds Sinicrope. "Let's say I wanted to put up a parking garage today. We could have it up in two or three weeks, but it might take a year or more because we have to wait for someone to actually produce all those concrete panels and then ship them to the jobsite."

Costs are further trimmed by reducing the size of the panels so there is no need to bring in expensive cranes to move large panels around the jobsite. Instead, the panels can be maneuvered by forklifts – which also cuts down on labor. "I can see an entire house going up with just 3 or 4 people onsite to tilt up the panels and set them in place," says Terrell Wiggins from Nonquit Homes, who along with engineer Alonso Forcado, designed and built the first residential home outside of Atlanta using this style of construction. "Plus, you're not sitting there waiting on the framer or struggling to schedule all the different trades required to build the actual house. For a builder, that is huge."

Depending on the size, a typical wood-framed home can take 6 months to a year to complete. However, once a builder gets going and perfects this new concrete building process, they could greatly reduce that build time.

Durability

While the insurance crisis is illuminating the need for more durable housing, climate change will only increase the urgency. According to data from NOAA, there were 60 weather and climate-related disasters in the U.S. from 2020 to 2022, with losses exceeding \$1 billion per year. For comparison, between 1980 and 2019 the average per year was eight.

Concrete homes can even withstand the extremely high winds associated with large hurricanes and tornados.

"Today, precast can hold up to a 200 mile an hour wind load, depending on how it's designed," explains Sinicrope.

However, it is often not just the straight-line wind that causes significant damage during a wind event. Shrapnel from other structures is also a major concern. As part of that, the Precast Concrete Institute (PCI) wanted to test the durability of concrete panels by pitting them against both a concrete block wall and a wooden house with brick veneer.

"They fired the two-by-fours out of an air cannon at 150 MPH at the concrete sandwich panel and the lumber shattered into toothpicks, without any damage to the panels" adds Wiggins. "However, it blew a massive hole straight through the exterior of both the brick and cinderblock wall."

Energy Efficiency

Another area of concern being addressed by new concrete home designs is energy efficiency. While concrete is very dense and therefore airtight, it is not considered a good insulator. By incorporating a thick layer of insulation into the concrete panels, however, the energy efficiency of the home can exceed that of a traditional wood-framed home.



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In addition, adding the insulation into the casting process further reduces construction time and costs by eliminating the need for insulation and sheetrock along the exterior walls.

Design

Traditional concrete homes typically offered limited architectural design options. However, the concrete industry has come a long way and design choices are now almost endless with colored, patterned, and textured concrete.





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Additionally, you can utilize traditional exteriors such as stone, brick or stucco to add the coveted curb appeal.

Further savings

While builders can see their construction costs greatly reduced by utilizing these new methods for building concrete homes, homeowners also stand to benefit. Not only does it promise a much safer option, with lower energy consumption and fewer repairs, but there are several government and banking incentives to buying concrete as well.

> For instance, concrete homeowners may qualify for Energy Efficient Mortgages (EEM) allowing borrowers to qualify for a larger loan amount due to the ongoing energy savings that result in much lower energy bills.

Some of the biggest savings, however, are likely to be seen in the dramatic drop in monthly insurance premiums. Many insurance companies already offer lower rates for concrete homes because they produce far fewer claims arising from fire, wind and water damage, or pests.

As insurance becomes scarce and costs surge, homebuyers will have no choice but to walk away from deals on wood-framed homes. This could be the crux for a major shift in residential home building. Especially if the right design can make sense for a home builder's bottom line.

"Like with anything else, it just takes one person to figure out a way to make it profitable and everybody will jump in," concludes Sinicrope. "When it comes to residential concrete homes, I think we've finally reached that point."

For more information about concrete residential homes contact Nonquit Homes via phone at (361) 972-6260, email info@nonquithomes.com or visit *www.nonquithomes.com* •



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