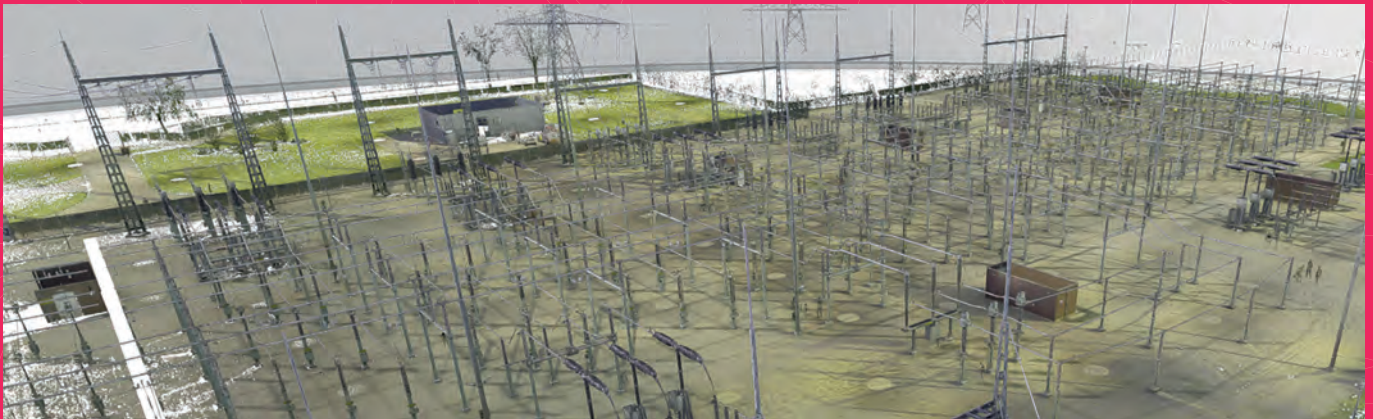
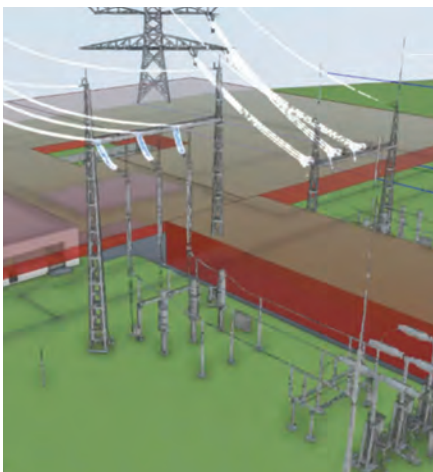


# SPIE transforms workflows and delivers automated 4D BIM with PointFuse



## About SPIE

SPIE is a leading provider of technical engineering solutions for the built environment. With more than 45,500 employees, SPIE has four key areas of operation: smart cities, energy efficient buildings, the energy sector, and engineering for industrial activities. SPIE prides itself on finding innovative ways of working that provide the best solution to its clients' needs.



Screenshot captured from Autodesk Navisworks. Clearances for health and safety are displayed as red boxes, the positions of these were calculated using the as-built mesh.

## The challenge - delivering fully automated 4D BIM

Sometimes, a project comes along that changes how everything works. For SPIE, that project was the refurbishment of key substations for TenneT, the transmission services operator for the Netherlands and a large part of Germany. Bas Rongen, BIM Manager for SPIE Netherlands, led the pitch for the project – and had a bold vision for how it would be completed. Since it was very costly and complex to switch off the substations, Bas decided that a 4D BIM plan would be the best way to manage the project.

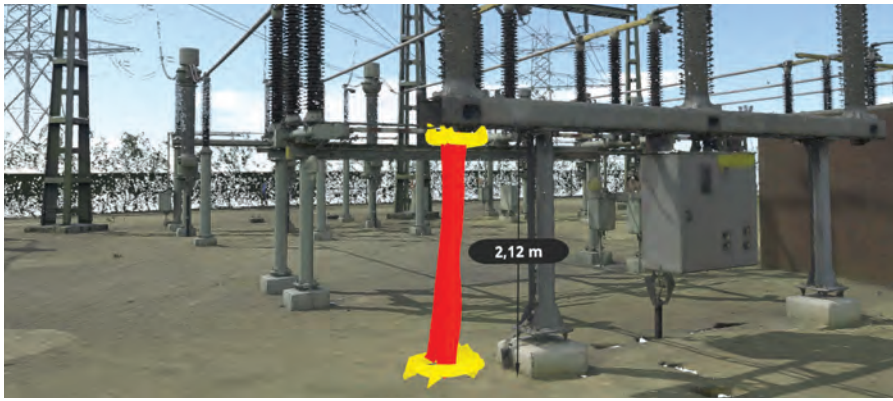
*“By adding the dimension of time to the BIM plan, we would be able to very tightly schedule our work and minimise the disruption to TenneT,”* Bas explains. *“My pitch demonstrated the power of using a 4D BIM approach – and how animation could be used to make the project easy to understand for all the professionals involved.”*

Bas' initial pitch involved a painstakingly created animation of a 4D BIM plan unfolding, showing what work would happen when and in what order. SPIE won the contract – and so Bas now had to make that vision a reality.

It quickly became apparent that SPIE would have to reengineer nearly all its processes in order to deliver the project, moving away from 2D work and into 3D modelling, including the use of asset data which TenneT had specifically requested. Bas also needed to ensure that the complex information about the site was easy for other parties to collaborate on.

A crucial aspect of the project was safety. High-voltage power stations and substations have very strict safety rules, including minimum distances to observe between some components, and keeping people from getting too close to live equipment. Bas decided to leverage as-built data to easily validate that all the safety regulations has been met in the design stage.

*“There was tremendous demand from both SPIE and TenneT for modern technologies in this project,”* Bas comments, *“so looking at as-built data felt very natural. But the sites we were dealing with were massive – so I knew we'd need to do something special to bring it all together.”*



Accurate measurements can be taken from the mesh model, using software such as Iris Prospect VR.



Sequencing animation that shows the temporary works coming in then the replacement unit.

## The solution - PointFuse as part of an ecosystem of advanced software

The size of the sites meant that the data the project would use was simply massive – the point clouds alone were in excess of 200GB. Bas decided that meshing was the only viable way to get the scan data they had into Autodesk Revit for design work. *“We had a meshing tool in-house already, so I knew the concept was sound, but the tool we were using just didn’t give us enough control over everything,”* explains Bas *“I had come across PointFuse during the pitch; their solution was the only one that could handle the level of data we had while still giving us that control. In fact, it was the only tool that could work on our data and still keep the user interface available – that was very impressive.”*

Bas quickly implemented PointFuse into the project. PointFuse’s role was to take the scan data gathered during surveys using LiDAR scanners and to turn that into intelligent mesh models. This process reduced the size of the as-built data from 200GB down to just 2GB, while retaining georeferencing data from the scan and automatically segmenting the entire mesh model, creating objects that could be used further down the process. The intelligent mesh data from PointFuse, including objects and their metadata, is stored in BIM360.

Adding PointFuse into the workflow made an enormous difference. Because the scan data was now a hundredth of the size, it could be easily viewed in Revit, making it possible to share with collaborators and stakeholders via a web browser. It also greatly sped up processes further down the chain that relied on the scan data, such as modelling in Autodesk Inventor which could be done using the as-built information as a background

to ensure the designs accounted for the spaces they would be in. The ease with which the data could be used also made safety validations much easier.

*“We had to show on our model that all the equipment and buildings would be safe from lightning strikes,”* Bas recalls *“and because the as-built data was so easy to work with, it was relatively simple to add lightning rods to the model and demonstrate they were in the right place with complete confidence.”*

The intelligent meshing capability of PointFuse was hugely valuable. It enabled Bas to quickly create classified mesh objects to which metadata could be added – including sequencing information. *“That was key to making the whole thing work,”* Bas explains.

*“With PointFuse it was much quicker and easier to create objects that could interface with BIM objects and that could be arranged onto a timeline to show the order work would be undertaken; that timeline could then be animated to show the whole process end-to-end.”*

That animation happened via an awe-inspiring workflow that moves reality capture and design data between Cyclone, PointFuse, Revit, BIM360, 3DSMAX, and Unreal. Bas custom-scripted the workflow using Autodesk Dynamo to achieve the following functionality:

- Point cloud data is brought from Leica Cyclone REGISTER 360 into PointFuse and turned into multi-resolution intelligent mesh models, with objects to be removed stored in a separate layer to the rest of the data.

- Designers working in Inventor and Revit can use as-built data when creating their designs and so ensure those designs will work in real life, with a Dynamo script in Revit doing all the calculations that power the time dimension of the BIM plan. An object identifier is added to every object, too.
- The data in the BIM plan is exported to 3DSMAX where textures are added back in and the data is animated according to the timeline in the BIM plan.
- The animation is exported to Unreal where it can be viewed in VR using Microsoft HoloLens.

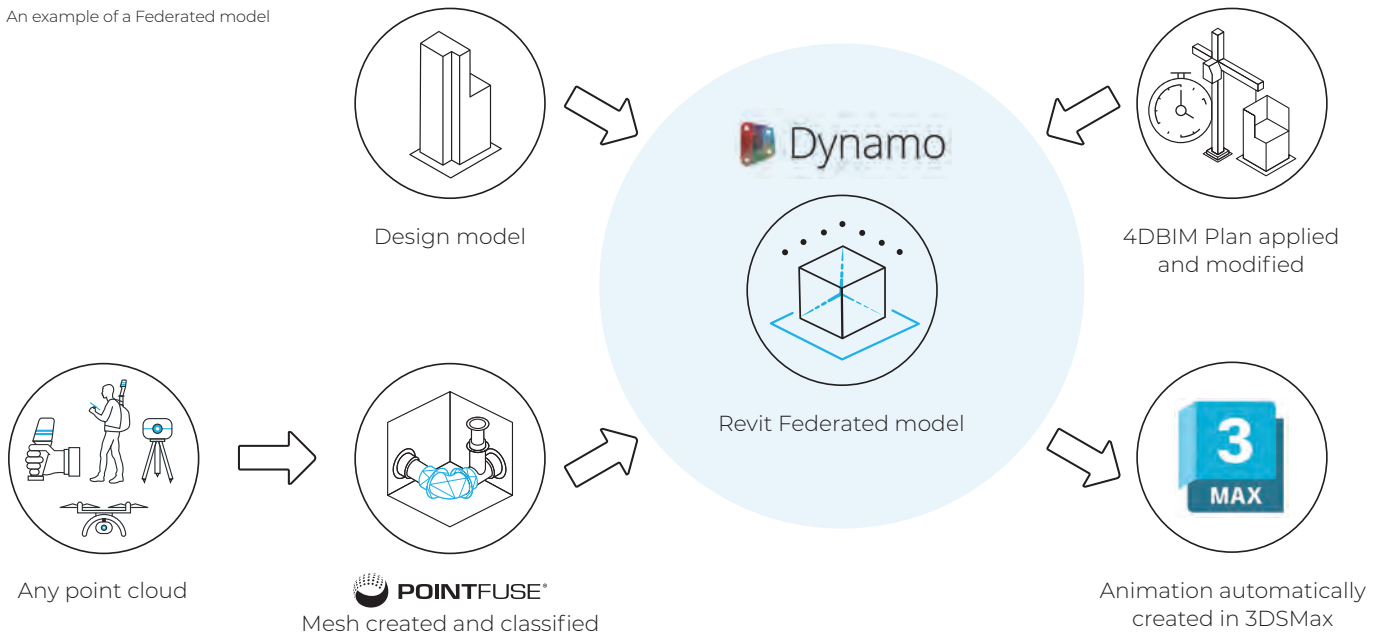
The animation is especially sophisticated. Bas’ workflow assembles the animations entirely automatically, pulling data through from the BIM plan – and if the BIM plan changes, a new animation is created reflecting the changes almost in real time.

Bas has worked very closely with the PointFuse team throughout. *“PointFuse are the best people I have yet worked with in terms of support,”* he says. *“I made a lot of change requests as part of this project, and I really felt like they were as invested in our project as I was.”*

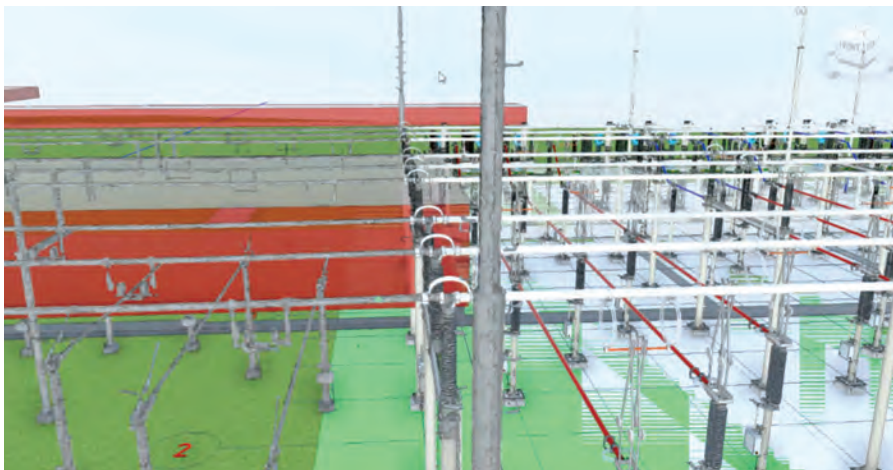
Mike Deacon, Technical Sales Manager at PointFuse, concurs. *“Bas really pushed the boundaries of what was possible with this project – his workflows blew my mind. The project pushed all of us to see what was possible with PointFuse, too. It’s great working with customers who are so ambitious and visionary with the technology stack available to them and it was a genuine pleasure supporting Bas and SPIE to bring this project to life.”*



An example of a Federated model



## Outcomes - a fully functional 4D BIM plan and an exciting future for SPIE



Screenshot federated model showing interface between mesh and BIM in bim360.

Thanks to Bas' expert design, PointFuse is a vital part of a completely automated 4D BIM plan, and SPIE has achieved a digital transformation in its processes that can be replicated across future projects to deliver even greater results for clients. Before this project, the team often wasn't able to see as-built conditions when creating designs, and was relying on manual modelling processes and drawings that sometimes dated back to the 1960s.

Now, the team is working in a data-rich environment, combining as-built data with design data in a seamless, automated workflow that is coordinated both in space and time.

One of the biggest benefits is how accessible the information has been made for everyone on the project – both colleagues internally and external contractors. *“Our BIM is so much more immersive than 2D drawings or click-and-drag 3D models,” says Bas, “and it means that I can show anyone involved on the project this data and be confident that they will understand what’s happening and what their role is.”*

In fact, that new awareness has brought unlooked-for benefits. Because the BIM plan is more readily accessible and understandable, additional improvements are being found in safety and efficiency. *“Because people are now fully understanding the project thanks to this model, they are able to suggest improvements based on their expertise that none of us would have spotted before,”* Bas explains. *“It’s certainly better than starting at hundreds and hundreds of MS Project exports!”*

Looking to the future, Bas now has an operational workflow that can be implemented on future projects. With all the development work done on this project, the ROI on subsequent jobs is set to be much improved thanks to Bas' work. *“I’m really excited to see where we can take this,”* he says. *“I’m already looking at improving the way we import the data into VR so we can immerse people in the data more fully. Thanks to the PointFuse mesh models, we’ve actually had virtual meetings inside the model, where we can easily view the entire site, zoom in on specific elements with a high degree of detail, and take quick measurements. It’s real next-generation stuff, and it’s thanks to the hybrid mesh we’ve built with PointFuse’s help, that it’s possible.”*