

Sacramento Central Plant

Customer Success Story

Project Team

Nacht & Lewis Architects
WSP Flack + Kurtz

Client

Department of General Services

Autodesk® Revit® Architecture

Autodesk® Revit® MEP

AutoCAD®

Autodesk® Navisworks®

Autodesk® 3ds Max®

BIM gives us a high level of confidence. It facilitates subcontractor understanding. It helps us detect problems early. And it plays a key role in getting buy-in from the client.

—Benjamin Sun
Vice President
WSP Flack + Kurtz

Powering the California capital.

Sacramento Central Plant project team discovers benefits of Autodesk® BIM solutions on fast-track project.



Sacramento Central Plant: Exterior

Project Summary

In 2007, the State of California reinforced its leadership on environmental issues, initiating a project to build an environmentally friendly energy plant for the state capital. The new \$181 million Sacramento Central Plant will replace an aging 40-year-old facility, efficiently heating and cooling 5.5 million square feet of office space in the Capitol and 23 other state buildings in downtown Sacramento.

The new central plant will use a tenth of the water of the existing plant and reduce energy consumption. It is on track to receive LEED® Gold certification. Photovoltaic cells located on the façade of the 4.25-million-gallon thermal energy storage tank will power the plant offices. For irrigation and gray water within the offices, the plant will reuse reclaimed water from the cooling tower. In addition, the plant's mechanical systems include many sustainable comfort and conditioning technologies.

"The locker rooms use radiant floor systems, the conference room has a low pressure displacement ventilation system, the wellness center utilizes a chilled beam system, and the cooling system uses evaporative cooling. In addition, we have eco-friendly-refrigerant direct expansion systems with chilled water fan coils backup for the control room and storage area," says Benjamin Sun, vice president of WSP Flack + Kurtz. "These various mechanical

systems showcase how green technologies can be used in different kinds of spaces."

The project team decided to use AutoCAD® software for documentation along with building information modeling (BIM) software from Autodesk. "We consciously took a parallel approach with 2D and 3D, since this was our first BIM project," says Michael Parrott, vice president and senior project manager at Nacht & Lewis. "It didn't take long before we discovered the benefits of BIM for design coordination, collaboration, clash detection, and visualization." With Autodesk BIM solutions, including Autodesk® Revit® Architecture, Autodesk® Revit® MEP, Autodesk® Navisworks®, and Autodesk® 3ds Max® software, the team has experienced new levels of collaboration and coordination—helping to maintain the fast project schedule. "We're now using Revit Architecture on all of our other projects as a result of this experience," adds Parrott.

The Team

When the Department of General Services (DGS) issued a Request for Proposal (RFP) for the Sacramento Central Plant project, the scope of work entailed a renovation. But it was clear to team members at Nacht & Lewis Architects, WSP Flack + Kurtz, and the design-builder that to maintain operations during the transition, the state would

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The team meets tight project deadlines by finding errors before construction begins.

need a different approach. “Our team proposed building a new, state-of-the-art plant around the existing plant, then demolishing the old plant once the new plant is operational,” explains Parrott.

The three firms collaborated closely on the proposal and submitted a single comprehensive bid to DGS. “We offered the best solution for the best value,” adds Parrott. The group is delivering this complex project through a turnkey design/build public contract, with a state team providing peer review at every step.

A design-builder is directing all construction on the project. Nacht & Lewis, an architectural firm that has worked on public projects in the Sacramento area since 1922, is responsible for the project’s architectural design. The multidisciplinary engineering firm of WSP Flack + Kurtz—ranked as one of the world’s top engineering firms in *World Architecture* since 1994—is handling all mechanical, electrical, and plumbing (MEP) engineering services. In addition, the teams rely on expertise from several subcontractors—making the close coordination and collaboration facilitated by BIM key to project success.

The Challenge

In fact, the core team knew from the outset that keeping everyone aligned on the project would be a major challenge. “It’s not only the design-builder, Nacht & Lewis, WSP Flack + Kurtz, and various subcontractors that must work closely together,” says Parrott. “The team also includes state architects and

engineers. The challenge is keeping all these people on the same page, particularly on a project of this complexity.”

Many Requirements

Above all else, DGS wants the new plant to fulfill three main goals: reliability, energy-efficiency, and safety—and it has spelled out the details in an RFP spanning 10 three-inch binders. Throughout the project, plant operations must continue uninterrupted 24 hours a day, 7 days a week, 365 days a year. “The state gave us lots of information about how they wanted the plant to perform,” says Parrott. “It has been our job to make sure that the design and end product met all those requirements.” Making the project even more challenging was the highly compressed timeline. “It is one of the fastest projects I’ve ever worked on, if not the fastest,” adds Parrott.

Urban Setting

The Sacramento site is highly urban, and designers had to create a plant that fit into the mixed-use landscape—not an easy task. For example, the plant’s chilled water thermal storage tank is a conspicuous element that had to fit in with surrounding structures. “The site is a mixed-use area, which made phasing, noise considerations, and other contextual aspects of the project much more important,” says Parrott. “We essentially designed a central plant that doesn’t look like a central plant.”

One of the hardest issues to overcome has been the acoustic requirements imposed by the plant’s urban

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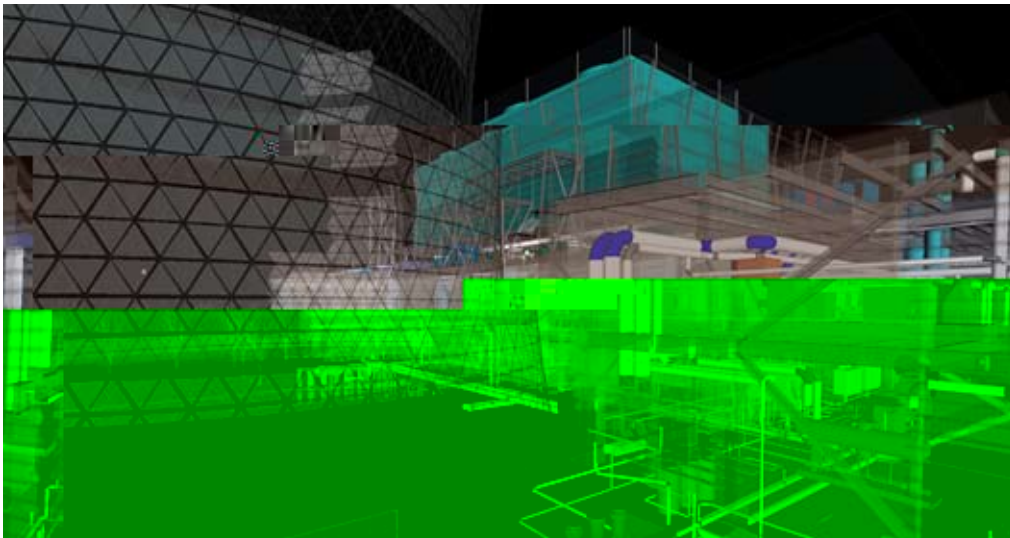
setting. “We had many design considerations from a mechanical and architectural standpoint—the plant has to operate efficiently 24 x 7, but can’t keep people up at night,” explains Sun. “We put in a very high Sound Transmission Class (STC) assembly, so you can’t hear the plant at all. Protecting operators and residents from the sound of moving pumps, fans, chillers, cooling tower, and boilers has been one of our greatest successes on this project.”

Green Goals

From the beginning, the team has worked to meet nationally recognized U.S. Green Building Council LEED certification requirements for energy savings, water efficiency, CO₂ emission reduction, improved indoor environment quality, and stewardship of resources. “It wasn’t always easy to meet LEED requirements,” says Parrott. “For example, we struggled to find recycled and regional materials. It was also difficult because LEED isn’t designed to address central plant facilities—and we had to factor in both office and central plant space.”

The Solution

With a complex project before them, team members needed to collaborate effectively and evaluate design alternatives quickly. Autodesk BIM solutions provided the powerful tools that helped the team make design decisions earlier, optimize sustainability, and better meet goals for energy use. “We suggested a BIM process because we knew it would help us communicate effectively and get quick buy-in from everyone on the team,” says Parrott. “We



Structural, Architectural, and MEP Design Models

believed that with Autodesk BIM software, we could keep everyone on the same page throughout the project—and we were right.”

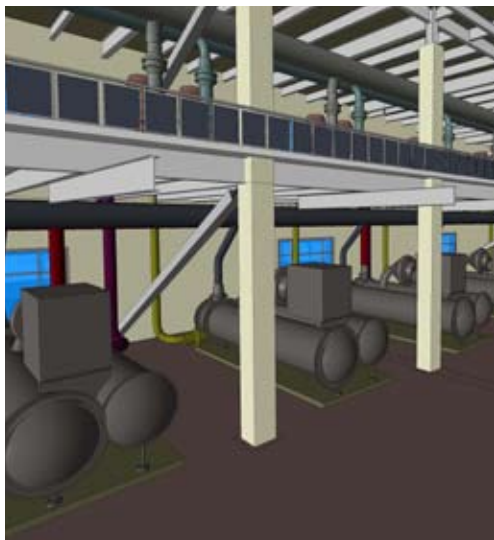
Even before the Sacramento Central Plant project, Nacht & Lewis and WSP Flack + Kurtz had recognized the value of BIM; the firms just needed the right project to take the plunge. “Moving to BIM was a strategic decision for us,” says Parrott. “We wanted to move to a fully parametric model and reduce the use of 2D drawings. We knew that in the long run, it would help us run more efficient projects and improve our productivity.”

BIM Process

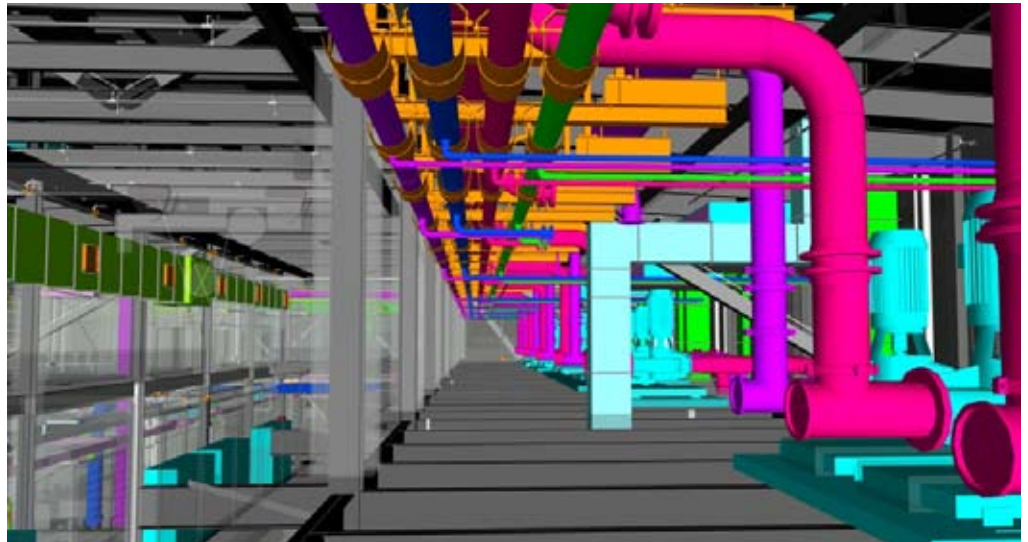
Autodesk BIM solutions make sustainable building easier, more efficient, and less costly. Designers can evaluate design alternatives faster and collaborate more effectively across teams. With consistent, coordinated BIM data, teams can spend less time correcting errors and more time creating innovative, energy-saving designs.

AutoCAD Extends the BIM Workflow

While the Sacramento Central Plant team relies on Autodesk Revit Architecture and Autodesk Navisworks software for 3D modeling, decision-making, collaboration, and clash detection, team members use AutoCAD to create 2D construction documentation. Because AutoCAD software more smoothly interoperates with Revit-based products, the system can better maintain data fidelity throughout the documentation process.



Schematic Architectural, Structural, and MEP Models



Sacramento Central Plant: MEP Model

“You’d think that it would be redundant to do designs in both AutoCAD software and Revit-based products, but it isn’t,” says Laura Wood, virtual design coordinator at Nacht & Lewis. “By relying on a familiar 2D process and the expertise of drafters not yet trained to produce construction documentation using Revit-based products, we can more easily meet our tight deadlines.”

WSP Flack + Kurtz follows a parallel path, creating traditional 2D drawings of MEP systems in AutoCAD and an MEP model with Autodesk Revit MEP software. Then both are coordinated with the work Nacht & Lewis completes using AutoCAD and Revit Architecture software. “At the start of the project, we didn’t have sufficient trained resources to use Revit MEP software for documentation,” says Sun. “Plus, some stakeholders that had to sign off on our designs—such as the State Fire Marshal—still wanted to review traditional 2D drawings.”

Coordinating Designs in the Model

Every Tuesday, WSP Flack + Kurtz uploads MEP data; other subcontractors upload mechanical and other designs; and Nacht & Lewis adds updated architectural data. Wood brings all the data into the Navisworks model for review by team members. On Wednesdays, everyone gathers for coordination meetings to correct any issues. “The model shows problems up front—from clashes to coordination problems,” explains Wood. “We look at the model and then reflect necessary changes in the 2D drawings as needed.”

By bringing all project data together, the BIM process also helps assure DGS of the design approach taken by the team. “There’s a lot of architectural, mechanical, and electrical coordination involved in this project,” explains Sun. “When DGS views a 3D representation, especially for complex components of the chiller plant, they can more quickly see that we’ve considered whether the structural slab is sufficiently heavy on the second floor or how overhead cranes can access certain components for future servicing.”

Collaboration Aids Phased Approach

Because the team must design and build the new plant around the existing plant, a phased approach has been critical. “We have to do a lot on a very minimal site, which makes the project difficult from a programmatic standpoint,” says Parrott. “Fortunately, with the help of BIM, we have a very collaborative process. Early in the project, we had many phasing discussions and worked closely together to overcome the challenges. Instrumental in these discussions are the models and drawings the teams deliver. We’ve been able to provide some fantastic phased visuals that serve as the basis for our discussions.”

Visualization Supports Decision Making

Thanks to BIM, the team has been able to make the fast decisions required to meet deadlines, despite the project’s complexity. Even during the proposal stage, BIM played a key role. “We proposed an enhanced approach that involved new construction

Winning client buy-in has been easier thanks to BIM.

rather than renovation,” says Parrott. “Everyone understood instantly what we were proposing—it allowed us to move forward.”

The team uses renderings from Revit Architecture, Revit MEP, and Autodesk 3ds Max software to create visualizations that help team members make decisions—and get buy-in from DGS. For example, in the very first coordination meeting, team members weren’t sure whether certain mechanical pipes were laid out the right way—until they saw them in the Revit model. “We were looking at 2D drawings with pipes going down to this walkway to the first floor,” says Wood. “We were debating the placement until we saw it in 3D. The best way to organize the pipes was clear right away, and the entire team came to an instant decision.”

Sun agrees that visualization has played a big role in overcoming the coordination challenges associated with a project of this size and complexity. “Given the amount of time we have to complete the project, it’s important that everyone quickly understands our design intent,” notes Sun. “We’re not only dealing with air handlers and a chiller system but also with a 250 psi steam system in a relatively small space. BIM helped the state accept the approach we took much faster because they could visualize how our designs work.”

Finding Problems Earlier

The team relies heavily on BIM to identify problems before construction. Viewing the building model, team members can more quickly determine, for example, whether they have allowed enough room around certain components to support future maintenance. Using Autodesk Navisworks software, they can also test for interferences between elements—especially those designed by different companies. “Our subcontractors use a lot of different data formats, including CAD, CAD-Duct, CADPIPE, and

Vectorworks®. It really helps that we can bring all of this data from a very large model, regardless of format, into Navisworks software and run clash detections in real time,” says Parrott.

Coordinating piping and ductwork has been a challenge—one overcome with the help of Navisworks software. “We originally did the coordination sector by sector using 2D drawings,” explains Wood. “Then we looked at the Navisworks model and found more clashes. Finding these problems early helped us avoid more costly problems later.”

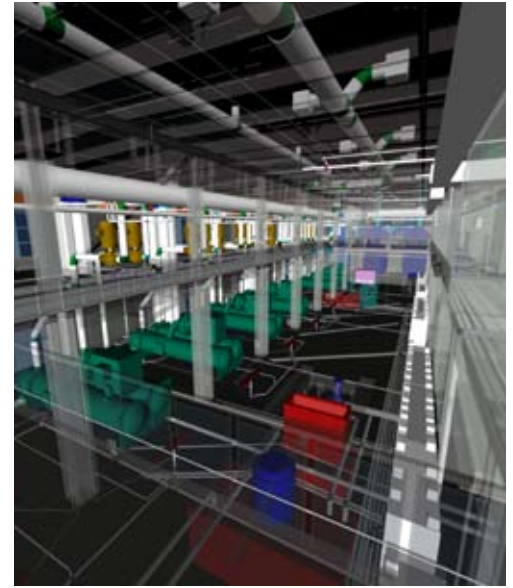
Sun adds, “We used Navisworks to assure the contractor that we had checked for clashes and they could rapidly proceed with their layout work. I believe it helped in the workflow for construction.”

The Result

Because the Sacramento Plant Project is highly complex and has many requirements, team members wouldn’t have been surprised to encounter a major problem or two along the way. But that hasn’t been the case. “With BIM, we got help avoiding mistakes,” says Sun.

Sun points to the visualization capabilities of Revit-based products, Navisworks, and 3ds Max software as key: “There are so many different components within the plant. BIM software from Autodesk gives us a high level of confidence. It facilitates subcontractor understanding. It helps us detect problems early. And it plays a key role in getting buy-in from the client.”

“We definitely reduced would-be mistakes,” agrees Parrott. “If you can’t see it, you don’t know there’s a problem. But once you see a problem, you can come up with a solution before you have to deal with it in the field.”

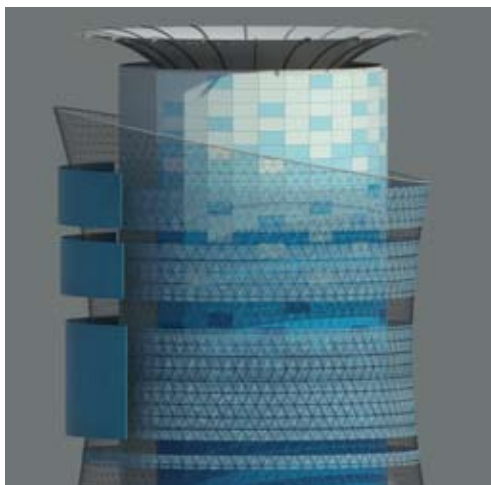


Sacramento Central Plant: MEP Model

Looking forward, WSP Flack + Kurtz and Nacht & Lewis have already begun building on the BIM processes initiated on the Sacramento Central Plant project. “With Revit MEP software, we know that what we’re designing can be close to what’s constructed in the field,” says Sun. “The confidence the BIM approach provides is a major benefit.” Parrott adds, “We’re really starting to reap the productivity benefits of Revit Architecture software. It’s very exciting.”

For More Information

To find out how BIM can help you complete green public projects more quickly and cost-effectively, visit www.autodesk.com/gov and www.autodesk.com/powerofbim.



Sacramento Central Plant: Tank Study

We believed that with Autodesk BIM software, we could keep everyone on the same page throughout the project—and we were right.

—Michael Parrott
Vice President and Senior Project Manager
Nacht & Lewis Architects