TIA and TIP allow producer to hit the ground running with older equipment at a Greenfield site.

Automation evolution

Granite Construction, Inc.

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Despite the bursting of the California housing bubble and a weak economy, in 2008 Granite Construction, Inc., chose to forge ahead – albeit with a modified plan – with its long-term plans to open a new sand and gravel facility in Vernalis, Calif. The decision to provide the new site with totally integrated automation (TIA) and totally integrated power (TIP) allowed Granite – within a year of breaking ground – to bring online a modern, efficient plant using older aggregates processing equipment that the company moved from a closing facility.

Granite had purchased the property for the Vernalis site in the late 1990s in anticipation of eventual material depletion at its nearby Tracy plant, which had produced sand and gravel since the early 1970s. Both plants are located south of Stockton in California's Central Valley, near the foothills of the Diablo Mountain range. By mid-2008, the Tracy plant was nearing the end of its reserves.

According to plant superintendent Don Claunch, "Granite purchased the Vernalis permit 10 years ago from a family that was using the land as an almond orchard. We knew the reserves at Tracy would run out soon, and by 2008, it was clear that we needed to get Vernalis up and running."

Claunch said the original intent for the Vernalis plant was to install all new equipment. "In fact, we purchased and installed two new log washers and a screen at Tracy near the end of its life because we knew we wanted them for this site," he said. But when the economy began to weaken, plans to purchase additional new equipment were scrapped, and Granite chose instead to refurbish some of the old equipment from the Tracy plant – with one major improvement. Granite went ahead with plans to include complete automation of all processes at the Vernalis site.

The acronyms TIA and TIP stand for totally integrated automation and totally integrated power. The terms were coined by Siemens and they accurately described Granite's goal – to completely connect all processes within the Vernalis plant and view them through one window, so to speak, using one software bundle for operating and monitoring the plant. Equally important to Granite was the ability to monitor and manage power. The company looked at providers of automation products, and it was Siemens that stood out as being able to provide the complete package using standard equipment.

Communication is key

"Communication was a big deal for us," said Dave Noble, power and automation specialist for Granite

Construction. “The Siemens equipment that we used on this site communicates seamlessly. All other manufacturers seemed to have holes that needed to be filled with equipment, software, PLCs or SCADA (supervisory control and data acquisition) from someone else. They (Siemens) make smart MCCs (motor control centers) that come standard with energy monitoring capability, providing features like smart overloads. With other manufacturers, that was a more expensive option,” he explained.

In addition, the Astec hot-mix asphalt plant that would also reside at Vernalis used Siemens automation products. “The ability for us to tie in with the Astec plant onsite was one of our deciding factors,” added Bruce Bunting, plant construction manager for Granite. “Switchgear commonality is helpful when the asphalt plant and the aggregate plant can trade parts and help each other out.”

Noble and Bunting approached Siemens with their interest in the manufacturer’s products, also indicating their need for an integration specialist that could provide all of the necessary components to outfit the Vernalis plant with TIA and TIP. Siemens recommended Rockford, Tenn.-based Rock Solid Industrial Solutions, the aggregates integration arm of Siemens’ automation, and distributor Brozelco, Inc.

Rock Solid had automated several aggregate plants across Tennessee, completely tying in automation and power with Siemens' products.

"We went to Tennessee, where Steve Disney, president of Rock Solid, showed us several aggregate plants we felt were taking the correct path that we also wanted to go down," Bunting said. "We saw an aggregate plant that was using older SIMOCODE motor protection and a new sand and gravel plant very similar to ours that was using all new Siemens products and software."

Noble and Bunting say there were specific factors that stood out for them at the plants they toured. "The ability to retrieve power management from the main, the power monitoring kits where you could keep tabs from the touch screen, and the ability to monitor maintenance were all great," Noble said. "We also liked the fact that if the main computer went down in the control tower, you could run the plant from the individual MCCs."

Another attractive aspect about Rock Solid was its apparent willingness to work with operators and other plant personnel, using their input for the integration process. Bunting said he felt this was key to making the automation and power package work for the Vernalis plant. "This was a big issue for us," Bunting said. "We've dealt in the past with automation outfits that would tell you how you needed to make it work.

In November 2008, as Granite began to grade the property according to its mine plan, the company also brought in electric power for the site. While Granite has never had to use more than 64,000 volts for any plant in the past, a neighboring facility already had 120,000-volt service in place from the local power utility. Granite merely had to build a substation to step down the power to 12,470 volts.

"We began to pull equipment at Tracy and overhaul it, lengthening and shortening conveyors as needed so that they would arrive here (at Vernalis) ready to erect," Claunch said.

Rock Solid also began its work onsite, installing the first Siemens products at the same time. "We used a local contractor, MarTech, to install the fiber optics, the underground and the motor distribution," Disney said, adding that this process is typically handled by his company, but he chose instead to work on the Granite site with a skeleton crew of just three from his own operation. "MarTech also installed the tie-ins from the main circuits to the plant gear," he said.

TIA and TIP

"The fiber optics are the backbone of the system," Disney said. He explained that fiber optics controlled by PROFINET connect all MCCs, including the most remote control centers, to the plant. "The fiber optics provide information faster, over longer distances and are less expensive than copper," he added.

Siemens NEMA 3R switchgear was added to MCCs in remote spots on the site, such as the well pump MCC. The wells themselves had already been installed onsite for the previous almond orchard. Rock Solid installed one static drive and one variable frequency drive (VFD) at each well pump for better use of power. The plant currently makes use of one freshwater pond, and as the slime pond settles and fills with water, freshwater will also be drawn from this source. The remote MCC that runs the pit conveyors is flexible so that it can move with the mining operation. Rock Solid installed Siemens 3RW44 soft starts on all conveyor drives and larger motors, eliminating jerky starts and increasing the life of the gearboxes and the conveyor belts.

The permanent MCC buildings, manufactured by Rock Solid and shipped with Siemens drives, switchgear and HMIs (monitors), are elevated 4 1/2 feet from the ground. "I saw that practice when we toured sites in Tennessee, and I thought it made a lot of sense," Bunting said. "But here in California, no one does it. Since they were installed, we've heard a lot of good things about them." Because each building has an HMI, if the main control tower HMI loses power, the plant can run from any HMI in an MCC building. "This also allows for our maintenance crew to operate from each location," he said.

Rock Solid integrated the automation for the plant using Siemens' Simatic Manager® software, which includes Step 7® for PLC, WinCC Flexible® for the local HMI devices and WinCC® for overall HMI control. Disney says that WinCC tracks alarms, trending and operator interface. The VFDs are MM440 and G150 Siemens drives with Drives ES® software embedded in Step 7. Soft starts are controlled with Soft Starter ES®. All other motors and data are set up using SIMOCODE ES® and are also embedded in Simatic Manager. SIMOCODE data allows operators to watch trending for predictive and preventive maintenance. The Vernalis site now has 30,000 feet of fiber optics installed throughout the plant that tie into Siemens Scalance®, through which the information travels from the PLC. PROFINET and PROFIBUS ports on the PLC talk to the drives, motor starters and breakers. Scalance picks up the information from the PLCs and displays it for the

operator information on the HMIs. Simatic Manager manages all of these packages for the integrator's use during installation and additional upgrades.

"Simatic Manager manages all of it so that it's contained in one package," Disney said. "Ron Robertson from Rock Solid worked to customize the Siemens WinCC software, along with Matt Brogger, who developed the Step 7 PLC code. This, with the drives, soft starts, intelligent overloads and power system, makes for TIA. Startups are smooth and fast, and you're producing material quickly. It sounds complicated, but the software is very intuitive and training is easy. Even push-button old-timers are running the plant with it in less than a day."

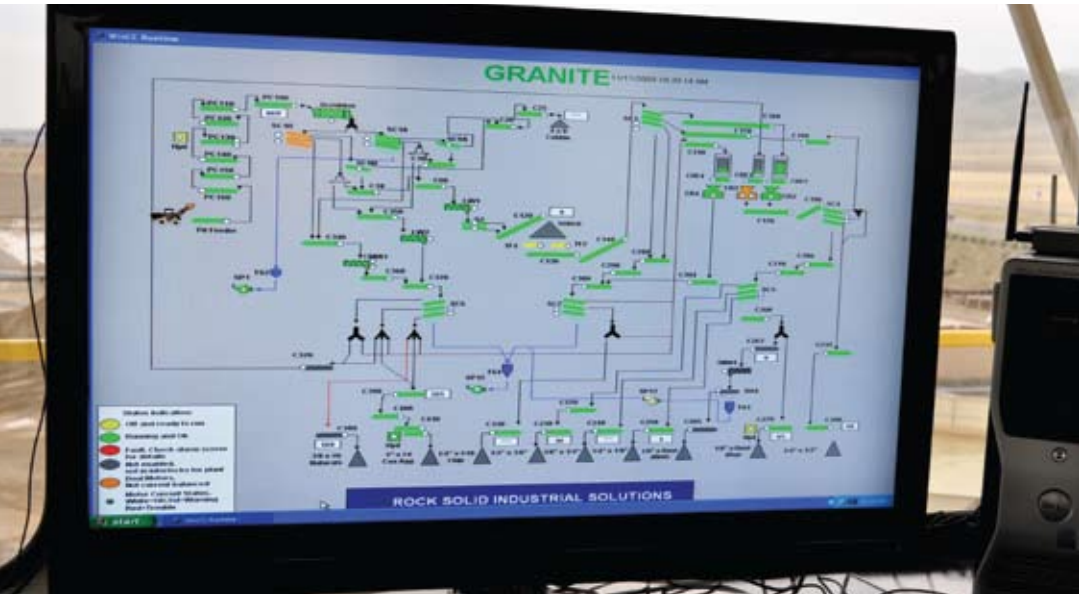
Rich Lopes, the plant electrician, can testify to Disney's latter claim. "I've been with Granite for 20 years, but I've never worked on an automated plant like this before," he said. "The learning curve has been pretty easy. Rock Solid and Siemens have been great; they've always been there to troubleshoot or answer questions. For an old-school electrician like me, it's been fun seeing this plant come online."

Go with the flow

"We mine with scrapers and an intermittent dozer," Claunch said. "The deposit is 200 feet deep, and there is only about 20 feet of overburden." From a grizzly in the pit, 2,500 feet of conveyors move the material to the plant, which consists of a McLanahan rotary scrubber, two Deister scalping screens, six horizontal and inclined Deister wash screens, two McLanahan log washers, three Deister dewatering screens, a GreyStone classifier and coarse material washer, two twin screws from GreyStone and McLanahan, two GreyStone single screws, six Krebs cyclones, a Phoenix clarifier and clean water tank, two REMco VSI crushers, a Telsmith cone crusher, two Superior telescoping stackers and other stacking conveyors. Products are fractionated, and an 800-foot tunnel runs beneath the stockpiles, with belt feeders and conveyors in place for blending Caltrans, ASTM C33 and custom mixes.

Disney says that every piece of machinery in the plant is automated with Siemens products and software, with the exception of the classifying tank, which uses proprietary software. "Phoenix especially worked closely with us as we installed the controller for the clarifier," he noted. "And the operator can start up and run the entire plant from one location – the control tower."

According to plant operator Mike Souther, integrating the plant helps not only with startups, but also the



ability to watch power usage and control it. "We're able to watch the power, and we can stop it quickly without incurring penalties from the power company," he said. "We also have to deal with load shedding and energy sharing in this area. So if the power company calls and says we have to shut down, we actually can shut down certain MCCs and run specific plants without penalty. Every plant should be set up this way," he added.

On time and on budget

The Vernalis plant officially went online to produce material in September 2009. Initially its production rates were 600 to 800 tons per hour (tph), but by November, just a year after Granite broke ground for the plant, it was able to produce material at its target rate of 1,400 tph. However, to concentrate as much on quality as quantity, Souther says, Vernalis has now settled in at an average of 1,200 tph.

According to Noble, the fact that Siemens and Rock Solid were able to work with Granite, using input from everyone involved in the plant, helped keep costs down. "If this plant had been built conventionally, with conventional operating methods, it would have been more expensive from a horsepower standpoint," he said. "There were a lot of unknowns as we were breaking ground for this plant – from the dirt to the water to the rocks. Siemens and Rock Solid were with us every step of the way."

Noble continued, "We did not want to automate just for automation's sake. We wanted to make the overall process simpler, give the operator a better view of the plant and run closer to full capacity."

"We also wanted to be able to plan for preventive maintenance, and we wanted the plant manager and plant superintendent to be able to sit in the office and see what the operator sees at the same time he's seeing it," Bunting said. "The amount of data on the screen is astronomical. But the operator can really tell what's going on throughout the plant, all on one screen. It's phenomenal."

Lopes added that he feels the ability to upgrade during a slower economy has been a benefit for the Vernalis plant. "For me, there's been a chance to learn while we're not stressed for time. We've worked out the bugs, and when the economy picks up, we'll hit the ground running," he said.

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