



Terna Energy Mountain Air Projects wind farm  
PHOTO: BEN BAINBRIDGE, POWER ENGINEERS

Power & Energy I

# On-Demand

Natural gas, wind and solar resources drive innovation and efficiency in transport, transmission, distribution and storage

By Vicki Speed

## What's Inside

### INTRODUCTION

Construction Spending on the Rise

### SECTOR HIGHLIGHTS

2015 Projects to Watch

Coast-to-Coast Delivery Platform

Enabling Energy Storage

Long-Term Ground Connections

Grassroots Rail Facility



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Progress Measurement  
Performance & Earned Value  
Data Integration & Reporting

# U.S. Energy Market to See Record Construction Spending in 2015

## Energy Storage Builds Momentum

**Construction spending** in the U.S. power and energy sector is expected to reach a record high of \$102.4 billion in 2015, according to FMI's most recent Construction Outlook report. Researchers at FMI report, "America is on the verge of a veritable manufacturing renaissance, building petrochemical plants in the Gulf and gaining interest from more companies, especially foreign-owned companies, considering relocating manufacturing to America."

Along with the need for new and rehabbed plants to support the emergence of natural gas, midstream and downstream owners have proposed over 1,700 miles of pipeline construction to be completed in the next few years.

As well, growing renewable wind and solar farms have created a comparable demand for transmission, distribution

and storage projects. Currently, wind is the largest source of non-hydropower renewable generation in the U.S. The U.S. Energy Information Administration (EIA) projects that renewables used for electricity and heat generation will grow by 2.9% in 2015, and that wind will contribute 5.0% of total electricity generation by 2016. EIA further expects that utility-scale solar capacity will increase by more than 60% between the end of 2014 and the end of 2016, with about half of this new capacity in California.

With all the new renewable systems coming online, it's no surprise that industry focus and innovation have shifted to renewable energy storage.

Snohomish County Public Utility District (PUD) is one of the leaders in energy storage adoption. Funded in part by a \$7.3-million investment from the Washington State Clean Energy Fund, the PUD's goal is to develop plug-and-

play type energy storage systems to support its emerging intermittent energy resources such as wind and solar. As part of the program, the utility is building a large-scale energy storage fleet at its Everett substation. The first two large-scale lithium ion batteries have already been installed and the third, an advanced vanadium flow battery, will be added by the end of 2015. Similarly Southern California Edison (SCE) recently awarded 261 MW of energy storage contracts, including a single 100-MW grid-scale battery storage project, to be put in place in the next five years.

SCE and Snohomish County PUD are not alone. GTM Research predicts that the U.S. will add an estimated 220 MW of energy storage in 2015, more than three times the storage that was put in place in 2014. ■

## Park-Like Power Plant Lights Up Community

**When a power plant** emulates a park, it adds new light to a community.

Working hand-in-hand with the Holland Board of Public Works in Holland, Mich. and the community, HDR engineers, economists and architects are reimagining the look and feel of a new 125-MW combined-cycle natural gas plant.

Bob Koonce, senior project manager of the project and an associate vice president at HDR, the owner's engineer, says, "We listened closely to understand stakeholders' concerns and priorities by leading a sustainable return on investment process—a first-of-its-kind for the power generation industry—in tandem with a traditional alternatives analysis."

The evaluation process led to the design of a 2x1 combined-cycle plant built in a park-like setting complete with paths, a waterfall and extensive natural



Rendering of new combined-cycle natural gas plant

greenery and wildflowers. A power plant so mindful of its impact, it's registered with the Institute of Sustainable Infrastructure as an Envision™ Sustainable Infrastructure project with a goal to achieve Envision™ Platinum Rating. As a nod to a community that's so invested, the design also includes a public gallery to see and learn about power generation.

While providing reliable, low-cost electrical power to the city and

surrounding township for decades to come, the power plant will reduce carbon dioxide and other emissions significantly compared to the current power plant. Additionally, the waste heat generated will be used in the winter months to melt snow in the city's downtown district, providing for a safe and enjoyable shopping and entertainment experience.

The plant will be an integral piece of the surrounding Macatawa Greenspace and an essential element of the Holland Community's Energy Plan, a 40-year plan to reduce the city's overall carbon footprint. As one of the most important infrastructure projects in the community's history, the Holland Energy Park (HEP) will provide major benefits to homes, businesses, the environment and community at large. After years of planning and community engagement, construction of the HEP has begun with a target completion of February 2017. ■

# Projects to Watch Entering a New Energy Era



## Power Flexibility

### Napanee Generating Station, Eastern Ontario, Canada

Construction Start: February 2015 | Operational: 2018

TransCanada is constructing the highly efficient Napanee Generating Station (NGS), a new 900-MW combined-cycle natural gas-fueled power generation station. As a flexible power source, NGS will replace retired coal and nuclear capacity, support nuclear refurbishment and provide on-demand power to backstop wind and solar resources.



## Energy from the Sea

### Block Island Wind Farm, Rhode Island

Construction Start: Summer 2015 | Completion: 2016

The 30-MW Block Island Wind Farm is the first offshore wind farm in the U.S. The wind farm will include five turbines that will generate over 125,000 MW-hours annually, enough to power over 17,000 homes, when complete in 2016. Power will be exported to the mainland electric grid via the 21-mile, bi-directional Block Island Transmission System.



## Grid-Scale Storage Capacity

### SCE Energy Storage, Southern California Edison, Los Angeles, Calif.

Construction Start: 2015 | Operational: 2021

Southern California Edison awarded 261 MW of energy storage contracts in late 2014, including a single 100-MW grid-scale battery storage project. The 100-MW in-front-of-meter battery system will have the capacity to deliver 400 MWh of energy when it is installed at the Alamitos Power Center in Long Beach, Calif.

PHOTO: AES



## Emerging Sun Spots

### Solar Star Projects, Rosamond, Calif.

Completion: December 2015

SolarStar Projects (formerly Antelope Valley Solar Projects) comprises two co-located solar installations in California's Kern and Los Angeles Counties. The solar network will have a capacity of 579 MW that will be provided to Southern California Edison as part of a power purchase agreement. The solar array network will produce enough electricity to power the equivalent of approximately 255,000 homes.

PHOTO: BHE RENEWABLES



## Pipelines of Productivity

### Pacific Connector Gas Pipeline, Jordan Cove LNG and Pacific Connector Gas Pipeline, Malin, Ore. - Coos Bay, Ore.

Construction Start: 2015 | Completion: 2017

The proposed Pacific Connector Gas Pipeline (PCGP) project will transport natural gas 230 miles from interconnects near Malin, Ore., west and north to an LNG terminal in Coos Bay, Ore. where the natural gas will be liquefied for transport via ocean-going tanker to markets on the Pacific Rim. The pipeline is expected to be complete in 2017.



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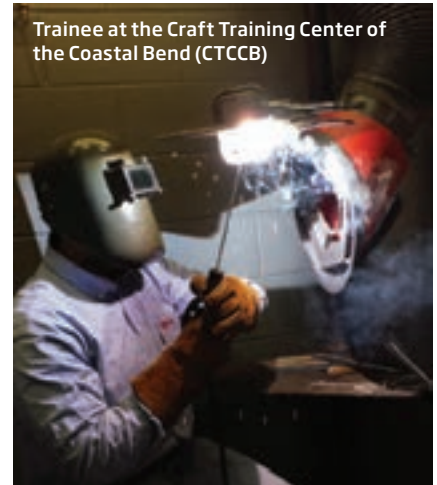
## Our Industry's Future Depends on Workforce Commitment

**The current and impending** shortages of skilled craft professionals have impacted the construction industry greatly. Now is the time for the construction industry—including both owners and contractors—to invest in its workforce.

To achieve comprehensive change quickly, the industry needs owner-mandated commitment. Newly developed assessment tools like the Contractors Workforce Development Assessment (CWDA) provide an objective measure of contractor commitment to training in both the prequalification and final selection of contractors and subcontractors. The CWDA helps owners and contractors compare contractor craft training programs and provide a set of objective measures to improve what has traditionally been a subjective analysis. Owner adoption of tools like the CWDA that promote workforce development can have a substantial impact on the industry's recruitment and retention

efforts. Contractors and subcontractors can subscribe to the CWDA at [cwda.nccer.org](http://cwda.nccer.org).

Owners and contractors must also commit to developing the future craft workforce by supporting high-quality craft training through industry-sponsored and career and technical education (CTE) programs. The industry should work together with schools to help align curricula and training to their needs. Through NCCER's Construction Career Pathways initiative, industry and education can identify each other's needs and effectively collaborate using an interactive connection map. Contractors and educators can submit opportunities for site visits, classroom presentations, mentor programs, internships, career day activities and more at [pathways.nccer.org/connection-map](http://pathways.nccer.org/connection-map). Along with the connection map, NCCER's national recruitment and image enhancement initiative, Build Your Future, offers free resources available to promote construction careers at [byf.org](http://byf.org),



Trainee at the Craft Training Center of the Coastal Bend (CTCCB)

and its Hard Hat Heroes initiative provides a program of recruiting, training, assessing and hiring transitioning veterans for careers in construction at [byf.org/military](http://byf.org/military).

The construction industry has the capacity and resources to conduct quality, craft workforce development. However, owners and contractors must elevate their commitment to effectively use these resources before current workforce challenges become unmanageable. ■

## Powering Up With Coast-to-Coast Delivery Platform

**Industry analysts across the board** believe that the U.S. energy production is on the rise with increasing demand for associated infrastructure. At the same time, utilities are expected to invest nearly \$980 billion in North American transmission and distribution infrastructure through 2030. Up to 60 GW of coal-fired generation will be retired, requiring replacement by cleaner forms of power, such as natural gas-fired power generation facilities and renewables.

With that in mind, Matrix Service Company recently consolidated its union subsidiaries, Matrix North American Construction (Matrix NAC) and Matrix SME into one company. The new organization will operate under the name Matrix NAC.

Through the separate subsidiaries, the company has long provided service to the power generation and delivery

segments, providing large capital construction as well as maintenance and repair services.

Most recently, the combined organization was awarded construction of TransCanada's Napanee Generating Station, a new 900-MW combined-cycle power generation station. The facility, to be constructed in Napanee, Ontario, builds on a long history of constructing these type of facilities in North America, and will be the second major gas-fired power generation project Matrix Service Co. has constructed for TransCanada in the past five years.

In addition to power generation and delivery, the combined organization also offers substantial expertise in storage solutions, oil and gas and chemical, and holds a position as a premier contractor in the iron and steel industry.

"The strength of the consolidated

250-MW natural gas-fueled, combined-cycle power plant



operations provides a solid foundation for future growth across the industries we serve and, by providing a singular union solution, our customers benefit from expanded services," says John R. Hewitt, president and CEO of Matrix Service Co. "While the merger extends the geographic footprint of our firm's union platform, it also generates operational efficiencies that will benefit our shareholders and create greater opportunities for our employees."

The new entity will be managed under a unified leadership team that will report directly to Jason W. Turner. ■

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At Ardent, we are dedicated to promoting a positive safety culture through our Behavior Based Safety Observation Program, which encourages peer intervention and reinforces safe behavior, while leveraging "Stop Work Authority" when working conditions or observed acts are unsafe.

*We believe all incidents are avoidable; no level or number of incidents are acceptable.*

	2012	2013	2014
HRS	2,112,644	3,051,236	3,388,240
TRIR	0.28	0.26	0.23
LTA	0.00	0.00	0.00



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## Enabling Energy Storage in a Renewable Generation World

**John Kumm, P.E.** | Business Unit Director, SCADA and Analytical Services (SAS) Group, POWER Engineers

**Electricity has the maddening** quality that it can't be stored without changing its form. The electric power system must use precisely the same amount of energy that is generated each instant or critical delivery parameters will fall out of tolerance. Throughout much of the history of the grid, we have directly controlled valves or fuel sources, making tiny manual or automatic adjustments to maintain operation very close to set-point across the grid.

The introduction of intermittent generation sources (wind, solar) limits our ability to directly control energy inputs to the system. This is the penalty for harvesting energy from sources beyond our discrete control. When the concentration of these sources in the power system was low, their

intermittency could be compensated by operation of other sources. As penetration of intermittent sources increases, the technical challenges grow, making room for an additional enabling technology: energy storage.

Integrating larger amounts of energy storage into the electric grid is the next step to increasing the positive impacts renewable generation can have on the power system. By storing energy produced by intermittent sources, we transfer the generation impact in time. Solar energy can be used at night and wind energy can be available while it's calm. Like earlier advances, increasing the use of energy storage requires that it be made economical, safe and reliable.

Our experience with best practices for design of lines, substations, fossil-fueled plants, wind plants and solar

plants—along with direct experience with energy storage facilities—offers us the tools to help you design and integrate energy storage systems of all sorts into your renewable plant, microgrid or utility system. We can model the impacts new facilities have on existing infrastructure, design the facility, lead environmental and public outreach activities, and create secure control and data acquisition systems that employ the latest and most effective architectures and protocols to provide situational awareness for utilities and owners/operators. ■

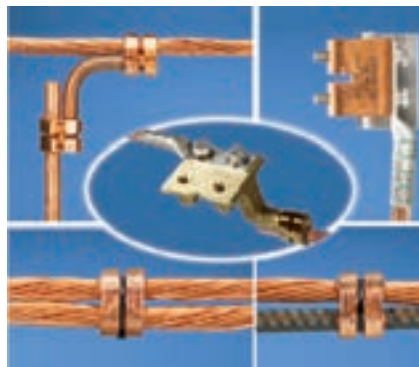
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## Component Reliability Leads to Long-Term Ground Connections

**Fred Dorman** | Director, Sales Strategy & Enablement, Panduit

**Efficiency is quickly becoming** the mantra across construction organizations. Even minor variances in construction practices can affect profit. All components need to be designed and engineered for productivity, reliability and safety in order to meet or exceed industry standards and pass inspections. Mistakes on the jobsite cause delays or rework which increases overall project costs and can lead to missed deadlines.

Connection reliability is critical to the long-term integrity of a grounding and bonding system. Traditional compression grounding systems offer installation efficiencies over exothermic welding systems and are compliant with IEEE Std. 837. The Institute of Electrical and Electronics Engineers (IEEE) developed this standard as a means of qualifying permanently installed grounding connectors. However, under certain circumstances such as installations



**Improperly installed grounding solutions can cause delays and higher costs.**

that are subject to corrosive forces or repeated freeze-thaw cycles, the reliability of compression grounding systems is often questioned.

If a grounding system is to last, the issues that put it in danger of failing must be identified and addressed. Risks to ground connectors include:

- ▶ The environment where the connectors are installed such as:
  - ▷ Damage from construction equipment before burial or during later site renovations
  - ▷ Electromotive forces from fault and lightning surges
  - ▷ Freeze-thaw cycles
  - ▷ Corrosive forces due to the presence of acids or salts
- ▶ Misapplication of the connector during the installation process
- ▶ Failure of the inspection process to find installation issues

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## Constructing a Grassroots Crude Oil by Rail Facility

**Competition in today's power** and energy construction market is strong, making it imperative that contractors surpass client project execution expectations, as well as confront all other competitive forces within the industry. In January 2014, Ardent was contracted to complete all aspects of electrical and instrumentation construction services on a grassroots crude oil rail car unloading facility located outside Taft, Calif., for a pipeline operator. The completed unloading facility has the capacity to unload 100 railcars per day. Once unloaded, the crude oil is transported by pipeline to various refineries.

This grassroots project consisted of extensive infrastructure raceway installations to accommodate the power, control, communication and instrumentation needs essential to support this highly automated facility, which has a wide range of power distribution apparatus, electrical driven equipment, process skids, motor operated valves,



**Grassroots crude oil rail car (aerial view) unloading facility was completed in late 2014 with zero recordable injuries and zero lost time accidents.**

lighting systems, control systems and extensive field instrumentation. The entire facility communicates and is controlled and monitored by a sophisticated central control room located just off-plot. Ardent provided services needed to coordinate and construct the incoming 12kv primary utility feeder, which consisted of overhead line construction, primary metering and circuit protection apparatus components.

Ardent's site management team was an integral contributor to successful

project completion through early constructability, scope management and solution management. The firm's early project involvement began by providing critical long-term strategies essential for a successful schedule-driven project. However, a majority of the team's project focus was on finding a solution to challenging conditions due to schedule compression, milestone accelerations and labor stacking. Ardent utilized its proprietary progress and productivity tools throughout the project phases, which positively impacted milestones and project completion expectations. Ardent's peak manpower exceeded 70 craftsmen and the firm executed over 60,000 man-hours of construction activities with zero OSHA recordable injuries and illnesses.

Completed safely and efficiently, the railcar unloading facility accommodated its first critical railcar delivery commitment on December 7, 2014. ■

## Enterprise Project Controls Create Flexibility in Capital Portfolios

**Commodity price shifts** as well as other macroeconomic shocks create challenges for the success of long-term capital energy projects. Oftentimes, owners must quickly and dramatically change priorities—they learn to expect the unexpected. It can be a challenge however for companies to react quickly enough to adjust as needed.

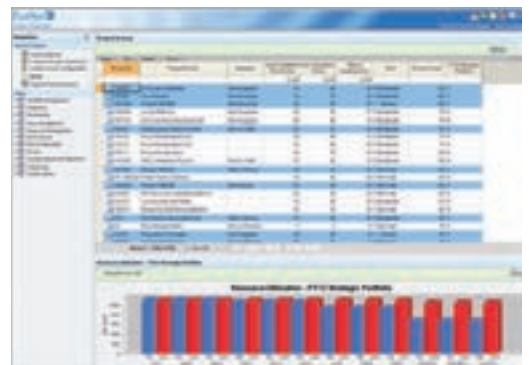
How can organizations address the inherent problem of change across long time horizons? An enterprise project controls approach inclusive of project portfolio management is vital to managing change.

Every project owner needs a standardized process for evaluating projects within portfolios so that cross-project comparisons have meaning. Then, what's imperative is the right tool to enforce the standards, provide visibility into current performance and facilitate what-if scenario planning in order to assess the broader impact of potential changes on projects

in any phase of development or consideration.

A full life-cycle approach to portfolio planning and controls provides flexibility to implement plan changes. It accounts for impacts and interdependencies that occur across a collection of multi-year capital projects. With a central repository for data, a holistic view of planned and active projects is achievable. Imagine the ability to use what-if analysis to understand the impact on strategic resources—from scarce labor skills to cash flow—to quickly assess options for investing in or shelving projects and have clear support for those decisions.

A best-practice portfolio approach puts in place the tools and information necessary to systematically evaluate projects and incorporate industry-leading cost forecasting techniques. Software solutions like EcoSys EPC allow the owner



**Agile owners take a life-cycle approach to project controls to gain the flexibility to make plan changes.**

or program manager to better assess risk exposure and contingency across the portfolio or, perhaps more importantly, proactively adapt to changing conditions. Throughout the long-term capital program, the owner is able to measure real-time cost status and productivity and take corrective action with a measured response.

In these times of workforce shortages, down oil prices and an ever-shifting political climate, take a technology approach and implement a flexible portfolio and planning controls solution. ■

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## Fast-Track Component Delivery Speeds Plant Construction

Through quick response, teamwork and effective collaboration, Burkhalter successfully delivered over 3,700 metric tons of power plant components to a new Pennsylvania power plant this past fall.

Seven generators and turbines, each over 300 tons, were transported to site via bluewater barge from Charleston, S.C., and 134 steam turbine components, totaling over 1,600 tons, were transported over the road from Newark, N.J.

Rapid response and logistics expertise were key to this large power transportation job, as Burkhalter was awarded the project just six days before a barge needed to be in South Carolina to receive the first shipment. Pulling together engineering, operations and field resources, Burkhalter chartered a barge and began movement within one day, all while continuing engineering plans and coordination between a number of other involved parties and subcontractors.

The sheer amount of components traveling over the road made close



The speedy delivery of critical components keeps power plant construction project on schedule.

coordination another important aspect of the job, especially utilizing smaller ports for such a large number of pieces. With some components going directly to the project site and others first transported to storage, ensuring that all are delivered per project

specifications and in correct priority was crucial.

Through innovative planning and a keen use of resources, Burkhalter was able to provide the quick turnaround necessary for the urgent need of the client. ■



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**Fenix Power Perú's** recently completed 520-MW combined-cycle power plant in Chilca is expected to provide at least 10% of Peru's power. It will also provide potable water to the local municipality from the plant's embedded desalination system.

Constructing complex plants such as the one in Chilca requires careful attention to material and equipment logistics. For instance, in advance of construction, Fenix Power needed a place to assemble turbines, store electrical equipment and materials, and provide services for nearly 300 workers.

Fenix Power Perú contracted Sprung Structures, a manufacturer of pre-engineered stressed membrane structures, to provide structures to support the plant's three year construction process.

Sprung provided three building systems, including:

- ▶ 60-ft x 117-ft shop/warehouse

structure for miscellaneous materials and electrical equipment terminals during construction

- ▶ 60-ft x 117-ft insulated structure used as a dining facility area for roughly 250 workers
- ▶ 100-ft x 250-ft gas-powered turbine assembly warehouse that features two double-panel rolling service doors and one large rolling service door

The pre-engineered structures were shipped in containers to the Chilca site in 2011. Local contractors' crews were able to assemble the large warehouse in less than three weeks—and despite considerable environmental loads from wind exposure and a corrosive sea salt environment, the buildings remain sound.

Now that the plant is operational, Fenix is using the structures for operation and maintenance activities. ■



These pre-engineered building systems, initially used as a turbine assembly warehouse (top photo) and a dining facility area (bottom photo), are now integral to plant operations.

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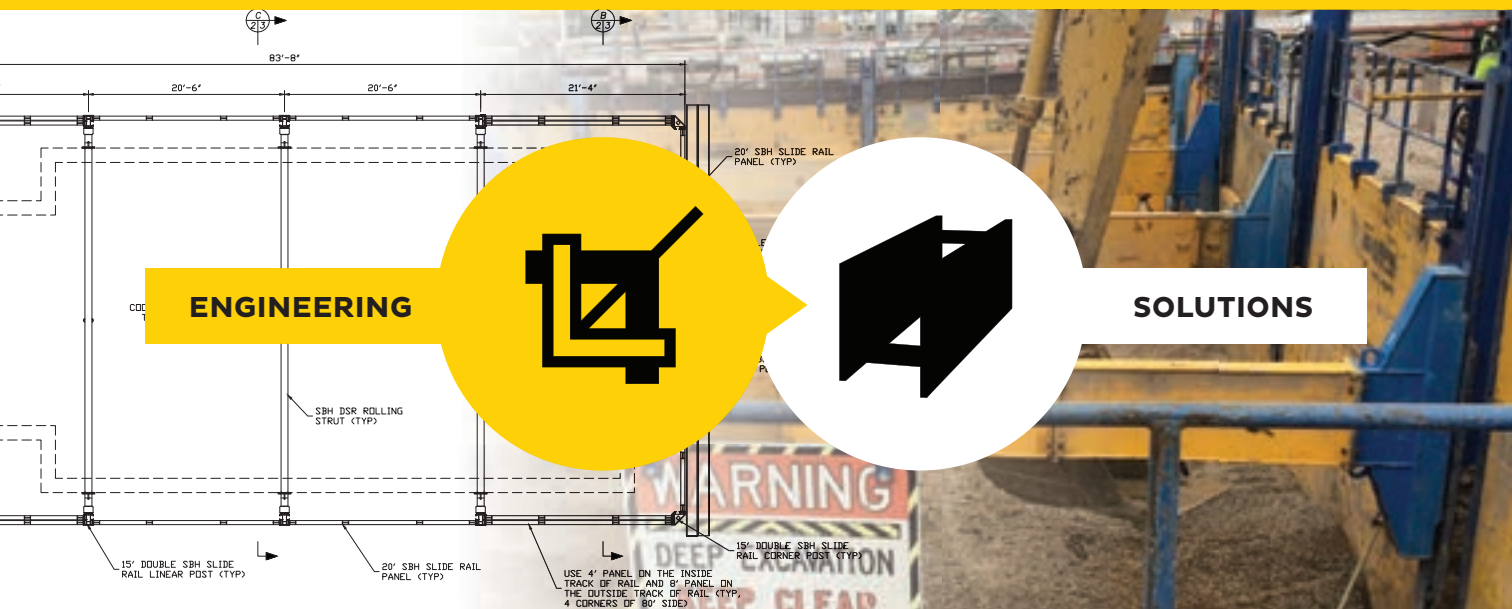
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## Contractor Wins With Estimating/Bidding Solution

After three decades in the business, Wanzek Construction is equipped to bring unsurpassed experience and expertise to every project, specializing in the industries of heavy civil and underground work, wind energy, power and renewable energy. The company's ability to stay within project parameters is facilitated by a comprehensive estimating and bidding solution from B2W Software.

For many years, the company used spreadsheets to manage its estimating and bidding. In search of more accuracy, Wanzek purchased B2W Estimate, and has since seen a huge return on its investment. Senior Project Manager Jeremy Stigen says, "We have won many projects because of B2W Software. The software pays for itself time and time again."

Using B2W Estimate, Wanzek was able to standardize its estimating and bidding across the organization, utilizing centralized resources including reusable task and item templates for repetitive



Centralized estimating/  
bidding makes it easy to  
share resources in the field.

work. Built from the ground up using Microsoft's most advanced development tools, B2W has the familiar look and feel of a Microsoft application, making it intuitive and easy to use.

"B2W Software makes it very easy to share information with the field," continues Stigen. "It is simple to filter the information for individuals at all levels."

B2W also allows Wanzek to import

cost data directly to their accounting and project management solution from Viewpoint, saving time and reducing the risk of data entry errors. ■

For more information on Wanzek Construction and B2W Software, visit: [www.wanzek.com](http://www.wanzek.com) and [www.b2wsoftware.com](http://www.b2wsoftware.com).

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Fenix Power - Chilca, Peru  
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# The **Most Powerful Plant** in the Park

Waterfalls, wildflowers and walkways will line an urban greenspace that packs more power than your typical park. That's because we teamed with the community to reimagine a new natural gas plant within a park-like setting, creating an inviting gateway to Holland, Michigan. **This is where great begins.**



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