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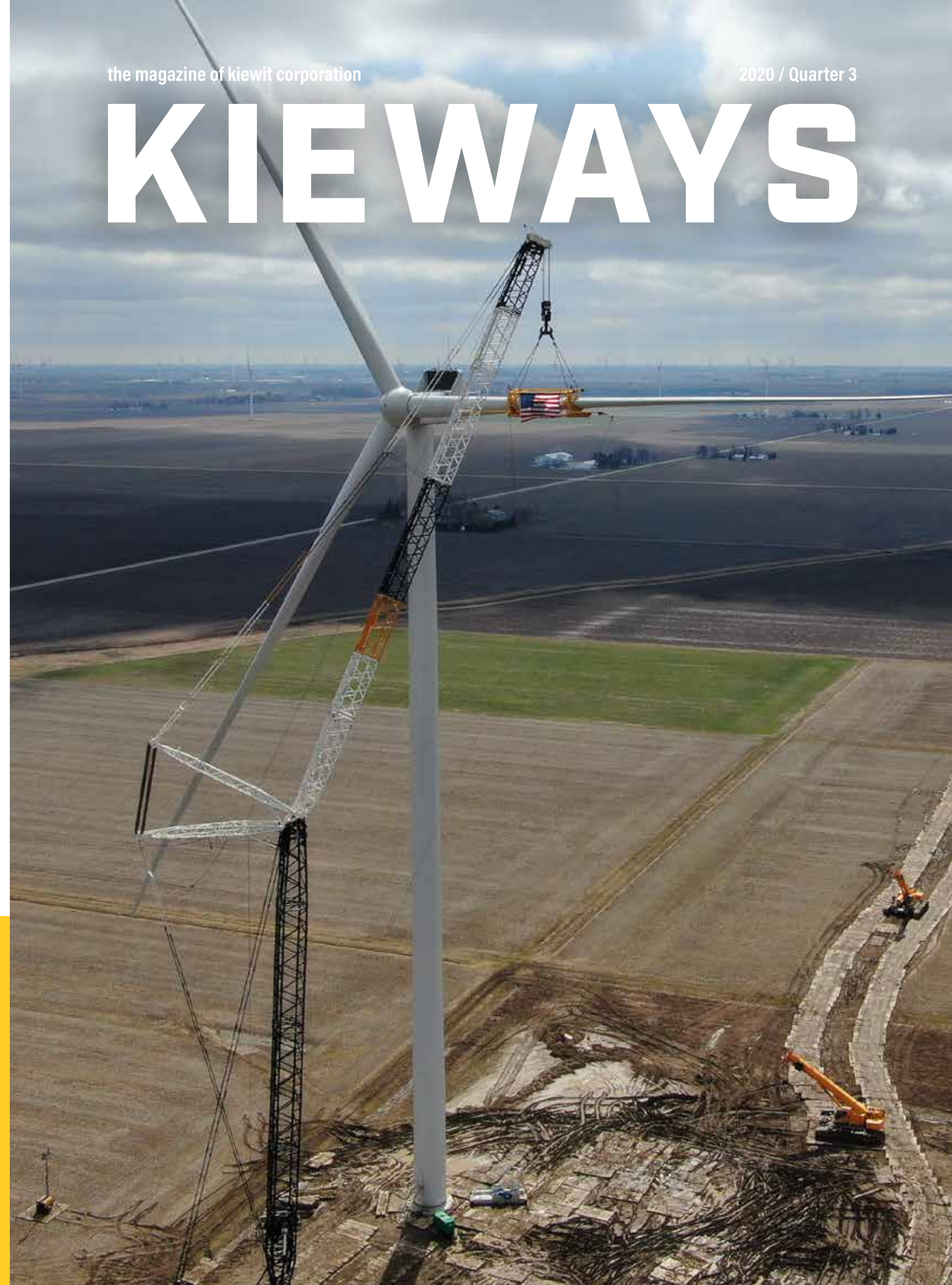


SINCE 1884

the magazine of kiewit corporation

2020 / Quarter 3

KIEWAYS





CLEARING POST BLAST

One of the toughest jobs on the Big Bar project was clearing a path to get heavy equipment down to the river to clear landslide debris and restore the habitat for migrating salmon. Read more on Page 10.



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Kiewit is one of North America's largest and most respected construction and engineering organizations. With its roots dating back to 1884, the employee-owned organization operates through a network of subsidiaries in the United States, Canada and Mexico. Kiewit offers construction and engineering services in a variety of markets including transportation; oil, gas and chemical; power; building; water/wastewater; industrial; and mining. Kiewit had 2019 revenues of \$10.3 billion and employs 23,000 staff and craft employees.

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KIEWAYS

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TACKLING NEW CHALLENGES HEAD-ON

Fall has arrived. And while COVID-19 remains a challenge for our people and business, our innovative, dedicated employees have never been more focused and committed to working safely and productively. The last several months have not been easy, but we've adapted and continued to successfully deliver projects while fulfilling our commitments.

For example, in this issue of Kieways, read about how our team refused to give up on the summer intern program. Instead of throwing in the towel, they stepped up to create a unique program that would engage students, teach them new skills and keep them safe. Find out what the interns had to say beginning on Page 6.

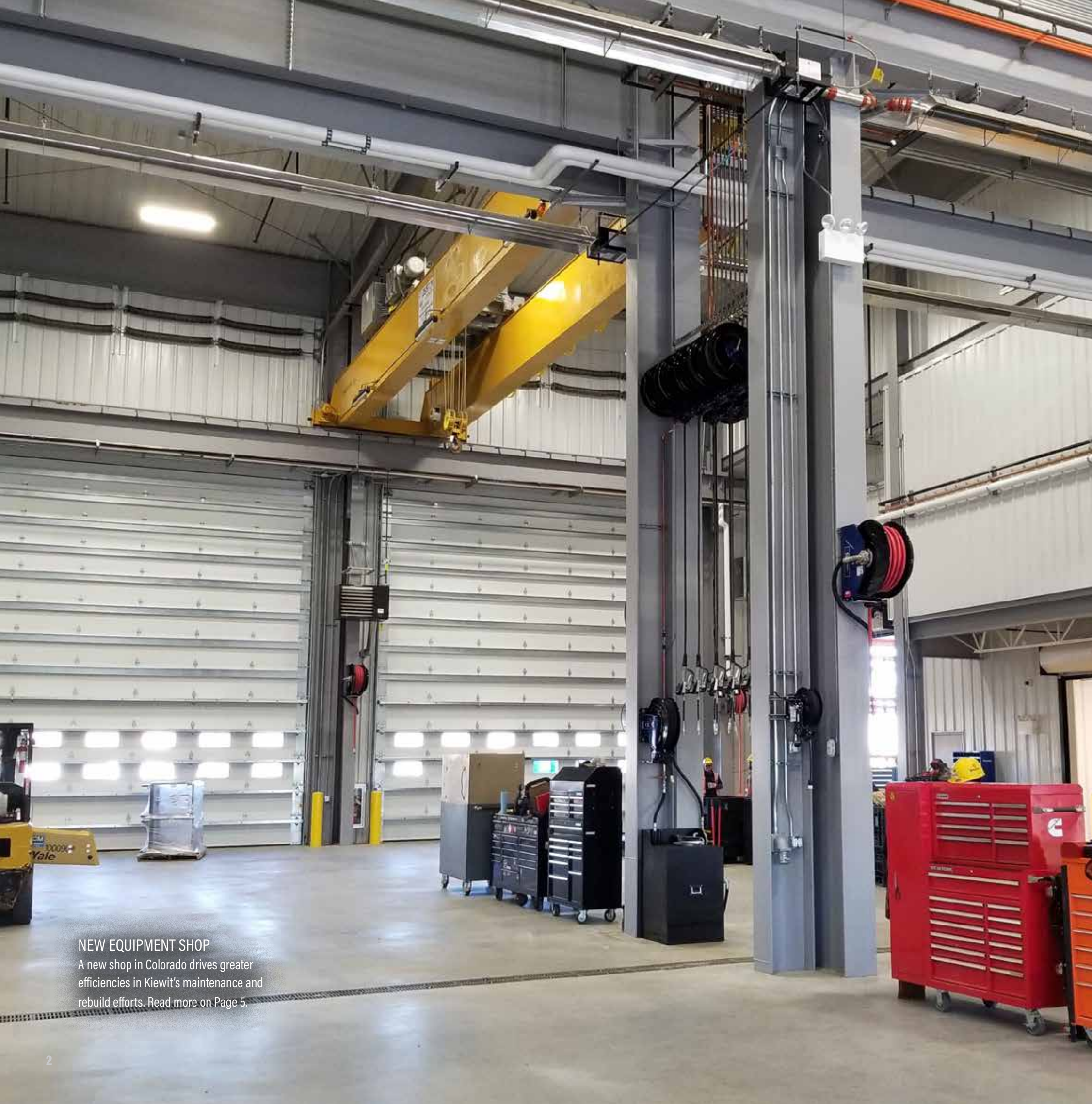
In addition to finding ways to adapt to a pandemic, Kiewit is adapting to changing markets. On Page 18, find out how Kiewit Energy Group has been stepping up its efforts to address a growing need for renewable energy, both wind and solar.

Another Kiewit team spent the past seven months saving salmon on the Fraser River in British Columbia. A huge landslide blocked the migrating salmon, threatening the livelihood of commercial fishers and the food supply and traditions of members of local First Nation communities in the area. Kiewit restored the habitat and gave the salmon a boost with a mechanical fish transport system. Read about it on Page 10.

In closing, I'd like to thank all of our clients and employees for all they have done to keep Kiewit moving forward through these challenging times. Stay healthy and safe.

RICK LANOHA

President and Chief Executive Officer



NEW EQUIPMENT SHOP

A new shop in Colorado drives greater efficiencies in Kiewit's maintenance and rebuild efforts. Read more on Page 5.

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The market for renewable energy continues to grow and become more profitable. Kiewit is in it to stay.

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Summer interns provide their thoughts on Kiewit's new program that was designed to keep them safe while providing opportunities to gain valuable experience in their chosen fields.








10 SAVING THE SALMON

After a devastating landslide blocked salmon migrations in Canada's Fraser River, Kiewit was brought in to remediate the damage and restore the habitat, preserving valuable commercial fishing and food supplies.

KIEWIT NEWS

What began in 1884 with two hard-working brothers has grown into a construction and engineering industry leader. As a multi-billion dollar organization, Kiewit can tackle projects of all sizes, in any market. Here's a brief collection of recent news and information from around the company.

OUR MARKETS:

-  BUILDING
-  INDUSTRIAL
-  MINING
-  OIL, GAS & CHEMICAL
-  POWER
-  TRANSPORTATION
-  WATER/WASTEWATER

OUR VALUES:

-  PEOPLE
-  INTEGRITY
-  EXCELLENCE
-  STEWARDSHIP

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G3 TERMINAL VANCOUVER OPENS

G3 Terminal Vancouver is open for business, receiving and shipping grains and oilseeds. Construction began on the G3 Terminal Vancouver in March 2017. The facility optimizes grain receiving, storage and shipping throughout Canada's West Coast, providing a more efficient path from farmers' fields to global markets. As the EPC contractor, Kiewit completed over 2 million man-hours on this next generation grain terminal that gives customers quicker access to high-quality Canadian crops. The terminal features three large ship loaders that move a variety of crops at up to 6,500 tons per hour, a storage capacity of 180,000 tons and a rail loop track that can hold three 150-car trains simultaneously.

NO. 7

Canada's Top Contractors, 2020

ON-SITE MAGAZINE RECOGNIZES KIEWIT IN LIST OF CANADA'S TOP CONTRACTORS FOR 2020

Kiewit Canada Group Inc. was ranked No. 7 on the Canada's Top Contractors list for 2020. The list is the product of a research project aimed at determining the leading construction contractors in Canada, ranked by revenue.

I-440 RECONSTRUCTION PROJECT COMPLETED

The I-440 Reconstruction project in Nashville, Tennessee, was completed in July, one month ahead of schedule. This was the Tennessee Department of Transportation's largest project ever. In less than two years, the entire 7.6-mile interstate was deconstructed and reconstructed to create easier travel for the community.



NEW EQUIPMENT SHOP IN COLORADO

Kiewit's new equipment shop in Colorado was designed with productivity in mind. Its centralized location will make maintenance and rebuild efforts of our equipment fleet more efficient.

The facility includes over 36,000 square feet, two 30-ton overhead cranes, a state-of-the-art wash facility and lubrication system and other features that aid in keeping our fleet in the best condition.



BUILDING A STRONGER CURRICULUM WITH KIEWIT

The annual Building a Stronger Curriculum with Kiewit faculty development workshop went virtual in July. Over the course of the week, 54 construction and engineering faculty members from 41 higher education institutions in the U.S. and Canada participated in sessions led by staff. Topics of these virtual sessions ranged from Constructability and Design Management to Procurement of Engineered Equipment and Curriculum Development.

KIEWIT TO DESIGN, ENGINEER AND BUILD CLEANBAY RENEWABLES' FIRST ANAEROBIC DIGESTION PLANT

Through a partnership with CleanBay Renewables, Kiewit will design, engineer and build CleanBay's Westover bio-refinery in Maryland which, using anaerobic digestion, will recycle more than 150,000 tons of chicken litter annually and convert it into renewable natural gas, renewable electricity and a nutrient-rich fertilizer product.

DONATING MASKS IN THE KANSAS CITY AREA

As COVID-19 continues, keeping our communities safe remains a top priority for Kiewit. To combat the spread of COVID-19, masks were donated to organizations in Kansas City.

Engineering and consulting services team members donated hundreds of masks to Children's Mercy Kansas City, and Kiewit's water team donated children's mask to the Boys & Girls Clubs of Greater Kansas City.



KIEWIT INTERNS



Kiewit didn't let the COVID-19 pandemic stop it from moving forward with its summer internship program in 2020. Instead of throwing in the towel, the company got to work designing a new program that would keep interns safe while providing them with opportunities to gain valuable experience in their chosen career fields.

JOSHUA GORDON (ABOVE LEFT)
Kiewit Infrastructure Co. | Lehigh University

"Our team is practicing Covid-19 safe actions across the project site. The Covid-19 station is stocked with masks, wipes, hand sanitizer, etc., so we always have the correct materials with us to stay safe. With all these actions and a few others in place, working on site has been rather interesting. They are excellent at making sure we are working and still interacting with each other as one big Kiewit family, but also maintaining our health and safety in these hard times."

ALICIA TUNGGAL (ABOVE CENTER ON RIGHT)
TIC - The Industrial Company | Purdue University

"Working remotely can be a challenge, but Kiewit finds creative ways to help us adapt and excel in what we do. To stay engaged with each other and our work, we use video conference calls for daily check-ins and on-site work. I am very grateful to be able to get this opportunity to learn from dedicated mentors within the company and witness work done on site virtually and live."

MARCY BARDMAN (ABOVE RIGHT)
Kiewit Water Facilities South Co. | Lehigh University

"Once I felt the adrenaline rush on my first 3 a.m. concrete pour, I was hooked on Kiewit. I love that people are passionate about doing their jobs well with safety as the number one priority. I was nervous about being one of the only women on site, but I have honestly never felt more supported. So many craft and staff encourage me to be confident in both heels and muddy work boots. I like that at Kiewit, you get what you work for and there is plenty of opportunity to go after. I am so thankful for all of the training and learning experiences that Kiewit provides."

RIISING TO THE CHALLENGE

"Cancelling the internship program, as many other companies chose to do this year, wasn't a viable option for us," said Curtis Thom, Kiewit Human Resources lead. "That would have gone against our commitment to continuous improvement and innovation." Thom spearheaded efforts to design a new program, which was a combination of virtual training, job tours, mentoring sessions, group projects and either remote or on-site work.

Thom and others worked to get this new hybrid version of the program ready by June when more than 800 interns from 30 states and six Canadian provinces began their internships. Many never set foot on a project site or in an office. Others worked remotely and then transitioned to job sites when it was safe to do so.

Based on feedback from interns, the program was a success.

Alicia Tunggal, a senior studying civil engineering at Purdue University, spent the summer working remotely with the quality group. Tunggal said working remotely can be challenging but video call technology allowed her to collaborate with coworkers, making the experience more personal.

"I'm really thankful for my mentors and the other people at Kiewit that I worked with," said Tunggal. "In the midst of their busy schedules, they made time to schedule video calls with me for different software training, to answer any questions that I had on my assignments, to do regular check-ins and to get to know me personally." For example, Tunggal said, a quality manager used a video call to let her shadow him as he inspected a fire tube for a project.

"I feel like the people at Kiewit really care about their work, so whatever they do they commit to. They are very open to welcoming new hires and training us well," she said. For Tunggal the internship provided insight into different departments in Kiewit and allowed her to gain valuable experience in her chosen field.

Interns also had an opportunity to develop some personal skills. They were assigned to small groups to collaborate and work on challenges such as emerging workplace trends, optimizing recruiting strategies, and building company culture remotely. They presented their findings in recorded presentations. **K**



MAX MAHFOOD
Kiewit Foundations Co. | University of Mississippi

"Peter Kiewit said it best in 1945: 'The success of the company in the past and in the future will be determined by the teamwork of the entire organization. Each and all members share in the responsibility.' I believe that our group at the Calcasieu Pass LNG project embodies that very statement. Each and every day, our team keeps Kiewit's core values in mind while working to produce the high-quality products that Kiewit is known for."



CHLOE SIRGES
Kiewit Canada Inc. | University of British Columbia

"I chose Kiewit because of the responsibility and learning experiences it gives its interns. You just have to look to the senior executives in this company and you know Kiewit is setting us up for success! It's hard to stay connected, let alone meet new people from home. But through team networking calls, the necessity of completing a project together, and some VERY virtual lunches, we did it!"



ABBY LAUNIKITIS
Kiewit Corporation | Texas A&M University

"I chose Kiewit for a second time this summer because the company culture is so bright and the people are always willing to lend a helping hand. My love for construction has come from seeing how a project helps people, whether it provides health care or a transit line that gets thousands of people to and from work every day. I also really admire the dedication Kiewit has to safety."



KAMERON FERNANDEZ
Kiewit Infrastructure West Co. | California State University of Fresno

"Whether it's seeing the logo on a job site or on a polo, the Kiewit brand carries a great deal of meaning. Even though I am spending this internship from home, I still have my gear from the past two years. On the left is my hard hat and safety/life vest from the SFOBB Phase III project in San Francisco, California, and on the right is my hard hat and safety vest from the Selmon West Extension project in Tampa, Florida. Both on the West Coast and the East Coast, the Kiewit brand shows a culture of safety, care, family and great people. Regardless of where the projects have taken me, I have always seen and placed those values at the forefront."



OLIVIER JÉRÔME
Kiewit Canada Inc. | Université du Québec

"In my first internship I learned that the most important thing on any Kiewit construction site is safety. I had a lot of safety meetings with my supervisor last year, and he taught me the importance of using all the PPE. My supervisor made me promise I would bring all this safety knowledge to my second internship, but I had no clue the internship would be at home... At least we can say I am a man of his word!"



SAVING THE SALMON

BIG BAR PROJECT TACKLES LIFE-CHANGING LANDSLIDE IN BRITISH COLUMBIA

The migrating salmon that travel the Fraser River in British Columbia are crucial to the livelihood of commercial fishers and members of local First Nation communities who rely on these and other fish for food and as part of their cultures. A 2018 landslide brought fishing in one area to a standstill. Kiewit has been working to help restore the habitat and preserve the communities' long-standing traditions.

About 365 kilometers (227 miles) into their spring 2019 migration up the Fraser River in British Columbia, the Early Stuart sockeye salmon were likely the first to notice a problem north of Lillooet. In construction terms, the road was closed.

The Stuart sockeye are the initial wave of salmon that travel the waterway every year, coming in from the Pacific Ocean near Vancouver on their long trip. Some will swim as many as 1,000 kilometers (620 miles).

But last year, at a remote part of the river near an area called Big Bar, these fish and those that followed encountered the effects of an event described by residents and experts as “devastating” and “disastrous.”

A DRAMATIC SIGHT

After a report of a suspected landslide was communicated to authorities in summer 2019, officials from the Department of Fisheries and Oceans (DFO) visited the site.

What they discovered was dramatic: About 110,000 cubic meters (143,875 cubic yards) of boulders the size of three-story, 3,000 square-foot houses and other debris had cut away a 125-meter (410-foot) cliff. The huge rocks tumbled into the river, significantly narrowing the water flow and creating a 5-meter-high (16-foot) waterfall.

Satellite imagery confirmed that the slide had occurred at least seven months before, in October or November of 2018.



Crews drill blast holes on the East Toe for channel constriction widening.

To try to save some of the fish, approximately 30,000 were moved upriver by helicopter. Remarkably, an estimated 245,000 still managed to traverse the slide naturally.

The initial emergency response by the Canadian government and DFO transitioned to an ongoing project response by fall 2019.

REMOVING THE ROCK, REMEDIATING THE SITE

At the end of last year, Kiewit was awarded a contract by Public Works and Government Services Canada to perform extensive remediation of the site from January through March.

Completing work before the spring thaw — known as the freshet — and the subsequent rise in water levels was critical.

The scope of work not only included removing as much debris from the river as possible, but also building an 800-meter (2,625-foot) access road to transport a large fleet of heavy equipment, including five excavators ranging from 25 to 90 tons, excavator-mounted drills, 30-ton rock trucks and a telehandler. The job also required stabilizing the rock slope to make the area safe for crews to work at river level.

“Our plan meant we would spend a significant amount of time gaining access to the water — seven of the 10 weeks available to do the work,” said Project Manager Patrick Wilson.

The team faced a typically brutal Canadian winter, braving winds that gusted over 100 kilometers per hour (62 miles



Crews drill, excavate and work on embanking the access road in the through cut.

per hour) in the 700 meter (2,300 feet) deep canyon. Temperatures also weren’t kind: The first week on site in January, crews were met with temperatures that dipped to minus 40 C/F.

“The first week of mobilization was really tough before the weather stabilized a little bit,” Wilson said. “Nothing would start, nothing would work. The helicopter couldn’t run. The boats couldn’t get in the water because the ice was too thick.”

“Kiewit ... established direct lines of communications with the First Nations’ project coordinators, and ... held regular community meetings to inform band members directly on the project progress.”

MARVIN NG

Senior project manager, Real Property Services Branch, Professional and Technical Services, Public Services and Procurement Canada

Preserving history

To help protect ancient artifacts found during the Big Bar remediation, Kiewit assisted an archaeological team led and managed by the High Bar First Nation. The team collected and catalogued items that included arrowheads, rock pictographs and small huts used to dry and store fish over the winter, as well as stone material shavings called “lithic scatter.”



Kamloops horizon point



Metal projectile point



Plateau horizon projectile point

Giving fish an assist



Rockfall protection mesh barriers

Rockfall protection mesh barriers

Water conveyance pumps and piping

Lock block fishway

Mechanical Fish Transport System, includes:

- SteepPass to attract fish
- Camera/scanner to categorize fish based on size
- Sorter to direct fish to the correct-sized transport tube
- Accelerator to use compressed air to propel fish into transport tube

Natural fishway currently partially submerged

• **Suspended access platform** built with rope access to support the installation of the transport tubes, hangers and cables

• **Six each fish transport tubes** suspended on tensioned 7/16" cables (cables are mounted to steel hangers weighing 1,300 pounds that are anchored to the face of the rock)

Termination structure supports the end of the fish transport tubes, and using electric DC Winches, allows the elevation of the fish discharge to fluctuate with the changing water levels. Water levels vary by 10 meters (33 feet).

As the project progressed, Kiewit's scope of work grew to building and placing structures to help give the fish better odds of making it upriver, including:

TECHNICAL FISH LADDER

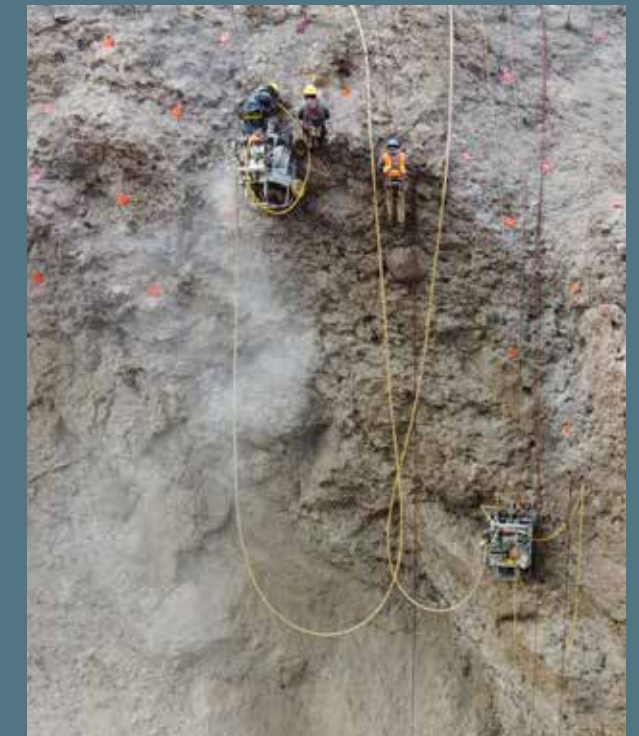
A technical fish ladder made of concrete blocks is a multi-tiered structure for fish to more easily reach a platform for the next part of their journey.

FISH TRANSPORT SYSTEM

During higher water flows, a Mechanical Fish Transport System supplied by Whooshh Innovations offers fish a way to bypass the rapids. They swim up the technical fish ladder to find their way into the Whooshh system. There, they are scanned and automatically sorted by size before being transported through pipes with a compressed air assist across the rapids.

NATURAL FISHWAY

A natural fishway was constructed from large boulders retrieved from the river. Located directly below the slide site along the face, this organic fish ladder was designed to calm the waters and give the fish a resting place before they swim the rapids behind the boulders.



Rockfall protection mesh was pinned on the brow of the slide area to protect the team (paint marks in the photo show completed pins).

Recruiting local craft

About 80 percent of the total craft on the Big Bar project was local. Kiewit's contract included an Indigenous Benefits Plan, providing socioeconomic benefits to the High Bar First Nation and Stswecem'c Xgat'tem First Nation. Together, they recruited local workers who ranged from medics, mechanics and road maintenance personnel to steel fabricators and a security team.

Playing a role in the remediation was meaningful to the First Nations, said Dennis Fletcher, coordinator for the High Bar First Nation's Big Bar response.



"Fishing is very important for all the bands along the Fraser River, which includes about 22 nations," he said. "We depend on fishing for our food and to train our kids on fishing. It's very important that we get this working and that the fish go through."



1. Crews attend a mass safety meeting by the fire at Beach 1. 2. First Nations leadership visit the site. (Note: Both photos were taken before the COVID-19 pandemic hit Canada.)



This excavator was used to build the toe of the embankment to minimize material loss in the river as trucks dumped blast rock from the top of the slope.

CARVING THE RAZORBACK

One of the biggest obstacles to building the road was punching through a rock structure that needed to be partially carved away in order to make the proper road grade.

"It's only about 50 meters (164 feet) in length, but it's called 'the razorback' for a reason," said Karson Doyle, general superintendent. "It elevates very quickly and then it drops off very quickly."

To build the steep embankment to access the river, crews excavated a total of 32,000 cubic meters, including 22,000 cubic meters of drill and blast.

After crews got through the structure, they filled an



embankment leading to the slide site, where they built three "fingers" giving equipment access to multiple large boulders in the middle of the river.

That achievement, Doyle said, was notable because the fingers were built in Class 6 rapids. Classified by authorities as extreme and exploratory, these types of waters can be difficult and unpredictable.

SELECTING THE RIGHT EQUIPMENT

Getting several pieces of heavy equipment to river level was another daunting prospect. Initially, the team considered transporting them by helicopter, dismantling each one as needed.

As the job progressed, however, they started to figure out the route could handle a little bit more, said Operations Manager Wes Prothe. "We knew a 30-ton excavator had been brought down the road before."

Using that as a baseline, the team collaborated with Kiewit Infrastructure Engineering (KIE) to calculate the largest size of excavator that could make the sharp turns on the steep path. Ultimately, they determined that a 90-ton machine could do the job.

"The KIE and Western Canada teams did a really good job of not only saying 'we think we can get a CAT 390 excavator down there,' but 'we can get it down there safely,'" Prothe said.

IMPROVING RIVER HYDRAULICS

As with any Kiewit project, safety throughout the process was a priority.

The time spent building the access allowed the team to install robust rockfall protection measures on the brow of the rock face 125 meters (410 feet) above the slide debris.



1. A CAT 325 excavator makes its way down a 70% grade slope tethered to a Falcon winch assist machine. 2. The tethered excavator.

"Removing slide debris below this rock extended the available work window for the heavy equipment because less rock had the potential to ravel during high winds," said Wilson.

A REASSURING APPROACH

"In the end, we successfully gained equipment access to the slide debris and were able to address an estimated 14,000 cubic meters of rock within the channel — more than twice the projected scope in the bid documents," said Wilson. "For scale, that is the equivalent of filling an entire hockey rink 30-feet high."

Gwil Roberts, Big Bar Landslide Response director for DFO, said from the beginning of the project, Kiewit's approach was reassuring — bringing a professional attitude, working diligently in an organized and respectful manner, and working well with First Nations, the province and the federal government on the response.

"We were very impressed from the start with that dedication to the project, the resources that were made available and the priority this project was receiving," Roberts said.

And for the salmon, the approach paid off. Big Bar landslide is no longer an issue for fish passage. By the start of September, hundreds of thousands of salmon made it past the slide site naturally, and thousands used the fish transport system. **K**

RENEWABLE ENERGY

Kiewit is in it to stay.

Harnessing the power of sunlight and wind has become a top priority for Kiewit Energy Group Inc. (KEG) as the market for renewable energy continues to grow and become more profitable.

"We're in it and we're going to stay in it," said Stephen Packard, who leads Kiewit's efforts in renewables. "If we want to be solution providers for our power clients, we need to be able to do everything in their portfolio, and that includes all types of renewable energy projects."

Kiewit's current focus is on solar, onshore wind, energy storage and delivery. But that doesn't mean the company isn't ready to take on a billion-dollar offshore wind project if the opportunity presents itself.

Offshore wind projects are expensive and extremely complex, and not a lot of investors are ready to make that leap in North America, according to Packard. But he said there's plenty of work with onshore wind and solar.

"Renewable energy generation has become more cost competitive as better technology is introduced, and the best is yet to come," Packard said.

WHY NOW?

Jacob Albers, KEG's business line manager for wind, attributes the strong growth in renewables to three key drivers: government policies, public perception and price.

States have implemented Renewable Portfolio Standards — mandates that a certain percentage of power come from renewable sources by a certain date. The pressure is on to meet these goals, said Albers.

Public perception is also driving the recent surge in renewables.

"There's been a significant shift in the past couple of years with large private companies coming in and buying power directly from the developers," said Albers. "They're saying, 'I want 100% renewable energy and I'm going to figure out how to do that.' So, they contract directly with the developers of a wind or solar farm."

In the past, developers typically transferred ownership or sold the power to utility companies. But now, these commercial and industrial buyers are disrupting the old business model, typically by setting up virtual power



The hub of this Vestas V150-4.2 megawatt turbine is shown being set on the nacelle. The blades will be attached to the hub, which is 105 meters high.



MEC installed conduit, cable and electrical equipment for nearly 300,000 solar modules on the 480-acre Rutherford Solar Farm in North Carolina.

purchase agreements (PPAs) directly with the developer. Albers said it's really just a paper transaction as these companies are not directly connected to the wind or solar farm. Through the virtual PPA, they're able to claim the energy added to the power grid by these renewable power plants.

"Utilities are getting in the mix with their own projects too, but these commercial and industrial customers that are buying renewable power directly are driving a major piece of where the market is headed," he said. "What you're seeing is companies pressuring utilities for renewable energy."

Price is also a key driver in the growth of renewables. A mix of production tax credits (PTCs) for wind and investment tax credits (ITCs) for solar have made it easier for developers to get into the market. Multi-year extensions of both types of tax credits at the end of 2015 gave the industry a long enough runway to plan for sustained projects. Further extensions were issued by the IRS in May 2020, which will provide some relief for renewable projects affected by COVID-19.

The tax credits have piqued the interest of more investors,

but it's also given the market time to mature with improved technology that's bringing the cost down further. Even without the subsidies, which will be phased out in the coming years, the cost of generating energy from renewables is cost competitive, according to Albers.

MAKING AN IMPACT WITH SOLAR ENERGY

"We believe right now that the biggest market we have is solar, with projected revenue of \$500 million to \$600 million in the next three years," said Packard.

Kiewit has anywhere from five to 10 solar projects in progress at any given time. The model varies from project to project — from electrical subcontract-only through Mass. Electric Construction Co. (MEC) to engineer, procure, construct (EPC) projects through KEG.

Solar isn't new to Kiewit; MEC has been installing solar panels for more than 10 years, adding more than a gigawatt of energy to the grid. Kiewit has also been providing engineering-only solutions for about three years, helping small developers and large power clients with basic things like permit drawings, performance calculations, site layout and tie-ins to assets they already have.

What's new is KEG's plan to bring the EPC model to the renewables market, and it's generated a lot of interest from clients and potential clients.

"Kiewit is always on the forefront, looking to diversify and trying to project where we think the markets are going to go," said Jake Strickland, solar business line manager. "Renewables is going to be a strong market and we're making sure we're part of it and can make a big impact for our clients."

Strickland said his group set a goal to book enough projects in 2020 to add about 600 megawatts to the grid and then double the megawatts each year for the next five years.

There's nothing complex about solar work but there are some unique challenges.

"Solar is a quantity problem. When you have 1.3 million solar panels on a 600MW job and you're off by two minutes a panel, it can scale up to millions of dollars," said Strickland. "Every second, every minute counts in solar because of the quantity involved. It's repetitive, but with massive quantities, and that's the challenge."

The same 600MW job can take 3,000 to 4,000 acres of land. There is a huge civil component, including site preparation, access roads for maintenance, drainage solutions, geotech permitting and management of environmental concerns. Even fencing can turn into millions of dollars.

"That's where we think we have the huge advantage and where we think we are going to make a big impact in this market," he said. "We have the tools and processes, the experience and the discipline to attack those kinds of problems."

Technology in the solar market continues to improve, with new panels able to increase output and lower cost. For example, new bi-facial panels capture sun from both sides, the front from direct sunlight and the back from the reflection off the ground, resulting in 20% more output per panel.

KEG has solar experts — engineers who specialize in using PVsyst technology to model and optimize solar fields. Jon Gribble, who leads the power engineering group, said the technology can pinpoint the amount of radiance from the sun that a specific location will receive, and calculates solar output daily throughout a year.

The PVsyst technology also factors in shade from trees and undulations in the land. Gribble said engineers can

1. Field engineers at the Timber Road IV project are (from left to right) Andrew Johnson, Tyler Williamson, Scout Crow and Ryan Halbur.
2. The Hoosac Wind Farm in Massachusetts included installation of a 34.5-kilovolt underground collector system for the wind farm's 19 turbines and construction of the substation.





The base section of a wind turbine is set at Timber Road IV. Each wind turbine has five to six tower sections.

jockey the number, placement and angle of solar panels to optimize the site, which is critical considering there can be more than 1 million panels spread across thousands of acres.

In addition to the engineering, Kiewit brings stability as a company, flexibility to help clients mitigate risk, different contracting models and an industry-leading safety record, said Strickland, adding that they have received a fantastic response from clients.

“Our ability to self-perform or subcontract any of the parts and pieces buys us a lot of value with clients, as well as the overall scope breadth that we can provide,” he said. Kiewit’s ability to work anywhere in North America is another big selling point.

ONSHORE WIND SOLUTIONS

KEG currently has five onshore wind projects under contract — two in Indiana, and one each in Ohio, South Dakota and Texas. Combined, these projects will add over 900 megawatts to the power grid.

A typical wind farm has from 25 to 100 turbines, depending on the size of the turbines used. Albers said turbines can range from 80 to 120 meters high and from 2.2 megawatts up to 5 megawatts. As the generators get bigger, blades are getting bigger and the diameters of wind turbines are getting bigger, above 160 meters on some of the larger ones.

“These projects are simplistic from an equipment standpoint, but they are logistically very challenging,” said Albers. “One of the biggest selling points for us is our ability to invest in the right equipment.”

Kiewit recently purchased two large cranes to help with installation of new-generation turbines that are bigger and more complex. The cranes can be used on other projects, but they are specifically targeted at building the bigger wind turbines that the market’s seeing right now.

Why is the crane so important? An average turbine is comprised of a tower (base and two to six middle and top sections), a nacelle (holds generator and other internal

components), the hub (attached to the nacelle and holds the blades) and the blades.

“The nacelle is about the size of a small school bus,” said Albers. “With the new cranes we will be able to pick the nacelle fully loaded instead of using multiple picks for the nacelle and internal components.”

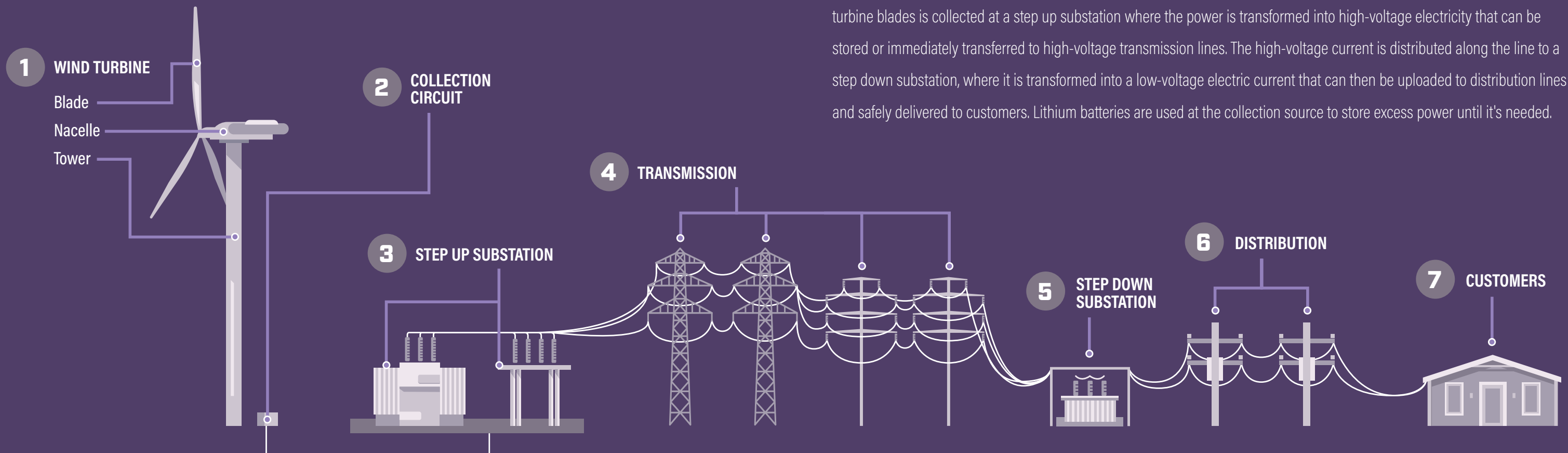
The new equipment will be deployed on a couple of projects coming up this year — Rosewater and Headwaters II. Albers said both projects are using Vestas wind turbines, some of the largest turbines available for installation in the U.S. right now.

Kiewit can provide a full, turnkey solution on wind projects, Albers said, including engineering, access roads, foundations, electrical collection systems, substations and transmission line systems.

ATTACKING ENERGY STORAGE

Solar and wind projects use lithium batteries at the site to store excess energy. They charge during the day when the

Wind energy distribution



Wind turbines capture the wind's kinetic energy, forcing the blades to rotate and create mechanical energy that turns an internal shaft, spinning a generator that produces electricity. Like other power delivery systems, the electricity created by spinning turbine blades is collected at a step up substation where the power is transformed into high-voltage electricity that can be stored or immediately transferred to high-voltage transmission lines. The high-voltage current is distributed along the line to a step down substation, where it is transformed into a low-voltage electric current that can then be uploaded to distribution lines and safely delivered to customers. Lithium batteries are used at the collection source to store excess power until it's needed.

“Renewable energy generation has become more cost competitive as better technology is introduced, and the best is yet to come.”

STEPHEN PACKARD

Kiewit Power Delivery President

sun is out or when the wind is blowing, and the batteries discharge when they are needed.

“We definitely want to play in that space because 30% of contracts have a storage component,” said Packard. “We can install and hook up the batteries, but the margins are razor thin, so we’re also attacking storage on the engineering side.”

Storage is included in Kiewit’s EPC model for the solar industry. That includes work early on with the owners in the development process to help them select the right technology for battery storage.

Kiewit believes there is a bigger market for energy storage that is just getting off the ground, and KEG’s engineering group has expanded its focus beyond solar fields.

“Right now, we’re doing the engineering on the largest stand-alone battery installation in the United States,” said Gribble. “It’s a 400-megawatt facility in California at the site of an old, decommissioned coal plant.”

The specially designed facility includes thousands of batteries racked together. A critical aspect of those designs is fire protection. Once a battery enters thermal run-away, it is difficult to stop, according to Gribble.

“To mitigate thermal run-away, you need a fire protection solution that will limit the fire from spreading to adjacent batteries,” he said. Kiewit engineers have designed that fire prevention solution.

Battery storage is just one of the energy storage solutions KEG engineers are ready to tackle. Gribble said the engineering team is pivoting with clients, moving away from fossil fuels to wind and solar and “getting ahead of the curve” in energy technology.

Electrification may be the next big market, said Gribble, including everything from electric vehicle charging stations and electrical transportation feeder systems to pavement that someday may charge vehicles as they travel.

A confluence of climate change initiatives and advances in transportation electrification may provide the electric industry a pathway to additional loads previously served directly by fossil sources.

Regardless of the direction, Kiewit is diversifying to be ready to meet clients’ needs. **K**

