

## Digging Deep To Complete Horizon's Blue Canyon V

By Angela Biniwall

The wind resources in the Slick Hills region of southwestern Oklahoma are intense, but so are the heat and the terrain. Despite less-than-ideal working conditions, construction on Horizon Wind Energy LLC's Blue Canyon V wind project was finished in a very short period of time.

"The project itself was completed in 165 days, which is extremely fasttrack for not only Horizon, but – I would say – for the construction of wind farms in general," explains John Stone, Horizon Wind Energy's director of construction for the Blue Canyon V project. "It's a very short- duration construction schedule – even without the difficulties of the wind days and the blasting and the trenching of the rock." Indiana-based White Construction Co. provided the balance-of-plant services for Blue Canyon V. Construction began on April 29, 2009, and the project went into commercial operation in October 2009. Horizon Wind Energy is owned by Portuguese developer EDP Renováveis.

"The topography was primarily rock," says Stone. "There was a lot of drilling and blasting of nearly every turbine site to install the foundation. It's somewhat unusual to have to do that much blasting." Project manager Charles Kennedy of White Construction says the location had some of the hardest rock in the state, which made blasting difficult. The type of rock at the site varied, and included limestone, rhyolite and granite. The hardness of the rock, combined with the angular formations, compounded the difficulty with blasting, he adds.

The project is also located in a rural ridgeline area, which means there were no roads to transport heavy equipment.

"It was a ridgeline job," says Kennedy. "The bulk of the turbines are along one ridge-line, and the ridgeline is only big enough for a 22-foot access road. "Trying to build a road on a 40-foot-wide ridgetop – there's just no room. It's a logistics nightmare." According to White Construction, a narrow-track crane was used to accommodate tight ridgeline roads. Blue Canyon V is a 99 MW wind project that utilized 66 1.5 GE turbines. The power from the project is sold to the Public Service Company of Oklahoma (PSO) under a 20-year power purchase agreement. Tulsa, Okla.-based PSO is part of American Electric Power.

"They actually buy power from our second phase of Blue Canyon, as well, so we already had a good relationship established with them," says Vanessa Kellogg, director of development for Horizon Wind Energy's Southwest region. The project, which occupies about 12 square miles, employed more than 300 people, who built 18.5 miles of access roads and installed 110,000 linear feet of an underground collection system. Laydown yards were also constructed for wind turbine delivery.

There were some additional costs "because the equipment that was used is much more robust for getting up the steep incline, and at times, they used support vehicles to pull them up," says Stone.



A crane maneuvers the rotor into place.

The Slick Hills area is geographically unique, according to Kellogg. “The Slick Hills are sort of a geological phenomenon in that area, which produces the tremendous wind resources that we have,” she explains. “A lot of what you will find in the central and in the further eastern part of Oklahoma is much flatter, more plains-type geology, and so this is just a prime location, where the topography accelerates the wind.” As of June 2009, Oklahoma ranked 12th in the U.S. for existing capacity and eighth for potential capacity, according to the American Wind Energy Association. Horizon currently has about 1,200 MW of wind in its pipeline for the state. Weather delays In addition to the rough terrain, workers at the Blue Canyon V work site faced other challenges, including unusually strong winds, which – unlike the terrain and hard rock – were not expected. Turbines cannot be erected when the wind is blowing too hard.

“What was not anticipated was the high wind in the summertime – I think that that was unusual,” notes Kellogg.

In fact, there were 60 days in which work could not be performed because of high winds. More than two weeks total were lost due to extreme weather, such as heat and thunderstorms. Workers also endured two months of 100-plus-degree weather. “[The hot weather] definitely didn’t assist with the working conditions and efficiencies,” says Kennedy. “We were very cautious, and we just told everybody to work within their means and to drink lots of fluids.” The large number of workers and high temperatures raised concerns about heat exhaustion, so employees were distributed energy-drink pouches.

“If it got too hot, we had to adjust work schedules – we’d start earlier or work at night sometimes,” explains Kennedy. In the summer, workers can adjust work schedules to avoid the hottest time of the day, but this cannot be done in the winter.

Kennedy is from Canada and has worked in both extreme cold and extreme hot conditions before. Naturally, he believes a moderate temperature is the ideal condition in which to work but would prefer to work in warmer weather if he had to pick. Financing and transmission In December 2009, tax equity financing for the project was provided by GE Financial Services, which announced that it was investing \$117 million in Blue Canyon V. Because of more attractive project economics, Horizon also opted for the production tax credit rather than the cash grant.

Blue Canyon V is actually the third phase of the Blue Canyon wind project to be built. Blue Canyon I, a 74 MW wind farm consisting of 45 1.65 MW Vestas wind turbines, began commercial operation in December 2003. Blue Canyon II has an installed capacity of 151 MW, consists of 84 1.8 MW turbines and went into commercial operation in December 2005. Blue Canyon II became a much larger project than originally anticipated and, essentially, incorporated the third and fourth phases. Horizon plans to build subsequent phases of the project but did not provide further details. Blue Canyon V – along with Blue Canyon I and II – interconnects with Western Farmers Electric Cooperative’s 138 kV power lines. “There was enough transmission capacity to get these phases built,” says Kellogg. “There is a little remaining transmission capacity, but not a lot out there.”

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#### Digging deep

Kennedy says Blue Canyon V was completed so quickly because of detailed preparation and “just digging deep and working as hard as we could to get the job done,” he says. “Horizon had the deadline, they wanted it operational by this date and we were going to do whatever it took to get it done in that time frame. Everyone just dug deep and worked hard. I know I was working seven days a week – most people were.” According to Stone, Horizon set a deadline in order to avoid the fall winds that could impact the turbine- erection process and to meet its annual business-plan target. Representatives of White Construction and Horizon say Blue Canyon V was one of the most difficult jobs they have ever worked on.

“I would definitely say that this was the most difficult job that White Construction has probably faced and our teams have ever faced,” explains Kennedy. “I think even Horizon will say that it was probably the most challenging of their projects.”

Horizon’s Stone backs up Kennedy’s sentiment. “[Blue Canyon] was the most difficult job I’ve ever been on in my 25-year construction career.”