Remote Monitoring and Control of Irrigation Pumps for Energy, Water, Labor and Cost Savings

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Situation

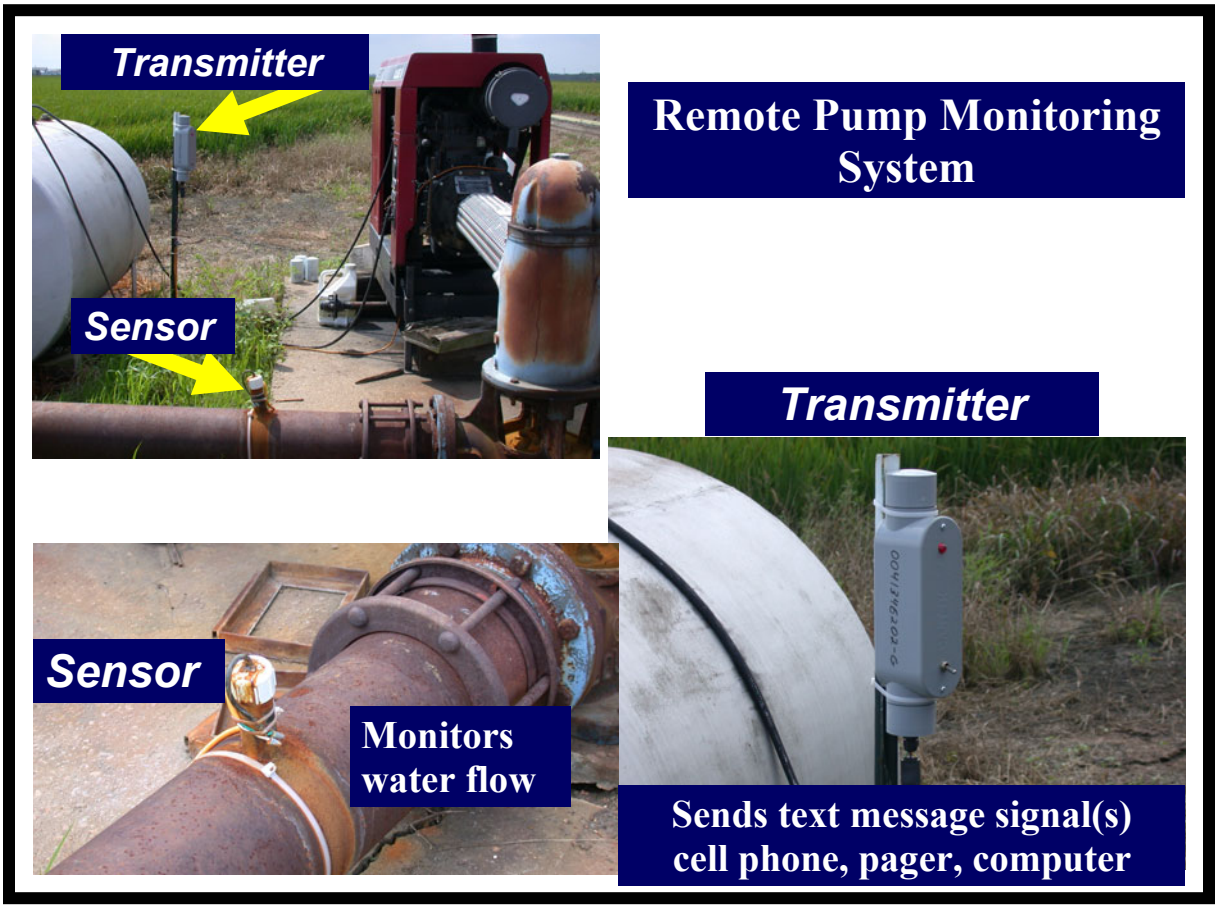
Agricultural producers continue to look for ways to more effectively manage time and labor. There always seems to be more to do than can be done within the time needed and with the labor that is available. Some farming operations expend a significant amount of time and labor to monitor the operation of the irrigation pumps on the farm. There are over 45,000 irrigation pumping systems in operation in the Arkansas Delta. In many cases the irrigation pumps are located in remote areas that are several miles apart and also at a significant distance from the farm shop or headquarters. During the irrigation season, one or more farm employees will spend several early morning hours and late evening hours traveling to the irrigation pumps in order to start them, service them, turn them off or to just make sure they are still running. There can be a lot of times when this schedule gets interrupted because the employee(s) have to take care of other things like fixing equipment that is broken down, getting parts or picking up seed or chemicals that are needed. If one or more irrigation pumps have shut down for a significant time before anyone realizes it then the crop(s) irrigated by these pumps can suffer. In the same respect, if no one is available to shut off a pump and it runs longer than necessary, then precious irrigation water and energy in the form of diesel, electric etc. can be wasted, resulting in additional cost to the producer.

Remote Monitoring System

A pump monitor system recently became available to agricultural producers to help address the situations described above. The system is composed of a sensor and a transmitter (Fig 1). The sensor is positioned in the water flow of the discharge from the irrigation pump and set so that it senses whether or not water is present. When it senses that water is not flowing, it can be wired into the power unit's shut down system so that the power unit automatically shuts off if needed. At the same time, a signal is transmitted to indicate that the pumping system is not pumping water. The transmitted signal can be received as a text message by a cell phone, an e-mail message or a page to a designated person or persons. It can be set up to either alert

two different people or to alert the same person using two different contact methods. Each pump being monitored is given a descriptive name or number that is indicated in the message so the producer knows exactly which pump is not operating. Once the pump is operating again the system sends a signal indicating that the water flow has been reestablished. It is also possible to use the monitor system to turn off power units remotely from a computer through an internet web site.

Figure 1: Field Picture of Remote Pump Monitoring System



The system can be used to monitor electric wells but some additional electrical components are needed to accomplish automatic or remote shut down. However, once the components are in place it is also possible to turn the electric pump on remotely through an internet web site. There is a setup in Mississippi that allows monitoring and automatic on and off control of electric pumps that are located 87 miles from the agency headquarters.

The transmitter component can be moved to a grain bin fan equipped with a different sensor that monitors air flow. In this application the monitor will notify someone when a fan has stopped operating in the same manner as is done with the irrigation pump. Another application of the system is to monitor the fuel level in the diesel tank that supplies the irrigation system's diesel power unit. A sensor is placed in the tank at a desired depth and when the fuel level drops below this depth someone is notified so plans can be made to refill the diesel tank. Both of these applications also have the element that a signal is received indicating that the fan is now running or the diesel tank has been filled.

Field Experience

The pump monitoring system was installed on two of the irrigation wells at the North East Research and Extension Center in Keiser, Arkansas. The installations were done by a company technician and went smoothly and quickly. The station employees who work with the monitoring systems are very pleased with their performance. On more than one occasion they were able to remotely turn off the wells from an internet website during a thunderstorm. This not only made it safer for the employees to not be out in the storm but it also avoided the rutting of field roads.

There have been numerous times when someone had just left an irrigation pump while it was running and in just a few minutes been notified that it had stopped. The first time this occurs the person is skeptical of the monitoring system but their confidence is established when they return to the pump and find that it had stopped. They also realize the benefit this gives them and the potential it offers for time and labor savings from not having to make trips to check on the status of the pump. Table 1 is one producer's estimate of the direct savings and also the indirect savings of using time spent checking pumps to spray fields himself rather than having to hire it done. He also noted the benefit of being able to better spray on his schedule and under more desirable conditions than might be available if he had to wait on it to be done by a custom applicator.

Table 1: Example of Producer's Estimate of Savings

Direct Savings:
40 miles round trip to check pumps
Average 10 mpg @ $2.20/gal fuel cost
4 gals x $2.20/gal = $8.80 per trip
3.5 labor hours and truck hours to make trip and service engines @$10/hr
3.5 x $10/hr = $35 per trip
$8.80 + $35 = $43.80 per trip
60 days of pumping saving 1 trip per day
60 trips x $43.80/trip = *$2628/season*

Indirect Savings (value of 3.5 hrs spraying)
80 ac/hr x 3.5 hrs = 280 ac @ $5/ac application savings
280 ac x $5/ac = *$1400/day*

Significant that spraying will more likely be done on your schedule and with desirable conditions!!

Many electric wells have peak load management switches that allow the power provider to turn off electric wells when needed to manage the electrical demand on their system. The switches are supposed to allow the electric wells to automatically come back on after a 2 to 4 hour period. Producers who have the monitoring system on these wells will get a notification that the water is running again. If they don't get notification when they should, they know to check the well and they also have information they can use with the power provider as proof that the pump did not come back on as it was supposed to.

When irrigation pumps are located in remote areas it becomes difficult for someone to always be available to go to the area in order to turn the unit off. Even though the producer knows the pump can be turned off, he and all of his labor may be busy. This can result in the pump running for a few hours or maybe even overnight before someone can go and turn it off. Unfortunately, this wastes water and energy and results in unnecessary pumping costs for the producer. The ability to remotely turn off the pumping unit can help avoid this situation.

A producer can reduce the down time for an irrigation pump when he knows within minutes of when it has shut down. This can avoid getting behind on crop irrigation and reduce the potential for lost yield due to drought stress. If a producer doesn't know he has a pump down until 6 pm when someone checks it, then it can lead to the loss of valuable pumping time. If he needs repair part(s) from a store that is closed until 7 am the next morning it can easily result in the pump being down for 12 to 24 hours. This situation can become even more serious if it occurs on a Friday or Saturday evening and parts aren't available until Monday. It is difficult to put a value on avoiding lost pumping time but producers know how important this can be especially at critical crop growth stages. One Arkansas producer was attending a baseball game in St. Louis, MO, which is over 350 miles from his farm, when he got a cell phone text message that one of his primary irrigation pumps had shut down. He was able to contact someone on the farm and 2 innings later he got a call letting him know that the pump was now operating.

Summary:

Application of remote monitoring and/or control technology to irrigation pumping and other agricultural operations makes sense. The fact that the system uses cell phones (telemetry technology) is very positive since most producers now use cell phones instead of radios. Experience indicates that the system transmitter has adequate power (approximately 2 watts) to send out a signal from very remote areas. Most producers purchase only a couple of the monitoring systems initially but soon put in an order for more units once they realize the benefits that they provide. This is an indication that they trust the technology and that they feel they can justify the cost for the monitoring system. One producer commented, "It is like having someone standing at the pump and it is hard to put a value on the peace of mind that gives you".