Irrigation system efficiency Some things to think about

Irrigation system efficiency is a vague term. Anything can be more efficient as technology develops. About the only thing that keeps most people from being as energy efficient as they can be is the high cost of equipment that's going to save them money. It's hard to spend several thousand dollars, knowing it will be several years before the money is returned and you actually start saving.

Well, the impetus is upon us. It doesn't take so long now before you see the return. Jim Bell, Rainbird Golf Market Specialist, estimates that, on the average, it cost $.07 per horsepower per hour to run a pump. Now, if you replace it with a pump that is only 10 percent more efficient, say a 10 horsepower pump, it's saving you $6.30 a night if it goes for nine hours. If you have to water 350 days out of the year, that's about $2200 a year you're saving. Quite a bit. But take that five years down the road when energy prices have put the cost of operating that pump at $.21 per horsepower per hour and you're talking about saving over $6000. That's what everyone is taking a long, hard look at.

John Skidgel, Golf Marketing Manager at Toro, says that they are putting the emphasis on making equipment that will run on less electricity and will save water by applying it at rates that the soil will accept. Bell reiterates this by saying that there are only two problems in watering a golf course ... wet spots and dry spots. The wet spots come from water that runs off the dry spots. Skidgel is talking about running a system on lower pressures and lower application rates. Toro now has some sprinkler heads with a fairly low precipitation rate, but Skidgel feels that they are going to have to get into larger sprinklers that throw larger diameters. On a golf course, he is talking about a 100 to 200 foot diameter that will still give good coverage. Water is a resource we need to protect, he adds. And when you pump 600 to 700 gallons of water a minute at 125 pounds of pressure, you're going to burn some electricity.

The people who build pumping stations feel the same way. They are looking for modifications that will conserve both energy and water. Kent Curley, President of Aqua Turf feels that the way to do it is to replace only that water that is taken away naturally. They are at a stage of new types of controls for pumps to utilize a more flexible control system to properly pump only the required amount of water at a specific moment.

There is a lot of energy lost with the constant speed, constant pressure pumps that are used for turf irrigation systems today. When the pump starts, it doesn't know if it has a requirement for 200 gallons per minute of water, or only five gallons per minute. If the pump was only using the proper amount of energy and relating it to the proper gallonage of water, who knows what the savings would be.

Pumps do not operate at a true 100 percent efficiency. It may be down around 60 percent, if you look at the consumption of electricity versus how many gallons of water it is pumping, and the total operating time versus how much water has been displaced.

But, the problem doesn't lie in the fact that technology is not available. Variable speed pumps have been around major industry for a long time. It's just that they don't adapt to the field very well. Some of these units are very complicated, and others are only pretty complicated. It requires specialized mechanics to work on them and they are just not available to everyone. It has been tried, is still being thought about, but so far has not proved practicable for the field situations such as on a golf course.

Many things go into determining the type of pumping station that a particular irrigation system needs. A designer needs to know how many gallons of water the system will be pumping at peak capacity. He needs to know how much pressure, or dynamic head, you have got to generate. Where the water is coming from makes a difference because of elevation that has to be taken into effect. All of these things plus more are taken into consideration and the complete unit is assembled and tested for the specifications it was built to. Then, it can be powered by electricity, gasoline or diesel engine, or whatever.

One thing that they have done on the systems designed by Pumping Systems Inc. is to design a station where the jockey pump shuts off on flow. Jerry Pettengill, President, explains that with the jockey pump pumplains that with the jockey pumping a full head before shutting off, it stays off for an hour and a half instead of coming on every twenty minutes.

Normally, the jockey pump comes on at 90 pounds pressure and kicks off at about a 110 or 120. On the PSI systems, it pumps water into a surge tank with a 36-inch diameter that holds 300 gallons of water. For every pound of differential between the turning on of the jockey pump and its turn-off, there is about 0.9 gallons of water stored. With a twenty pound differential (110 minus 90), that equals about 18 gallons of water. By shutting the jockey pump off on flow rather than pressure, it will pump a full head of about 170 pounds, or 80 pound differential, into the tank. If the jockey pump usually ran every 20 minutes, it would now have enough head to stay off for an hour and a half.

What this means in terms of energy conservation and also extending the life of the pump itself is a large savings. It takes about 600 percent of running voltage to start a pump. This is basically converted to heat. You can only start a pump a certain number of times in a given period of time before the heat cuts its life drastically short. Starting a 25 horsepower motor more that 10 times in a hour will damage it through overheating. The larger the motor, the less times you can start it before it overheats.

Bob Whalen, Vice President at PSI also states that proper starting and operation of a motor can cut the energy consumed. He feels that the way to efficiency is through developing systems where if 50 hydraulic horsepower is needed, you should be expending no more than 50 electrical horsepower at the pump station. Pumping stations are normally set up with a number of pumps to give peak operating efficiency at any given pumping rate. What this generally means is that a station with 25, 50 and 100 horsepower pumps will only operate the 25 at about 200 gallons per minute, it would shut off and the 50 would come on at 400, the 25 would come back on with the 50 at 700, they would shut down and the 100 would come on at a thousand gallons per minute and so on up to the capacity of the system.

While this is the norm for pumping

stations, care has to be taken not to overcomplicate the system. For example, if the system calls for two 100 horsepower pumps, you might spend more on extra controls and maintenance if you put four 50 horsepower pumps in. A lot of things hang in the balance of choosing the right system.

The Rainbird Maxi controller is the most sophisticated controller on the market. People in the water short west are taking a hard look at the water savings it can bring. There is talk that meters will even be put on the wells in the desert areas. With a large price tag of around $20,000 dollars, the simplicity of use and a number of uses that hasn't even been estimated yet, the Maxi seems to be the controller of the future. A user, and it takes about an hour for the most basic training, can program an entire watering cycle in about six seconds. And the machine will have his coffee ready when he gets there to do it.

On the serious side, this machine allows programming to meet immediate watering needs in a very short time. It is nothing to program it to put 30 minutes worth of water on in six shots of five minutes each to avoid overwatering and run-off. And if you want to try two percent less water, just tell it water budget 98 percent and it cuts the entire course by two percent.

Integrating moisture sensors into the program can further automate the system. Most turf managers tend to overwater. It might be scary to hook up to such a system and the pumps don't come on for six days simply because the water is still there even though everything says you've got to water more often. And you breathe a sigh of relief when it does come on just because you know now that it still works.

Toro is looking towards a dollar savings both in parts and labor with their Pressure Modulated Control system. Several superintendents saw the system work at Windcrest in San Antonio at the GCSAA show two years ago. The system has gained acceptance and is going in on several courses around the country.

The system is designed to automate quick coupler systems without the cost of wiring. It is estimated to save about 40% labor on installation and can be easily installed by an existing crew. The only limitation right now is elevation. The system can only handle about 100 feet. The system needs a good 100 to 110 pounds of pressure as about 85 is needed to turn it on.

While the industry is becoming much more sophisticated as the demand for energy and water conservation grows, superintendents as a group are not keeping up with it. Basic practices in plant/water relationships need to be reaffirmed and practiced. And as one becomes more concerned with this balance and less concerned with just watering the soil, the sophistication of the industry will grow on them.

The Maxi, at right, is Rain Bird's most advanced computer controller. The cycler, middle, is the heart of the Toro MPC irrigation system. One is installed beside each sprinkler. Bottom, Carroll Childers Company, out of Houston, Texas builds pumping systems such as this one.