Golf course energy use Part 1: Energy generation and delivery

What are you doing to not participate in this recession?

Editor's note: This article is the first in a three-part series about energy use on golf courses. The series is based on a utility-funded energy efficiency outreach program to 320 golf courses in Southern California conducted from 2006 to 2008. The program was the first energy outreach program of its kind and completely free to the customer. It identified areas of energy savings opportunity, focusing attention on irrigation and water management as well as lighting and golf car charging. The program provided the customer with a cost-benefit analysis for potential work performed. Samples indicated a potential of 30% energy savings for participating courses.

It's difficult to be in the golf business right now. Play is down, expenses are up. Golf courses are doing everything in their power to survive. We've all heard this before and, quite frankly, are tired of it. As one member of the golf industry put it at this year's Golf Industry Show in New Orleans, "I am no longer participating in this recession!" Although many in our industry agree with this statement, most golf courses have no idea how not to participate in this recession. Where do we begin? Let's begin with saving energy.

Golf's energy crisis

A typical golf course can use anywhere from 250,000 kilowatt hours (kWh) (the equivalent of 14 2,500-square-foot houses) to upward of 5,000,000 kWh (the equivalent of 278 houses). A typical pumping system will account for 25% to 50% of a golf course's energy use. Using the national average cost of a kilowatt-hour, energy costs for the entire facility are upward of $550,000 and possibly $250,000 to pump water. With these kinds of expenses, courses are in a position where they must save energy to stay afloat. In areas of the country such as Southern California, customers have seen their utility bills rise nearly 30% in the past five years, the sharpest jump since the energy crisis of the1970s. Increases like these have motivated golf courses to implement energy management strategies to help mitigate the sharp rise in costs. However, the golf industry in general has little understanding of how to implement these plans, and golf courses are often left wondering how to save energy and cut costs.

The California power crunch of 2000-2001 was characterized by extremely high prices and rolling blackouts. Because of price controls set by regulators, utility companies were paying more for electricity than they were allowed to charge customers. Power companies such as Enron took advantage of a partially deregulated energy system, bilking the end-users out of hundreds of thousands of dollars. Almost 10 years after its energy crisis, California continues to rank as one of the states with the highest energy costs. This crisis has caused utilities, power companies and governments to re-evaluate how energy is produced and delivered, and this re-evaluation has made it even more important for customers to pay attention to their energy use.

Understanding the energy business

To truly understand energy use as it relates to golf courses, one must first understand how the energy business works. Electricity is a commodity just like gold or oil, and it is traded much the same way. The cost of a kilowatt (kW) is continually changing depending on the pressures of supply and demand, the cost of the fossil fuels needed to drive the turbines of the power plants and even changes in weather and geographic influences. Because the cost of producing electricity is constantly changing, utility companies are continually hedging their bets against fluctuating prices,

Andrew Staples

The 15th hole of The Championship Course at The Golf Club at Sand Hollow Resort, Hurricane, Utah, takes full advantage of the natural beauty of the site. Designed by John Fought and Andy Staples, The Championship Course was constructed with minimal movement of soil and disruption of the environment, and the entire resort was constructed with energy efficiency in mind. The 27-hole facility uses a gravity-fed irrigation system, eliminating the need for electricity to power a traditional golf course pump station. **Photo by Brian Oar**

all the while trying to maintain a constant price for the end-user.

Utilities and power generation companies are currently in the middle of a tremendous shift in the way the energy business works, creating challenges as to how power is ultimately produced and delivered. Most power plants generate electricity by burning fossil fuels (more than half of our nation's electricity is generated by burning coal), so utilities and power companies are now looking for ways to reduce emissions by reducing the need to produce more energy. In addition, because of environmental restrictions on building new power plants and the length of time and the expense required to build them, utility companies have found it more cost-effective to institute energy savings programs than to build more plants. Utilities understand they can run a more efficient business if their customers use energy efficiently.

This is great news for the consumer. An energy savings program can be an effective way to combat the negative issues mentioned above and it can also increase the value of a property. The more efficiently a property can be operated, the more profitable it can become. It is now more important than ever for golf courses to understand how they use energy. The incentives offered by the utility and power companies should be used by every golf course to benefit the bottom line.

How energy is delivered

Utility delivery systems are designed to deliver approximately 115% of the total amount of electricity demand (often described as kilowatt demand) to a given customer base throughout an entire service area. The utility company's responsibility is to deliver the total amount of energy needed to power all the customers within a given area at any one time. For example, in summer when building environments need to be cooled, there must be enough energy on hand to meet the kilowatt demands of all the air conditioners (and, of course, all other energy-using devices) in the service area if they were all turned on at the same time. Imagine the amount of power needed to operate all of a service area's energy-using systems at one time. Utility companies spend a great deal of time and resources understanding the amount of kilowatt demand at any given time and making sure their systems are able to meet maximum energy needs in an efficient manner. The utility companies' ability to deliver maximum energy at maximum efficiency will have the greatest effect on how much golf courses will pay for their energy.

Bill calculation

Bills are calculated on two factors: overall kilowatt demand of the system and length of time the user consumes energy at this demand (kilowatt hours). In other words, you are billed by the amount of power needed to operate a piece of equipment multiplied by the amount of time the power is being drawn. Since most utility companies know that at some points during the year it is more expensive for them to deliver the needed amount of energy to their customers, they use billing rates to deter customers from using energy during difficult times. In some cases, it is better for a utility to convince a customer to reduce demand or shift the use to an alternative time so both parties benefit: the customer pays lower rates, and the utility needs to deliver less power at that particular time. Essentially, if the utility is going to deliver power during a period in which it incurs the greatest amount of expense, the utility is going to pass that expense along to the user. Therefore, it is absolutely critical for the golf course to under-

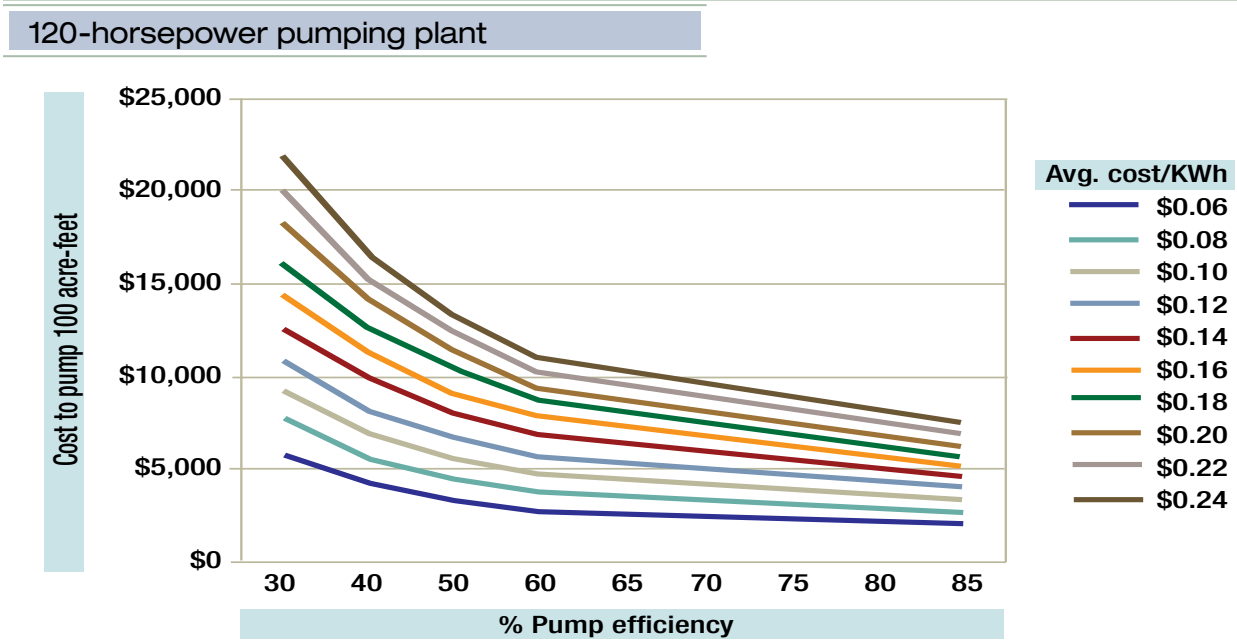


Figure 1. Graph of cost to pump 100 acre-feet of water with different costs per kilowatt-hour (kWh).

stand what its overall kilowatt demand on the system is and what type of billing rate it currently uses. (For an example of a utility bill for a Southern California golf course, go to www.gcsaa.org/GCM/2009/june/pdfs/utilitybill.pdf)

Account types

In Southern California, a customer can be billed for energy use through two basic types of accounts: general service accounts and agricultural accounts. General service accounts will cover most uses other than the golf course itself. Clubhouse, maintenance building, golf car charging, tennis court lighting, etc., will be billed at these rates, which are generally pricier than agricultural accounts (Figure 1). A customer will have an agricultural account if 70% of its energy use is for pumping water for use in agriculture (growing grass is considered as agriculture). This differentiation is important when the two billing rates are considered. In some cases, general service accounts will be priced upwards of 400% higher than agricultural accounts. This can become important when a pump station is positioned on the same meter as the clubhouse. In other parts of the country (including Northern California), golf courses are not separated out from a regular general service account and are not able to take advantage of the lower rates afforded by an agricultural rate. Golf courses should consult with local utility representatives to understand the types of accounts available to them.

Account rates

Once a course figures out which type of account it should be on, the next question is what type of rate they will be assigned. Energy bills are calculated using two numbers: kilowatt demand and kilowatt hour usage. The kilowatt demand generally dictates the user's rate. The amount paid

Cost-savings example

A customer in Southern California was being billed at an incorrect rate and overcharged for his power. This customer worked with his utility representative to investigate the correct rate based on the type, size and use of the golf course's system. Ultimately, this customer received a refund totaling over $60,000 for overbilling. Since the customer is now on the correct rate, the golf course will save more than $15,000 per year on the cost of energy, before any efficiency upgrades are made.

per kilowatt hour is determined within this rate structure. For example, a small commercial user with demand of less than 10 kilowatts may pay an average of $0.14 per kilowatt hour, but a larger user with a demand of more than 200 kilowatts may pay closer to $0.08 or $0.10 per kilowatt hour.

The tier system

Utility companies have established a tier system for various uses. For example, the base tier may be 0 to 1,500 kWh, billed at the cheapest rate. If this amount is exceeded, the user will be bumped to the next tier, resulting in a higher rate, and so on. The final bill will be broken out by two separate charges: a charge per monthly maximum kilowatt demand, and a charge per total kilowatt hours used. Often, within a certain type of account, the rates can be split among varying sizes of kilowatt demand, as long as each system is separately metered. A pump station with four 75-horsepower pumps will have a greater demand than a 100-horsepower well pump and therefore will be billed differently because of the larger size of demand of the station (Table 1).

Energy is billed by the maximum total load (in kilowatts) of your system at any one given time. Load is calculated by adding each energy-using piece of equipment that will run at one time to equal the total demand on the system. The system is checked through the meter on a rolling 15-minute schedule, calculating the highest total load during one hour. Demand is then charged at the highest load within that hour. Typically loads are broken into tiers of 0-20 kW, 21-200 kW, 201-500 kW and more than 500 kW.

Standard vs. time-of-use plan

The final question is how a user will be billed within a specific rate structure. Again, there are two options: the standard plan and the time-of-use (TOU) plan. Standard plans bill the user a set amount per kilowatt demand and kilowatt-hour use, maintaining the same price regardless of when the power is used within a specified tier. This type of account benefits a customer whose use is the same throughout a 24-hour period and who cannot shift use to other times of the day.

The time-of-use plan adjusts the amount a customer pays depending on the time of day the energy is consumed (Figure 2). Rates are increased during the on-peak times of day when more users are likely to consume energy, and rates are decreased during the off-peak times when use is at its least. In other words, golf courses will benefit from this type of plan because most pumping

A measure of power over time

Watts and kilowatts

1,000 watts (W) = 1 kilowatt (kW)
1 kW used for 1 hour = 1 kilowatt hour (kWh)
1 MWh (megawatt-hour) = 1,000 kWh
1 GWh (gigawatt-hour) =1,000,000 kWh
1 TWh (terawatt-hour) =1,000,000,000 kWh

Horsepower

1 horsepower (hp) = 0.74566 kW
5 hp = 3.7283 kW
25 hp = 18.6416 kW
50 hp = 37.2832 kW
75 hp = 55.9248 kW
100 hp = 74.5664 kW

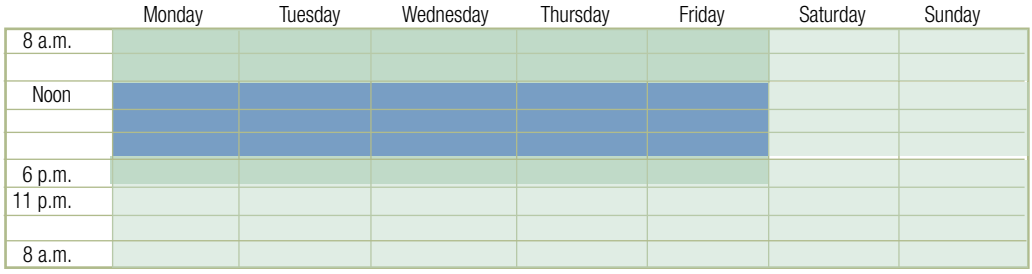
Billing horsepower/kilowatt-hour

100-hp motor used for 1 hour = 74.5664 kWh
74.5664 kWh × $0.11 (national average) = $8.20/hour

Table 1. Conversion factors for kilowatts and horsepower.

Summer/Winter schedules

Summer schedule: TOU-PA-1, TOU-PA-2, TOU-PA-5, TOU-PA-7, TOU-PA-ICE
First Sunday in June to the first Sunday in October



Winter schedule: TOU-PA-1, TOU-PA-2, TOU-PA-5, TOU-PA-7, TOU-PA-ICE
First Sunday in October to the first Sunday in June

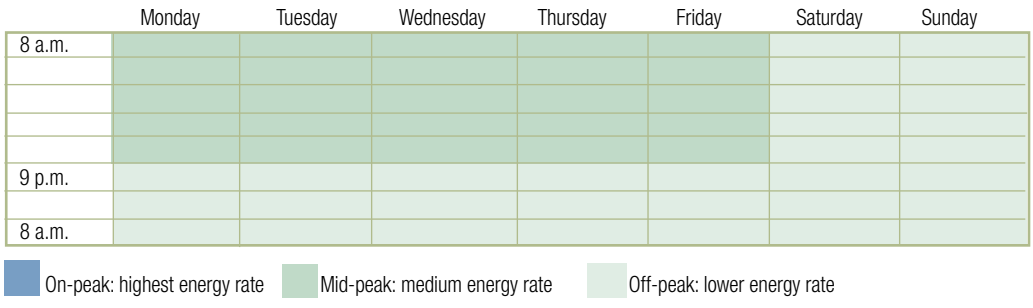


Figure 2. Peak and nonpeak times for electrical use during the day in different seasons.

The Links Course at Sand Hollow is a nine-hole course built as a practice or warm-up nine for the longer Championship Course. The No. 6 hole is shown. **Photo by Andrew Staples**

The research says

- To survive in today's economy, energy management planning is critical.
- Golf courses must work with their local utility companies to conserve energy and save on their energy bills.
- Energy consumers are billed according to their overall demand and the length of time they use this demand.
- Golf courses in some areas can decrease costs by being billed for irrigation on an agricultural account and by being billed on a time-of-use plan, which bills at lower rates for nonpeak hours.
- Consult with the utility company before purchasing new equipment such as pumping stations to make sure that the total use of a system matches an efficient rate plan.

takes place at night when it is least expensive for the utility to deliver power.

Finding the right rate plan

Based on the size of each system, rate plans can be set up to provide the greatest amount of cost efficiency relative to the total amount of use. This can be extremely important when choosing to upgrade a pump station or a well pump. Making sure the final demand and total use of a system matches an efficient rate plan can increase the number of options available for that station, and, depending on the system's size, it may prevent the system from being locked into less flexible and more costly delivery charges. To fully understand the local rate plans and size cutoffs, check with your local utility representative for details.

Conclusions

The energy business is changing and so is the motivation to save energy. Gone are the days when resources like water and power were cheap and plentiful. Costs are up and rounds are down. The golf industry needs to adjust and do what it takes to stay at the forefront of a changing economy to remain as profitable as possible -- or, in some cases, just stay alive.

GCM

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