



Commercial Energy Specialists
proudly presents:

Proven Green Technologies
For
Commercial Aquatic Facilities

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CES - Experience in Energy Industry.

- CES (Commercial Energy Specialists) was founded in 1983 as the commercial division of a highly-successful alternative energy company with years of expertise in solar heating, thermal transfer, solar electricity, high-efficiency pool heating, pool covers, and more.
- As the nation appeared to steer away from energy saving orientation and cancelled many programs in the mid-1980s, CES concentrated on pool chemistry, pool heating, and other money saving methods.

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2007- Return to energy conservation

- Rapidly-rising costs of energy are driving municipalities, management companies, and owners to become strongly interested in both lowering energy consumption and protecting the environment.
- Going GREEN is defined as any technology with favorable impact on ecology...low emissions, minimal noxious by-products, or significantly reduced energy consumption.
- First, let's review the basics of energy costs.

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Dissecting Energy Consumption


- How is electricity consumed & billed
 - ✓ 100 Watt light bulb operated for 10 hours = 1000 Watts (1 kilowatt).
 - ✓ Power Company charges for electricity by the Kilowatt/Hour (KWH)...say 10 cents.
 - ✓ Therefore that 100 watt light bulb will cost \$0.10 for each 10 hours that is operated.
 - ✓ If you operate that light 24 hours in a day, it would cost you \$0.24 (2.4 x \$0.10). In 30 days it would cost you \$7.20.



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Dissecting Energy Consumption

- How is electricity consumed & billed
 - ✓ If you use an 27 watt compact florescent lamp in its place (puts out equivalent light to a standard 100 watt light bulb), here is the math:
 - ✓ In 10 hours, the same amount of light would use 270 watts instead of 1,000, and would cost 2.7 cents instead of 10 cents.
 - ✓ Per day, this alternative would cost 6.48 cents instead of 24 cents.
 - ✓ In one month, the light would cost \$1.94 instead of \$7.20. A savings of over 82%.



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Dissecting Energy Consumption

- How is electricity consumed & billed
 - ✓ The formula for calculating electrical costs is:
(Watts x Hours x Days) / 1000 x Cost per KWH
 - ✓ 100 watt light bulb example:
 - 100 x 24 x 30 days /1000 x \$0.10
 - 72,000 / 1000 x \$0.10
 - 72.0 KWH x \$0.10 = **\$7.20** a month
 - ✓ 27 watt light bulb example:
 - 27 x 24 x 30 days /1000 x \$0.10
 - 19,440/ 1000 x \$0.10
 - 19.4 KWH x \$0.10 = **\$1.94** a month

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Dissecting Energy Consumption

•How about your pool pump?

- ✓Step one: Calculate how many watts:
- ✓Rule of thumb is 746 watts per horsepower
- ✓Therefore a 10 HP pump would use 7,460 watts an hour. Using our formula:

(HP x 746 x Hours x Days) / 1000 x Cost per KWH

•(10 x 746 x 24 x 30) / 1000 x \$0.10

•(7,460 x 24 x 30) / 1,000 x \$0.10

•5,371,200 watts / 1,000 x \$0.10

•54,712 KWH x \$0.10 = \$537.12 per month



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Pool Pump Operation Cost?

• How much does your circulation pump costs to operate?

Pump HP	KW / Hr	Cost / Mo.	Cost / Yr
3	2.2	\$161	\$1,934
5	3.7	\$269	\$3,223
7.5	5.6	\$403	\$4,834
10	7.5	\$537	\$6,445
15	11.2	\$806	\$9,668
20	14.9	\$1,074	\$12,891
25	18.7	\$1,343	\$16,114
30	22.4	\$1,611	\$19,336
50	37.3	\$2,686	\$32,227

- Based on 24-Hour operation at \$0.10 per KWH
- Does NOT include Demand Charges!



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Dissecting Energy Consumption

- Volts, Amps & Watts
- You can actually figure out the energy costs for any appliance in your home or workplace using the previous formula and the following relationships.

volts x amps = watts

120 volt appliance @ 10 Amps = 1,200 Watts

watts / volts = amps

1,200 watt appliance @ 120 volts = 10 Amps

watts / amps = volts




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Comparison of Energy Costs

- Department of Energy - 2007
 - ✓ Electricity 10.65 cents/kwh or
 - \$31.21 / million BTU
 - ✓ Natural Gas \$1.21/ therm (100,000 BTU) or \$12.53/ MCF (1,000 cubic Foot)
 - \$12.18 / million BTU
 - ✓ Propane \$1.87 / gallon
 - \$20.47 / million BTU

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Explanation of Power Charges:

- Natural Gas can be billed in two ways:
 - ✓ \$ x.xx per therm (per 100,000 BTU)
 - ✓ \$ xx.xx per MCF (1,000 cubic feet)
- Electricity can be billed in two ways
 - ✓ Energy Charge for electricity consumed
 - ✓ Additional Demand charges
- Propane is billed by the gallon consumed

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Demand Charge

- Is an element in a two-part pricing method used in electric bill transactions (energy charge is the other element). The Capacity Charge, sometimes called Demand Charge or System use Charge, is assessed on the maximum or peak amount of electricity used. Often, the charge is based on the maximum amount of electricity used at any time in the previous month.

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Demand Charges

- A demand meter has two sets of dials.
- One measures use over the entire billing period.
- The other indicates the highest total of loads that were turned on during any fifteen minutes in the billing period. The demand dial or pointer is moved upscale by the amount of power consumed in successive fifteen-minute periods. The highest amount of use detected during the preceding periods is stored.
- Once the meter is read at the end of the billing period, the meter is reset for the next month.



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Demand Charges Example

- Say your electric bill is for 5,000 KWH used, and your largest peak "Demand Charge" was for 17 kW.
- At \$0.10 per KWH, the consumption or "energy charge" would be \$500.
- The demand charge was \$7.50 per peak kW. So the demand charge was \$127.50.
- The demand charge added up to 25% of the consumption charges.
- The demand charge added up to 17% of the entire electric bill, including the storm charge, franchise charge, utility tax, Florida sales tax, & discretionary sales tax.



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Facility's Largest Energy Consumers

- Circulating Pumps
- Feature Pumps
- Heating Systems
- Room Ventilation Fans
- Pool Lights
- Chemical Feeders



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Going Green on your Pool Operations!

- There are many new modernizations and products that save energy while saving money.
- Some energy conversions are so strong that they can “pay their own way” from savings in labor, chemicals, maintenance and liability... or increase the safety of the facility.
- Here are the most popular and best performing modernizations in the industry.



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Options for “Going Green”

- Electrical / Mechanical
 - ✓ VFD Reduce Pumping Costs, Demand Charges
 - ✓ Timed Circulation, Setback
 - ✓ Hi-Rate Sand Conversions
 - ✓ LED Pool Lights
- Chemistry
 - ✓ Direct Control of Chemistry
 - ✓ Ozone, UV supplemental treatment.
 - ✓ Saline Chlorination, Hybrid non-chlorine treatment, Non-fuming acids.
- Heating
 - ✓ High Efficiency Heaters, Heat Pumps
 - ✓ Heat Retention Covers



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Electrical & Mechanical

- There are several ways to save energy and protect the environment in your electrical & mechanical systems.
- They are:
 - ✓ Timed Circulation
 - ✓ Variable Frequency Drives
 - ✓ D.E. to Hi-Rate Sand Filtration
 - ✓ LED Pool Lights



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Timed Circulation

- DOH allows circulation pump to be shut down 3 hrs after closing as long as it is re-energized 3-hours before opening.
- 8 hours off-time could save up to 1/3rd of pool pumping cost if you can do it!
- Known issues with Timed Circulation:
 - ✓ No overnight recovery for stressed water quality.
 - ✓ No heating, chemical treatment, or filtration during off-time.
 - ✓ D.E. filters lose "coating" when pump is shut off.



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Electrical Savings - VFD

- Instead of turning OFF the pump, you can turn it down with a VFD.
- Variable Frequency Drives (VFD' s) are a tremendous source of energy savings while not sacrificing pump longevity or performance.
- Major savings are expected in most applications as pool pumps are generally oversized by design, and must be trimmed back with proportioning valves.
- Very important as most pumps are oversized by design.



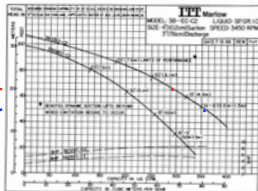
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Pool pumps are oversized by design!

- Pools may be designed to operate at 65 TDH, or stock pump is selected (next size up).

Example of pool designed At 60-65 TDH, per DOH, in order to provide adequate flow for filters, heaters, etc.



Real operating TDH due to efficient piping runs, clean filters, and/or pump-assisted heaters and chemical feeders.

Pump must then be trimmed (with additional restriction) to prevent "over-pumping", but that is inefficient.



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Electrical Savings - VFD

- In comparison to trimming pumps by adding restrictions, VFD's work by varying the "speed" of the motor to provide the desired flow rate.
- VFD's also reduce the power company "Demand Charges" - the surcharge paid by larger power customers. So you will pay less for your electricity.
- This savings is applied to your entire electric bill, not just the swimming pool or spa portion.

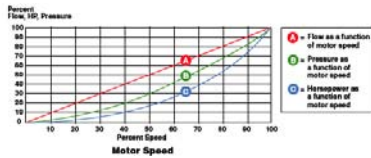


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Electrical Savings - VFD

The use of a VFD device has a verifiable savings pattern that is more significant than shutting down pumps at night or even under-sizing pumps to use less horsepower.



A motor running at 50% of full speed capacity has a motor torque of 25% of full speed. In addition, electricity required to operate the motor at 50% of full speed is 12.5% of the amount of electricity required if the motor was running at 100% full speed capacity. Thus, reducing motor speed can significantly reduce the electrical energy consumption.



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Example of VFD Savings

- During normal operations, some pumps can be operated at 80% of peak capacity due to more efficient piping runs, and/or oversized pumps.
 - ✓ During this time period the electrical consumption would be $.8 \times .8 \times .8$ or 51.2% of normal power.
- During off-peak operations, some pumps could be operated at 50% of peak capacity while still circulating, filtering, and heating.
 - ✓ During this time period the electrical consumption would be $.5 \times .5 \times .5$ or 12.5% of normal power.

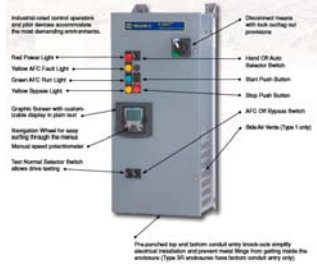


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VFD - a complete power center

VFD's are more than a drive, they are a complete motor starter and pump power center. They include pump protection, phase monitoring, service bypass, auto/off/manual switch, indicator lights, and more. They are good for the pump in many ways.

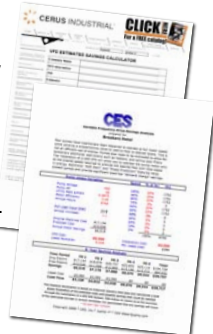


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VFD Savings Analysis

- Simple-to-Complex VFD savings calculators accurately predict electrical savings.
- Simply enter motor size, cost per KWH, hours of operation, and any potential to set back the flow during off peak hours.
- Plots savings for 5 years, with leasing option to verify the value of the investment.



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Convert D.E. to Hi-Rate Sand

- D.E. is prehistoric skeletal remains and causes exposure (silicosis) and disposal issues.
- D.E. is temporary media, needs to be recoated after each filter cleaning cycle, then discarded.
- Some Hi-Rate sand filters are classified as permanent media filters, and do not present health and disposal issues.
- Sand filters utilize the same filter media for many years.




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Convert DE to Hi-Rate Sand

- Significant savings in labor, media, treatment chemicals, maintenance, and water.
- This popular conversion to semi or fully automatic hi-rate sand will pay for itself over and over for years to come.
- Available under a PCF (positive cash flow) lease plan, often with \$1 buyout at the end of lease.
- Improved water quality, up to EPA "Drinking Water Standards".



Semi-Automatic Filters




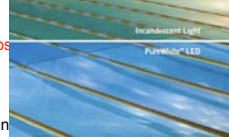
Fully Automatic Filters

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LED Pool Lights

- LED Pool light provide 300 Watts of illumination for 45 Watts?
- Bulbs are rated for 50,000 hours
- Light is brighter and the pool actually is said to look cleaner
- Savings:
 $(255 \text{ watts} \times \text{Hours} \times \text{Days}) / 1000 \times \text{Cost}$
 $(255 \times 12 \times 30) / 1000 \times \$0.10 \times 12 \text{ months}$
 •Or \$110/yr savings plus lamp replacement and labor savin






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Chemical Treatment

- There are several ways to save energy and protect the environment (and yourself) in your chemistry program.
- They are:
 - Direct Chemistry Control
 - Chlorine Supplements and Alternatives
 - Safer Chemicals








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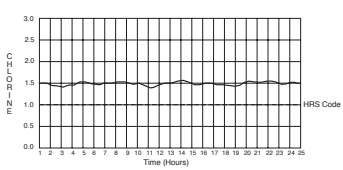
Direct Control of Pool Chemistry

- Baseline requirement for any legitimate water treatment program on pools of any size.
- Use only the chemicals you need per DOH, on 24/7 basis.
- Set desired chemical levels, and system will maintain!!
- Works with chlorine, bromine, saline, ozone, UV, and all types of pH adjusters.
- The secret: It is very important to maintain the highest ORP level possible at a nominal Chlorine level.



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Direct Control of Pool Chemistry



One of the most popular “green” aspects of direct control of chemistry is protecting bathers and the pool equipment from the effects of over-chlorination. You can maintain an optimum Code-Approved ORP level (700 mV) with the absolute minimum amount of chlorine possible.

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Importance of maintaining High ORP's

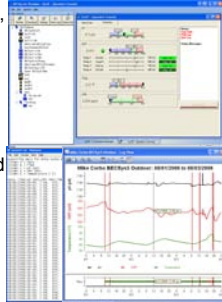
Non-Potable Water	DOH Minimum	Quick Crypto Kill
650 mV	700 mV	DOH Maximum
	750 mV	
	800 mV	
Self Deteriorating Water		Self Healing Water
	850 mV	

- ORP is the single most important variable used in determining the overall health and safety of pool water.
- HOW MANY PPM of Chlorine it takes to ACHIEVE a certain ORP is the single secret to water quality control for your pool operations and your patrons.

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Advanced controls save more energy!

- Monitor and Control flow, heaters, chemistry, and water level for maximum savings.
- Provides automated log keeping for minimum liability.
- Alert notification of any out-of-range conditions for pool operators, management staff, and technicians.
- Connects to VFD's for maximum pump savings.
- Programmable energy saving mode for off-peak savings.

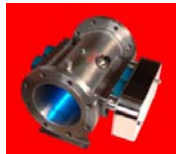


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UV Treatment

- Non-Chemical, Full-flow treatment of pool or spa water.
- Stainless Steel Chamber with high output UV lamps is installed in the circulation system return line.
- Provides positive control over Giardia and Cryptosporidium kill, with no chemical byproduct.
- Required in many states as mandatory treatment of water activity pools and splash pads.

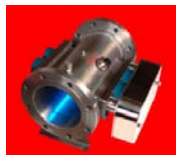


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UV Treatment

- Economical to operate.
- UV allows operating at lower chlorine levels, and eliminates the need to super-chlorinate.
- UV reduces potentially harmful trihalomethane (THM's) resulting in healthier water.
- Removes noxious chloramine odors & fumes from pool water.
- Install once and provide on-going annual maintenance program.



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Saline Chlorination

- Add special high-purity salt and turn your pool or spa into Mineral Water, similar to the water used in famous health spas for years.
- Install a saline chlorinator, and convert that mineral water into chlorine using a reaction chamber and a small amount of electricity.
- Reduces the need to purchase and to store hazardous chemicals.
- Reduces on-site handling of chemicals and feeder repairs.



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Saline Chlorination

- Enjoy soft and silky water, with the absence of chlorine odor and skin / eye irritation.
- Power supplies last indefinitely, and reaction chamber has a 15,000 hour warranty.
- Listed as a "Green Technology" by many hotel corporations and management companies.
- Works in conjunction with the chemistry controller to provide perfect pH and chlorine levels.



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Non-Chlorine Peroxolyte Treatment

- Patented Granular Non-Chlorine "designer oxidizer". Can be fed manually, or can be used with an fully automatic feeder.
- Used in "boilout" of pool piping, gutters, and filters to remove bioslime and bacteria which contribute to chlorine demand.
- Organic Contaminants that are chlorine resistant are easily oxidized by peroxolyte treatments.
- Combine with Chlorine treatment to form popular "Hybrid" system.



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Ozone Pool Water Treatment

- Used in most "Bottled Water" treatment system programs.
- DOH considers as Supplemental Oxidation, so must maintain proper Chlorine and pH levels.
- O₂ (oxygen) is converted to O₃... extra "O" oxygen "oxidizes" swimmer wastes, and then converts back to O₂.
- Ozone is 1,500 times faster than chlorine in handling heavy oxidation task, so chlorine has "less to do" and lasts longer in pool water.
- Requires planned maintenance.

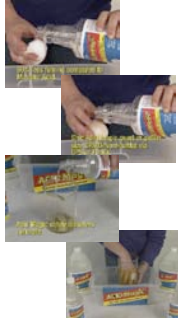


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Acid Magic - the safer acid substitute

- Up to 90% less fumes than regular 20 Baume (31% hcl) muriatic acid, while being 4% stronger than muriatic.
- Proprietary blend of buffering agents prevent burns to intact skin.
- Safer to store, handle, use.
- Protects storage areas, pump room, and electrical-mechanical equipment from corrosion and degradation.
- Can ship gallons via UPS using ORM-D classification.



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Heating & Heat Retention

- There are several ways to save energy and protect the environment in your heating and heat retention systems.
- They are:
 - ✓ Lower temperature settings
 - ✓ More Efficient Heating
 - Hi-efficiency, LoNOx heaters
 - Air & Water Source Heat pumps
 - ✓ Better Heat Retention



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Control Temperatures

- Hold lower temperatures
 - ✓ Each 1°F cost approximately 10% more to maintain. So if you hold 85°F, you will save 10% of your heating cost instead of holding 86°F.
- Maintain tighter control over the thermostat
 - ✓ Purchase a digital thermostat to maintain the optimum temperature with little variation.
 - ✓ Set up your chemistry control system to maintain digital control over temperature. You can then monitor, change (or alarm) the settings for all your facilities from one remote location.



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High Efficiency, Low NOx Heaters

- The most energy efficient 88-89% gas-fired, non-condensing heaters in the pool industry.
- Fan-assisted combustion, much like fuel injection in an automobile, provides consistent output and guaranteed efficiency under all environmental conditions.
- Low NOx reduces the amount of noxious fumes that are harmful to the environment, and contribute to the global warming problem.
- Fastest heat up time of all heaters.



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High Efficiency, Low NOx Heaters

- Low NOx heaters have much lower emissions (less than 3%) than standard heaters, and many US States (Cal, Texas, Indiana, etc) require that all new heaters meet Low NOx designation.
- Digital thermostats provide pinpoint control over temperatures and prevent costly over heating.
- Heaters will provide thousands of dollars a year in heating savings over older inefficient gas models.



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High Efficiency, Low NOx Heaters

- Higher efficiency is not always better.
- Heaters with efficiencies higher than 90% normally “condensing-type” heaters, and are more complex to operate and maintain than “non-condensing” heaters.
- These heaters have received a reputation for being less reliable, and having longer repair lead times than non-condensing models.
- Strike a balance between efficiency and reliability.

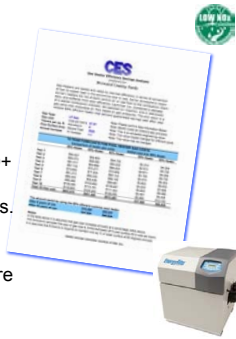


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Savings from High Efficiency Heaters

- Gas Heaters are tested and rated by thermal efficiency in terms of conversion of gas to usable heat.
- The higher the efficiency the lower your heating cost.
- This example shows a \$4,000+ annual savings between using 89% and 82% efficiency heaters.
- Heaters that are condensing (white residue in stack) or burning poorly (yellow flame) are operating at lower % efficiency.

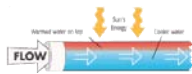


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Solar Pool Heating

- Divert water flow from pool system through solar panels to raise pool temperature a maximum of 3-5F per day.
- Require 75-100% sq. ft. of collector area to pool area.
- 1,500 sq. ft. pool would need 1,500 sq. ft. of panel area.
- Not assured, must use either backup system or pool cover.




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Heat Pumps

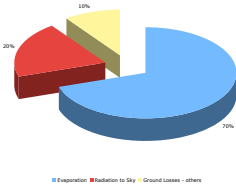
- Heat pumps take available heat from the air or ground water, and transfer to pool at a high ratio.
- Water-source heat pumps are the most efficient heaters in the pool industry, and can both heat and cool the pool.
- Air Source heat pumps are also extremely efficient, but cannot work at temperatures below 49°F.
- Heat Pumps are more expensive to install, and heat at a slower BTU rate than a gas heater.



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Heat Losses in an Outdoor Pool

Department of Energy • Outdoor Pool Heat Losses




The reason evaporation has such an impact is that evaporating water requires tremendous amounts of energy. It only takes 1 Btu to raise 1 pound of water 1 degree, but each pound of 80° water that evaporates takes a whopping 1048 Btu's of heat out of the pool.

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Heat Retention Covers

- Since late 1970' s, pool covers have been the most significant energy saving device in Florida.
- #1 Pool Savings (per AFO class) Provides 66% energy savings over un-covered pools.
- Covers are custom-fitted and trimmed, lightweight insulated sections that float on pool water surface.
- They are stored on and deployed with a multi-tube stainless steel storage reel / winder system.



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Heat Retention Covers

- Allow for smaller, less costly heating systems to be utilized.
- Custom fitted and reinforced around all ladders and rails.
- Cannot be utilized by some pools (high-wind, freeform, open 24/7).
- Cuts night-time losses to 1-2°F.
- Saves hundreds of thousand gallons of water annually, lowers chemical usage, reduces energy.
- Covers have traditionally lasted 10+ years with normal care.



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DOE savings analysis

- The Department of Energy (DOE) RSPEC (Reduce Swimming Pool Energy Costs) program accurately demonstrates pool heating costs under a variety of conditions.
- Fill in the Energy Smart Pool Data form, fax to CES, and we will forward a 6-8 page report that details heating costs, water usage, and payback information with the utilization of different energy saving (covers, solar, higher efficiency) alternatives.

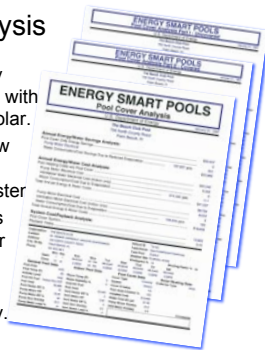


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DOE Savings Analysis

- RSPEC program accurately predicts energy consumption with base pool, pool cover, and solar.
- It can also be used to review make-up air savings from indoor air handling system
- Program produces specifics on BTU savings, water savings, and dollar savings.
- Provides ROI information to help assess viability.

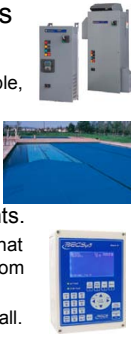


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Evaluating Energy Alternatives

- Payback Analysis
 - ✓ Look at initial cost + savings from credible, not inexperienced or biased source.
 - ✓ Factor in known replacement costs
 - ✓ Evaluate over 5-year period
 - ✓ Evaluate versus potential lease costs
- Positive Cash Flow (PCF) investments.
 - ✓ Energy investments that are so strong that they save more money than they cost from month one.
 - ✓ What is payback? The moment you install.

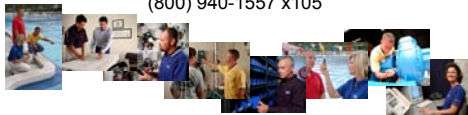


Thank you for your attention!

Do you have any questions?

For assistance with any portion of this energy presentation, please contact:

amendoza@cesmail.org
(800) 940-1557 x105



Proven Green Technologies For Commercial Swimming Pools Course Quiz

1. **True / False:** An 100 Watt appliance that is operated for 10 Hours will consume 1 Kilowatt of Power.
2. **True / False:** At \$.10 per kilowatt rate that appliance will cost \$200 a month to operate.
3. **True / False:** In order to receive the most favorable demand charges from the power company, it is best to "stage" or stagger the start up of large fixture pumps.
4. **True / False:** The Department of Health Code allows you to turn off the circulation pump at closing time as long as you turn it back on upon opening the facility.
5. **True / False:** Ozone, UV, and Peroxolyte treatments are approved for use as Supplemental oxidation meaning that one must still maintain the code-mandated chlorine residual.
6. **True / False:** Saline Chlorination can be used as supplemental oxidation, or as a stand-alone is sized to the recommended DWH sizing guidelines.
7. **True / False:** Heat retention through a code-approved pool cover is the #1 method of saving energy on a heated pool.
8. **True / False:** Air-Source Heat Pump heaters work equally efficiently at all outdoor temperatures.
9. **True / False:** A variable frequency drive (VFD) save energy by reducing the number of volts supplied to the pump.
10. A VFD-operated pump that is operating at 50% power will utilize what percentage of its normal energy consumption?
 - 75%
 - 40%
 - 13%
 - 25%