



# Smart Energy Design Assistance Center

Newsletter Vol. 6, No. 6, June 2010

[www.sedac.org](http://www.sedac.org)

## SEDAC

The Smart Energy Design Assistance Center (SEDAC) provides advice and analyses enabling private and public facilities in the State of Illinois to increase their economic viability through the efficient use of energy resources. SEDAC is sponsored by the Illinois Department of Commerce and Economic Opportunity in partnership with ComEd and Ameren Illinois Utilities and provides valuable services at no cost to for-profit businesses and public facilities. SEDAC is managed by the University of Illinois at Urbana-Champaign and supported by the 360 Energy Group.

*(Hyperlinks are shown in green)*

## EDUCATION

ENERGY CENTER OF WISCONSIN

Online course available anytime:

Beyond Code: Designing Energy Efficient Commercial Buildings

by Donald Fournier

### SEDAC FACT SHEETS

- Warehouses
- Convenience Stores
- Supermarkets
- Water Treatment Facilities
- 2009 Recovery Act
- Restaurants
- Hotels
- Ice Arenas

**APPLY FOR SEDAC SERVICES ONLINE**

## WATER HEATING

Heating water uses energy and costs money. The less water you need to heat, and the more efficiently it's heated, the less energy and money it costs. This article examines how to heat water efficiently. Naturally, water consumption varies widely between different building types. For example, a highrise condominium uses far more water, and energy to heat that water, than a highrise office building due to the needs and uses of occupants. Savings potential will therefore vary based on the water use characteristics for a particular building.

There are several types of water heaters: natural gas-fired or electric storage water heaters, demand (also called tankless) water heaters, indirect water heaters, and solar water heaters. The most common water heaters use natural gas or electricity to heat water stored in an insulated tank. In some buildings, the boiler used to heat the building may also provide heat for domestic hot water (DHW) through the use of a heat exchanger and an insulated storage tank. This is typically referred to as indirect water heating which this article will not address.

Water-heater (WH) efficiency is denoted by an Energy Factor (EF). Energy Factor is the ratio of useful energy output from the water heater to the total amount of energy delivered to the WH. The higher the EF, the more efficient the WH.

| EF for different types of water heaters |              |
|---|--------------|
| Standard Gas                            | 0.59 to 0.67 |
| Condensing Gas                          | 0.80 to 0.96 |
| Electric Resistance                     | 0.90 to 0.94 |
| Heat Pump                               | 2.0 to 2.35  |
| Gas Demand                              | 0.82 to 0.96 |

First, let's look at how much energy it takes to heat water. One British thermal unit (Btu) is the energy required to raise one pound of water by one degree Fahrenheit. A U.S. gallon of water weighs 8.3 pounds. So, to raise one gallon of 55°F water up to 120°F would require  $(1 \times 8.3 \times (120 - 55)) = 540$  Btu.

Using this information and an energy rate of \$1.00/therm and \$0.10/kWh, the following table illustrates how much it would cost to heat 100 gallons of water from 55°F water up to 120°F using different types of water heaters.

| Energy & cost to heat 100 gallons of water |      |        |        |
|--|------|--------|--------|
| Water Heater Type                          | EF   | Btu    | Cost   |
| Standard Gas                               | 0.65 | 83,000 | \$0.83 |
| Condensing Gas                             | 0.95 | 56,789 | \$0.57 |
| Electric Resistance                        | 0.92 | 58,641 | \$1.72 |
| Heat Pump                                  | 2.25 | 23,978 | \$0.70 |
| Gas Demand                                 | 0.95 | 56,789 | \$0.57 |

At these utility rates, it is more than twice as expensive to heat water with electric resistance heating than with a standard gas WH. Also note that although the electric water heater has a higher efficiency, the rating does not account for the fact that electricity is produced by a power plant, requiring 3.4 Btus of source energy to generate 1 Btu of electricity. Electric water heaters typically have the lowest first-cost making them common in many buildings. They do not require fresh air for combustion,

## SPOTLIGHT

### New Construction Programs

**DCEO:** Provides grants to public sector entities in the ComEd and Ameren Illinois electric service territories to encourage applicants to design new or rehabbed buildings to achieve the greatest level of energy efficiency. The program offers \$/square foot incentives for facility design improvements beyond code, with incentive levels increasing for additional percentages beyond code. Estimated electricity savings must be documented by energy modeling and/or supporting calculations. This program is part of the Illinois Energy Efficiency Portfolio.

DCEO contact: Tom Coe, 217/785-2433 <[tom.coe@illinois.gov](mailto:tom.coe@illinois.gov)>

**Ameren's ActOnEnergy:** This program will provide financial incentives and technical project assistance for energy-efficient building design and construction projects. Additional information and applications for the New Construction Program will be coming soon. Until then, new construction project applications may be submitted through the **Act On Energy Custom Incentive Program**.

**ComEd Smart Ideas New Construction** will increase the maximum funding amount of financial incentives for new construction or major renovation projects in its service territory to \$150,000—a \$50,000 increase since the programs inception in June 2009.

The *Smart Ideas* New Construction service combines financial incentives and technical assistance to encourage building owners, architects, engineers and contractors to design high performance buildings and exceed standard building practices. The New Construction service, which follows the IECC 2009 state code as its baseline, is designed for industrial facilities, offices, private schools, universities, hospitals, restaurants, retail and nonprofits. Residential and municipal projects are not eligible; schools and public sector buildings are eligible through DCEO.

What are the benefits?

- Financial incentives of up to \$150,000 per project
- Design incentives for eligible projects in the Comprehensive Track
- Free technical assistance to identify ways to save energy and lower operating expenses
- Increased property value and reduced environmental impact

For more information, visit [www.ComEd.com/BizIncentives](http://www.ComEd.com/BizIncentives) and click the "New Construction" link. For questions or to discuss a specific project you are working on, call the ComEd *Smart Ideas* New Construction team at 1-888-806-2273 or e-mail [ComEdSmartIdeas@ecw.org](mailto:ComEdSmartIdeas@ecw.org)

## WATER HEATING

...contd.

a flue, or a gas line, which lowers installation costs. Developers and property owners can often minimize first-costs by installing electric water heaters, while the tenant has to pay the utility bill for its use. An American Council for an Energy Efficient Economy (ACEEE) study on water heaters, the first reference at the end of this report, does a good job of illustrating the life-cycle-cost of ownership of various WH types. Low first-cost does not equal lowest life-cycle cost.

If a building is all-electric, electric heat pump WHs are a good option. Electric heat pump WHs take energy from the surrounding air to heat water and will cool the surrounding environment. Electric heat pump WHs are two to three times as efficient as electric resistance WHs.

If a fuel-burning WH is purchased, look for one with sealed combustion where outside air is brought directly to the appliance and exhausted after combustion. These appliances will not increase building air infiltration.

Demand water heaters eliminate the standby losses that are a characteristic of storage WHs. However, newer electric and gas storage WHs have increased levels of jacket insulation reducing these losses. Electric demand WHs are ideal for sinks and low gallon per minute (gpm) situations. Larger electric demand WHs have large peak kW demands. Gas demand WHs can support the same or equivalent gpm rates as storage WHs.

Finally, some additional suggestions for reducing water heating costs:

- Reduce hot water demand by installing low-flow fixtures for sinks, showers, dishwashers, laundries, and any other device or appliance that uses hot water. In addition, this will contribute to water and sewer cost savings.
- In most instances a water heater temperature setting of 110°F is sufficient.
- Insulate all hot water pipes to reduce heat loss from pipes.

<http://www.aceee.org/consumerguide/waterheating.htm>

[http://cafs.ahrinet.org/gama\\_cafs/sdpsearch/search.jsp?table=CWH](http://cafs.ahrinet.org/gama_cafs/sdpsearch/search.jsp?table=CWH)

<http://www.pmengineer.com/CDA/Archives/8cf9e86f7c298010VgnVCM100000f932a8c0>

<http://www.epa.gov/watersense/>

To participate in the *Smart Energy Design Assistance Program*, contact us at: (800) 214-7954 or [info@SEDAC.org](mailto:info@SEDAC.org)  
Smart Energy Design Assistance Center, 1 East St. Mary's Road, Champaign, IL 61820

[www.sedac.org](http://www.sedac.org)