BUILDER'S GUIDE TO ENERGY EFFICIENT HOMES IN LOUISIANA: WATER HEATING

by
Howard Hershberg, AIA

The Builder's Guide to Energy Efficient Homes in Louisiana (Builder's Guide) is being updated to reflect new code requirements. This is the twelfth in a series of articles that will summarize the information in the guide and highlight updates.

Water heating consumes approximately 15% of the electricity (electric water heater) and 23% of the natural gas (gas water heater) used in residences. Water heating is the most variable class of energy consumption depending on water heater capacity, climate, economic status and occupant behavior and utility consumption regarding showers, clothes washers and dishwashers. Americans use approximately 15 to 40 gallons of hot water per person per day (See Table 1). Designing or selecting a water heater involves consideration of the first hour rating[1]or recovery capacity and the storage capacity. The size of heating equipment, capacity of storage tanks, and piping design is determined by recovery capacity needed by a building. Water heating systems are designed for recovery capacities of 3 to 20 gallons per resident per hour. Storage capacity usually varies from approximately 8 to 20 gallons per person or approximately 30 to 65 gallons per living unit.

The majority of North American domestic hot water systems use storage hot water heaters consisting of a tank, insulation, and a heating device using gas, oil or electricity. Recent improvements in storage hot water heaters include more and better tank insulation and improved combustion systems. Most single family homes use direct storage water heaters that combine the heating device, heat exchanger and storage tank into one unit. The tanks are insulated with fiberglass or plastic foam insulation and covered with outer jackets or painted steel. Hot water exits the top of the tank and cold water enters through a tube extending to the tank's bottom. Since May 1980, all new storage hot water heaters sold in the U.S. must have an energy guide label. The energy guide label is intended for comparison shopping and not as a table for actual operating cost and performance. It features an estimated yearly operating cost, a bar scale comparing operating costs for similar models, and a table to allow the buyer to estimate the annual operating costs.

Fuels for water heating include: fossil fuel, electricity, solar energy and waste heat recovery. Each of the fuels can be used directly or indirectly. Direct water heating applies the fuel's heat to only one heat exchanger.[2] Indirect water heating applies heat collected by water or air in a remote area to heat the domestic hot water. This remote heat comes from a boiler, solar collector, or waste heat exchanger. Indirect water heaters employ two or more heat exchangers. In a standard gas water heater, combustion air enters the bottom, combines with gas, and rises through the flue (which is an annulus in the tank surrounded by water). The gases heat the water as they rise through the tank annulus.

Water heaters use energy in the following three ways.

1. Demand - energy used to heat incoming water as hot water in the tank is used up
2. Standby – energy used through heat loss through the storage tanks walls

[1] Hourly peak hot water flow rate in gallons per hour is known as the first hour rating or recovery capacity.
[2] A tank or pipes containing domestic hot water.

3. Distribution – energy used through heat escaping through pipes and fixtures.

The various efficiencies used for rating water-heating systems account for losses in the combustion process, standby losses, and distribution losses (all numbers are approximate):

- Combustion losses 10% - 30% of input
- Standby losses 0% - 70% of input
- Distribution losses 2% - 25% of input
- Output 35% - 70% of input

Table 1. Single Family House Data

Number of Residents	Annual kWh	Annual Therms[3]	Gallons Per Day
1	2700	180	25
2	3500	230	40
3	4900	320	50
4	5400	350	65
5	6300	410	75
6	7000	750	85

SOURCE: *Residential Energy: Cost Savings and Comfort for Existing Buildings* by John Krigger and Chris Dorsi.[4]

This information was summarized from *Residential Energy: Cost Savings and Comfort for Existing Buildings* by John Krigger and Chris Dorsi.[5] More information on energy savings features, and the full text of the *Builder's Guide*, can be found on the DNR Technology Assessment Division website at URL: http://www.dnr.louisiana.gov/tad and click on the *Builder's Guide* link.

[3] One Therm = 100,000 BTUs
[4] Author's interpretation of single-family house data from Energy Information Administration, Lawrence Berkley Laboratory, *Home Energy Magazine*, and others.
[5] John Krigger and Chris Dorsi, *Residential Energy: Cost Savings and Comfort for Existing Buildings*, Saturn Resource Management, Inc., Montana, 2004.