

Energy Implications of Wool Fleece Washing and Drying

For those who produce wool and wash the fleece at home rather than send it out to be commercially washed, there are standard recommendations to follow to successfully clean the fleece and to remove lanolin. The energy used in the process is primarily confined to heating the wash water. Some procedural changes can reduce the amount of hot water used, thus reducing energy requirements for the process.

Most home wool washing is done in large tubs (bathtub, stock tank, etc.) or in top loading washing machines. Most standard process recommendations call for washing fresh, dirty fleece in very hot water (140° F). Generally the process calls for one detergent wash (two if fleece is very dirty) and at least two rinses. Here are the steps:

1. Fill the wash vessel with the hot water.
2. Add ½ cup detergent for each 2 pounds of wool fleece (original blue Dawn™ detergent is most often recommended). Do not stir the water and create soap bubbles. These are very difficult to rinse from the fleece.
3. Gently place fleece in net sweater bags and place on top of water in tub or washer. Note: Don't use the agitate cycle in a washer, just let the fleece soak.
4. Let the water and detergent soak into the fleece. If the fleece doesn't sink into the water, you can gently push it down, but avoid excess handling, which causes felting of the fleece.
5. Allow the fleece to soak in the hot water for about 20 – 30 minutes. (Don't let the water get cold)
6. Pull the fleece bags out of the water and drain the dirty water. If using a washer, it is okay to use the spin cycle to drain the water from the fleece. But remove the bags of fleece from the vessel before refilling with water. Pouring water onto the fleece can result in felting.
7. If fleece is very dirty, complete a second water/detergent soak. If not very dirty, one detergent soak is probably enough.
8. To rinse, fill wash vessel with clean water that is the same temperature as the wash water. Place fleece bags on the water and allow fleece to settle in. Let fleece soak for a few minutes and remove (gently) from water. Drain rinse water and repeat the rinse process. A small amount of white vinegar can be added to the final rinse to help cut the soap residue.

Great care must be taken not to over-handle or agitate the fleece during the wash and rinse process to avoid felting of the fleece. The spin cycle on a washing machine does not harm, because all the wool is moving in the same direction. Never use the agitation cycle if washing in an automatic washer.

Drying Washed Fleece

Washed fleece should be air dried, so there is no energy input for drying. Washed fleece can be dried inside by spreading it out on a suitable drying rack that allows air flow around the fleece. The fleece should be turned over once during the drying process. It is also proper to dry fleece outdoors on a mesh rack set in the sun on a warm, breezy day. Care must be taken to keep pets or other animals from the fleece drying rack. Never dry fleece in a clothes dryer.

Energy Requirements for Fleece Washing

As stated before, energy is required to heat the water for the fleece washing. The hotter the wash temperature, the more energy required to heat the water. If an automatic washer is used, each wash/rinse/rinse cycle requires from 25 - 40 gallons of water. Three pounds of fleece divided into three mesh bags, will require as much as 40 gallons of water to thoroughly wash. If an electric water heater is used and its thermostat is set at 140°F, it will require about 9 kWh of electricity to heat the water

40 gallons of water @ 140°F
8.34 lbs/gallon of water
Supply water temperature = 55°F
Temperature rise = 85°F (55°F to 140°F)
1 Btu/1°F temp. rise/lb. of water
3413 Btu = 1 kWh
Water heater efficiency factor = 0.90

40 gal water X 8.34 lbs/gallon X 85°F temp rise X 1 Btu/1°F temp. rise/lb of water ÷
3413 btu/kWh ÷ 0.90 eff. Factor

$$\frac{40 \times 8.34 \times 85 \times 1}{3413 \times 0.90} = 9.23 \text{ kWh per 3\#fleece wash}$$

Cost of Energy per 3# fleece wash = 9.23 kWh x \$0.13/kWh = \$1.20

How to Save Energy

About the only way to save energy is to reduce the amount of hot water used for washing or to reduce the temperature of the wash water. Some say that moderately dirty fleece can be washed in warm rather than hot water. If the wash water temperature were reduced to 120° F, then the electricity requirement would be reduced to 7.06 kWh per complete wash for a savings of 2.17 kWh or \$0.28 per complete wash. If the wash water is not hot enough to remove the lanolin from the fleece, the savings will be lost in poor fleece quality.

Some suggest that cold water with Dawn dish detergent can effectively clean moderately dirty fleece. If cold water is used, the entire water heating cost of \$1.20 per 3# fleece wash can be eliminated. However, many are reluctant to wash in cold water.

If the rinse water temperature is reduced to 100°F then the cost of heating water for a complete wash cycle can be reduced to 6.34 kWh for a savings of \$0.38 per complete wash of 3# of fleece. However, there are numerous recommendations that rinse temperatures should be the same as wash temperatures to facilitate the removal of lanolin. Needless to say, the value of energy conservation measures is small and the risk to fleece quality could be significant. And remember, very dirty fleece may require at least 33% more hot water to accomplish a successful wash.

The easiest way to save energy without compromising quality is to be sure not to use more hot water than needed. If you are only washing a 2 pound batch of fleece, you should only need a total of about 27 gallons of water. It would only require 6.23 kWh or about \$0.81 to heat the water for two pounds of fleece. Thus, if you are washing smaller batches of fleece, be sure to use less water.