Dry faster with energy (heat)

The acronym of HAT is used for teaching drying – Humidity, Airflow and Temperature. These three elements make up what is called the drying pie. Increasing any of the "slices" would decrease the need for the others. The inverse would be true, as well.

Humidity and Airflow seem to get the most attention. Temperature control is usually limited to keeping the temperature in optimum range for dehumidifiers and the comfort of the occupants, but when properly applied, temperature, in the form of heat energy, can be a great help to drying.

Great advances have been made in recent years in drying equipment and methods, but there remains a bottleneck to our current drying systems. This bottleneck is evaporation. We have excellent equipment for removing water vapor from the air, but we have been limited in the ability to get the vapor into the air – evaporation. The surface water evaporates very quickly, but the water contained in the materials (hardwoods, carpet cushion, sub-floors, sill plates and wall boards) can take days to remove. If we could speed that process, we could speed the overall drying process.

How does evaporation work?

Water exists in three different phases – solid, liquid and vapor. What causes it to change from one phase to another? It is the addition of energy or heat. The phase change from liquid to vapor is our main concern and what we call evaporation.

Energy (heat) and airflow applied to directly to water (liquid) will speed the phase change to vapor causing evaporation. You have experienced this all your life. Here are two examples: One is a hair dryer – how can you step out of a long shower into a small room with water condensed on the all the surfaces, including the fogged mirror and even have visible vapor (steam), yet dry your hair with a hair dryer? Or why does it take water from an aquarium so long to evaporate, but a pot of water on a stove burner will evaporate very quickly? The answer is, of course, energy (heat).

Is there a way to gauge the evaporation potential of liquid in a material to see if the evaporation rate can be increased? Yes and here it is:

$$\mathbf{V_S - V_A = E}$$

$\mathbf{V_S}$ is the vapor pressure of the surface containing the liquid water. This is calculated using the temperature of the surface at equilibrium vapor pressure (100% RH).
$\mathbf{V_A}$ is the vapor pressure of the air directly above the surface of which we are trying to remove the moisture. This is calculated by measuring the temperature and relative humidity.
E is the evaporation potential. The higher the evaporation potential (difference in the vapor pressure of the surface and the surrounding air), the faster the evaporation may happen as long as there are no barriers preventing vapor transfer.

Raising the temperature (applying energy or heat) to the surface will have a much greater effect on the evaporation potential then lowering the grains (vapor pressure) in the air.

If you want to dry structures faster; consider using energy (heat) to your drying process.