EXTENSION EDUCATORS BUILD COST-FRIENDLY

Chance Marshall and Hudson Hill

Keeping thawed water in front of livestock during Wyoming winters is an ongoing struggle and more expensive than many realize.

Considering Wyoming residential electricity rates, running one 1,500-watt tank heater nonstop costs about $4 per day, about $120 per month. Commercial products can be expensive, so we decided to try building a solar-heated water tank from materials available from local hardware stores that could match their performance.

We chose to test our model against the 42-gallon Solar BT Sun Tank from Pine Ranch Products (www.ranchtanks.com), which is guaranteed not to freeze to -50°F. These tanks do not require electricity, battery hookup, or any outside energy source besides heat generated by the sun. The units collect thermal energy from the sun through glass and store the energy in the water inside of the insulation. These commercially available tanks ($781) can be filled daily with a garden hose or have a direct line attached with auto fill and shut-off float to keep the trough full. The manufacturer also claims these tanks will work regardless of animal usage frequency.

Data Collection

For this study, one Solar BT Sun Tank and one DIY stock tank are both being used in Fremont and Lincoln counties. Horses and cattle have unlimited access from November-March in each location. Each tank has temperature sensors that measure ambient temperature outside the tank and water temperature inside the tank. Data can then be uploaded into a computer software program where results can be compiled and compared.

Using Solar Thermal Tanks

One side of the tank must allow sunlight to penetrate for the tank to works to its highest performance. This side should face south. Heat from sunlight shining into the tank and heat from any water added to the tank must be captured. Determining how to maximize heat capture from the sun and providing effective insulation to reduce heat loss are key points for tank design.

Ease of use is also important. We wanted tanks that could be moved if needed and durable to the elements. We wanted components to be accessible for cleaning and repair.

Our Custom Tank Design

Our prototype materials included a 40-gallon Rubbermaid water trough; ½-inch plywood; 2x 4 lumber; 2-inch blue board insulation; ½-inch Plexiglas; black oil-based paint; handles; spray foam; caulk; screws; and washers. The water trough opening is 12x16 inches. Total costs were about $145.

Findings and Ongoing Modifications

After one winter, we found the commercial tanks were effective at keeping water above freezing at all ambient temperatures; however, the DIY prototype was ineffective during temperatures below 10°F.

We believe controlling heat loss is the biggest issue. We plan to modify our design to further minimize heat loss. The plastic float within the commercial tank, which covers the exposed water and thus reduces heat loss, turned out to be a valuable component that our prototype lacked. Our year-two model will include something similar to minimize loss of heat from the top.

To maximize heat capture, the year-two model will have a slightly upward-slanted sun permeable side instead of a flat side. Greater efforts will be taken to properly insulate and seal. A synthetic deck paint designed for protecting wood on wet surfaces will be used to help increase durability.

We hope with these simple modifications we will have a design that can be easily and affordably recreated and save money for livestock owners. At the very least, we can conclude that, even if our tank design will not keep water thawed during the most extreme temperatures, it is still likely to be a valuable option to use with a tank heater. The electric heater would only have to provide energy when the solar thermal energy was not enough.

Use of a solar thermal tank would likely offset electricity cost considerably when used in conjunction with a tank heater.

For any questions or ideas to share, please contact University of Wyoming Extension educators **Chance Marshall** *or* **Hudson Hill***. Marshall, based in Fremont County, can be reached at (307) 332-2363 or cmarsha1@uwyo.edu. Hill, based in Lincoln County, can be reached at (307) 885-3132 or hrhill@uwyo.edu.*

DIY SOLAR THERMAL STOCK TANK PROTOTYPE

Lessons from year one modify year-two model

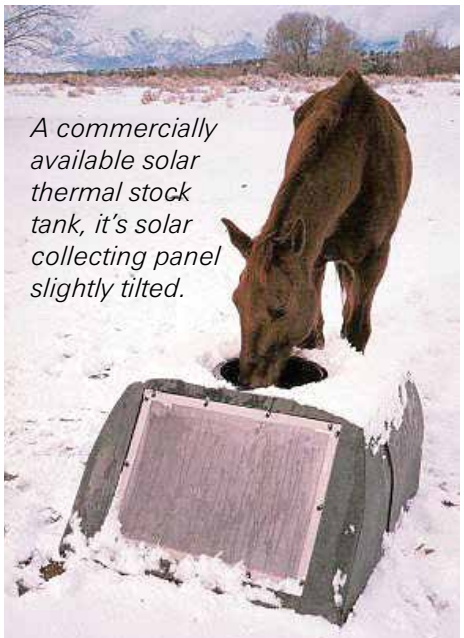
Hudson Hill cuts framing for the stock tank.

The 40-gallon tank

Hudson Hill and Milt Geiger install 2-inch blue board insulation.

Chance Marshall, left, and Milt Geiger, former extension energy coordinator, with the prototype. The heat collecting side is facing forward.

Framing of the second tank sits atop a finished unit. The wooden pocket holds the sensor.



A commercially available solar thermal stock tank, it's solar collecting panel slightly tilted.

A finished unit