

Solar Energy for the Household

Experiments, 2018 and 2019

Dale Andreatta

It takes a lot of energy to support a family, even in the developing world

- For cooking
- Water heating
- Space heating (depending on climate)
- Boiling drinking water (frequently not done due to lack of energy)
- Drying grain or firewood
- Other needs

Collecting wood takes a lot of time



Buying wood or charcoal takes a lot of money



Burning wood can be dangerous.....



.....for many reasons. Tending a fire takes a lot of work too.



What can the sun do to help us?

- Part 1: A general purpose heater and drier, very inexpensive and versatile
- Part 2: A solar water heater of a new type, inexpensive

Put down 5 cm of loose insulation such as straw, then black plastic



Use large buckets, full or partly full, for wash water. Jerry cans work too.



For space heating use many buckets then bring them indoors



Cover with clear or translucent plastic



Water for washing or space heating

- Perhaps 1 or 2 buckets for washing, heated to 50-60 C.
- Perhaps 6-12 buckets for space heating, heated to 45 C.
- Or heat water in jerrycans, heated to 50 C.

Dry corn or other grain

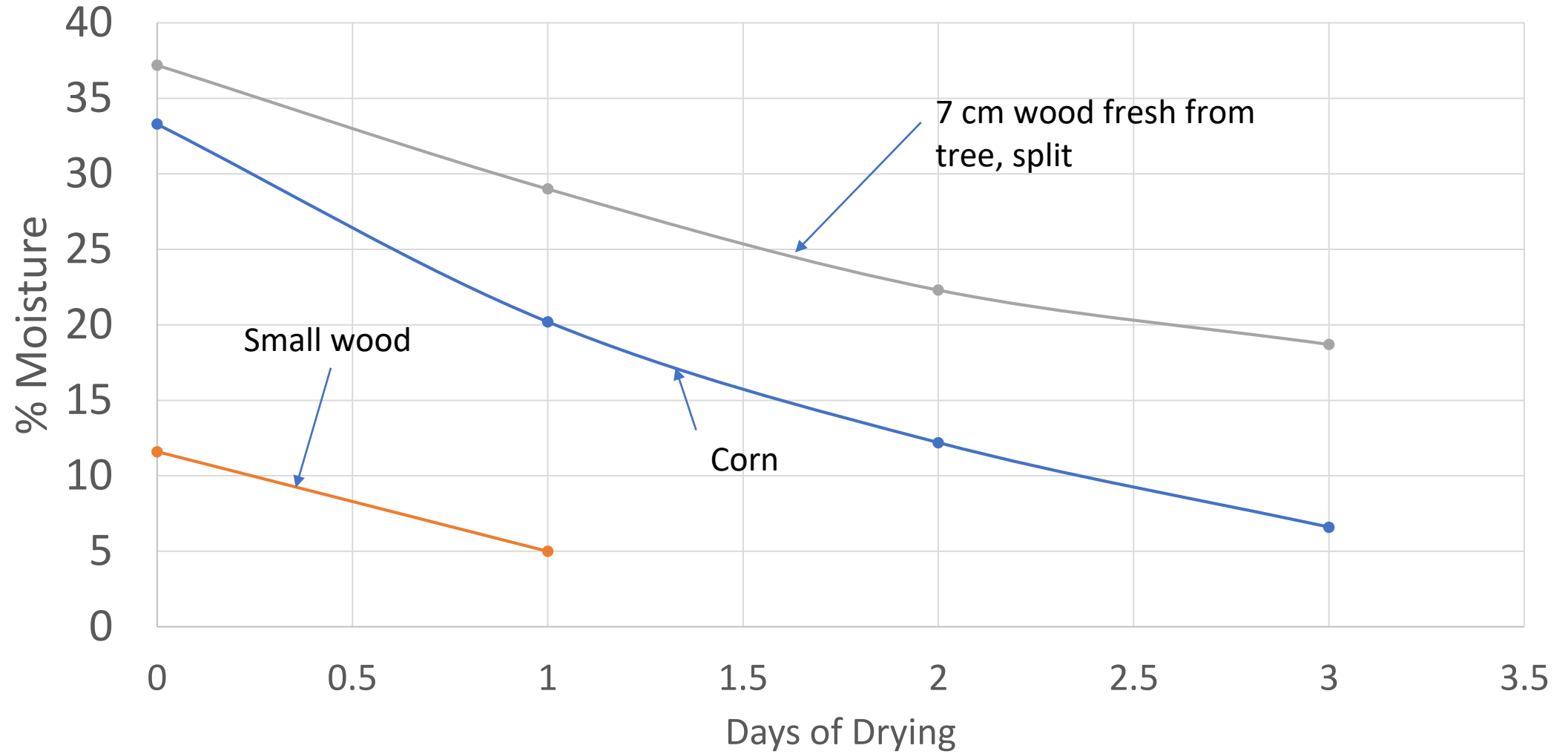


Dry firewood to make a less smoky fire

(rather than invent a better stove, invent a better way to dry wood?)



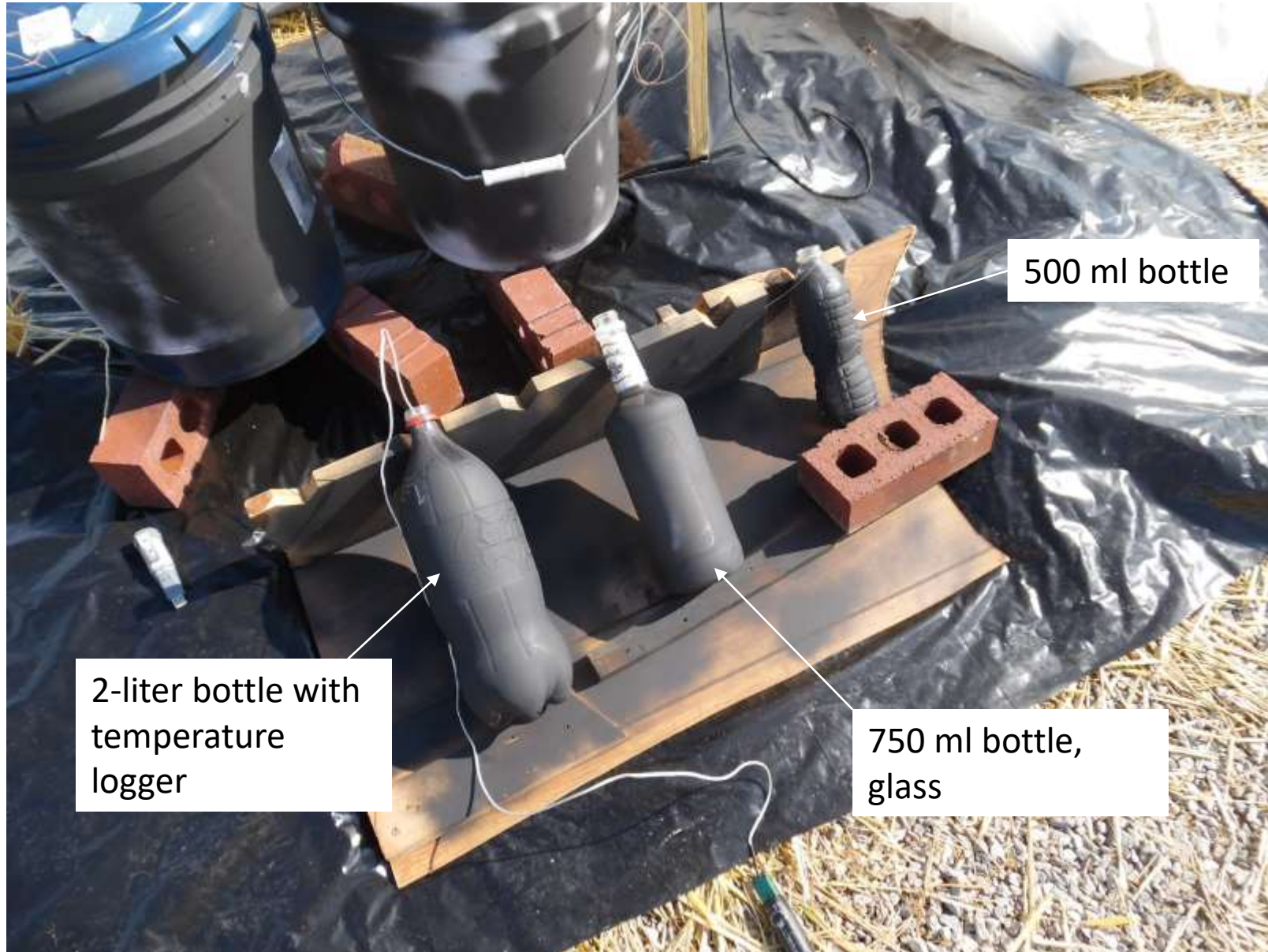
Some drying results



Basics of Pasteurization

- Pasteurization is the heating of a food or beverage to temperatures sufficient to kill all pathogens.
- For water, 65 C for a few minutes, or 60 C for 30 minutes is sufficient.
- This can be achieved in the general purpose heater with vessels of water up to 2 liters.
- It is NOT necessary to boil the water, as many people believe.

Pasteurize water in vessels up to 2 liters. Narrow neck on vessel helps prevent recontamination.



500 ml bottle

2-liter bottle with temperature logger

750 ml bottle, glass

In some areas, boiling is common

- About 1 billion people boil their drinking water.
- If 2 liters per person per day, with wood stoves of typical efficiency, this is about 100 million (metric) tons of wood per year, producing 147 million tons of carbon dioxide. This is about 0.5% of the fossil fuel carbon dioxide footprint.

The device easily achieves the 55 C necessary to kill insects and their eggs in dry clothing.



Preheat water for cooking up to 70 C, saving up to half the fuel, in the cookpot itself.
(Instead of a better stove, invent a better way to preheat water?)



If you have a little money and have piped water, but you don't want to spend \$1150 for this type of solar water heater.....



Use a low cost solar water heater

- Several types under development.
- Most advanced version shown in the following slides. Proof of concept shown, final design would be a little different.
- Cost is around \$100, can pay for itself in months with saved electricity costs.

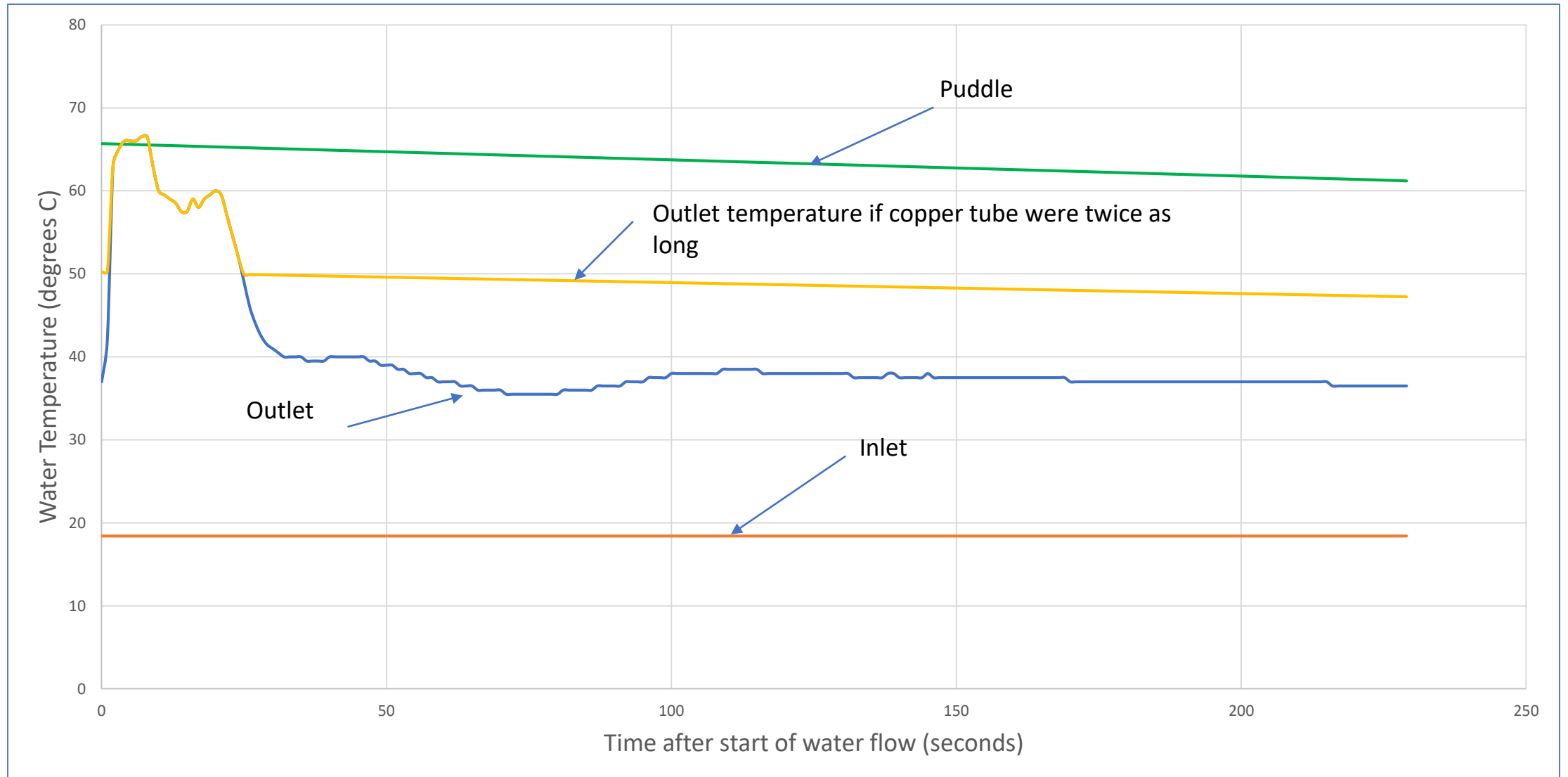
This is the working part of a “solar puddle”, a low cost energy collection and storage method



Solar puddle with top layers of clear plastic, forming an insulating air gap.



Results of water heater proof of concept test. In 4 minutes 8 gallons (31 liters) was produced, and outlet water was still warm. Blue line is measured outlet temperature. Yellow line shows approximate temperature if copper tube had been twice as long.



For more information

- Video at <https://youtu.be/6Z6snha3uHE>
- Contact Dale Andreatta dandreatta@sealimited.com