Engineering a Sweet Solution

Background:

Maple syrup has been collected through many different techniques dating back well before Europeans settled North America. Early Native American methods used a wedge of wood stuck into a v-notch to guide sap out of the tree into a basket. When Europeans began to tap maple trees, they used an auger and hollow wooden spouts. Though the materials changed over time from wood to metal, and now to plastic, this method is still heavily in use especially for small-scale maple operations. During the 1800s, evaporation methods began to change and become more effective. Producers began to shift from large pots and cauldrons to flat pans, increasing their surface area and evaporation potential. These large flat pans were improved more with a two pan system, one for initial evaporation and the other for finishing the product, and flues, channels along the bottom of the pan, were added to increase surface area further. Currently, plastic tubing connects maple trees directly to producers' sugar shacks, vacuum pumps help pull sap into their storage tanks, and reverse osmosis machines help to concentrate sugar content before the sap is even boiled. These modern advances have allowed for large-scale maple syrup production through out North America. Though they may look a long way from trees dripping into baskets, the general concepts are the same. Low sugar content sap is collected from the tree and is evaporated down until it is sticky sweet maple syrup.

References and Resources:

"The History of Maple Syrup" Maple Valley Cooperative. Retrieved 11 January 2019.
https://maplevalleysyrup.coop/the-history-of-maple-syrup/

"So, When Did it All Start?" Michigan Maple Syrup Association. Retrieved 11 January 2019.
https://web.archive.org/web/20110525093903/http://www.mi-maplesyrup.com/about/history.htm

Activity:

Designing a Maple Solution:

Goal: This activity works to have students think through an engineering process to retrieve sap from trees and bring it to their sugar shack.

Equipment:

- Colored pencils or other art supplies
- Paper

Procedure 1:

1. Introduce your students to the problem.
   You need a way to get sap out of a tree, collect it outside the tree, and transport it to your sugar shack.
   You can be as specific or as vague as you want with your students.

2. Have your students brainstorm a solution to this problem.
3. Let them sketch their solution and pair it with a written description.
4. You can have the class compare and contrast the different solutions thought up and the current systems in use in commercial maple production.

Procedure 2:

1. Introduce your class to two maple sap collection systems.
    a. Spouts connected directly to buckets.
    b. Tubing connecting spouts all the way to the sugar shack.
2. Have the students create drawings of each system
3. Have the class compare and contrast the two systems on the pros and cons of each.

Link to Standards: This links to engineering problem solutions and comparing different solutions and systems.