

## Student Scientist Investigates Bioenergy Potential of Pine Cones



**Above:** Arianna Fobbs measuring the mass of pine cones in preparation for burn testing

In October and November homes throughout Metro Detroit are littered with thousands of pine cones and leaves that have fallen from trees. In most cases homeowners either put the material in the trash or leave it on the ground to decompose into the soil. This approach is fine, but is there a bigger opportunity that homeowners are overlooking?

Arianna Fobbs, a student scientist in the Ecotek Lab program and a 7<sup>th</sup> grader at Anderson Middle School in Berkley, Michigan, is investigating the bioenergy potential of pine cones. Bioenergy involves producing energy from organic materials such as soy beans, wood, corn, food waste and algae. It is one of the fastest growing areas of the energy sector. Arianna's work centers on developing creative ways to use bioenergy to power small devices.

One key scientific measurement that she is focused on is the mass to energy yield ratio (net change in mass after combustion to the original mass of the pine cone before combustion). This is an important piece of data because it helps scientists measure how much of the feedstock is waste product and how much of it can be converted to energy. Answering her scientific question regarding the energy potential of pine cones will not be easy. Not all conifer trees are the same. There are three species of evergreen conifer trees native to the State of Michigan: pine (*Pinus* spp.), fir (*Abies* spp.) and spruce (*Picea* spp.). They produce cones and needles, rather than flowers and fruit.

Arianna has determined that the energy potential energy varies by species. For example in a recent experiment she noted an 80% mass to energy conversion for *Pinus* compared to a 50% mass to energy conversion for *Picea*. She has also learned how a pine cone manages its water concentration levels through the manipulation of its ovuliferous scales. When it needs to be hydrated, the scales are opened. Conversely, when the pine cone wants to keep water out or it has reached its optimum water concentration level, the scales are closed.

There are a lot of scientific clues that still have to be investigated. Based on her performance to this point in the research project, Arianna is on the right track and is well on her way to making her mark in the field of bioenergy.



Arianna using mini torch to conduct burn test



Pine cone biomass sample after going through mulching process



Low temperature stirling engine being powered by pine cone biomass

### About the Ecotek Science Program

Ecotek is a science research lab program for young inventors and researchers in grades 5 thru 12. Student scientists work on projects aligned with the issues being addressed by world leaders at the United Nations. To learn more about Ecotek Lab go to <http://www.ecotek-us.com>