



Bioenergy Badge

Description: The Bioenergy badge was developed in collaboration with [Michigan Department of Education](#). This badge is earned by youth who explore how Michigan's abundant natural resources, growing agriculture industry and emerging technologies are changing the face of energy and what it means to your family, Michigan and the world! Youth in the bioenergy track learn how renewable biofuels are created from plants. Students connect processes including photosynthesis, carbon accumulation in plants and soil and conversion of plant carbohydrates and oils to ethanol and biodiesel. Youth also learn about production, environmental and social implications of renewable fuels.

Criteria: (Recipient has done these specific things that demonstrate or as proof of the description)

Youth receiving this badge learned and practiced the following:

- Basic concept of photosynthesis which helped connect the plant energy source to conversion into a usable energy product
- Agricultural crops and residues that can be converted to renewable fuels
- Conversion processes including fermentation (ethanol plant) and transesterification (biodiesel) and the use of these energy products
- How to conduct a titration to optimize vegetable oil to biodiesel conversion
- Determine density of multiple types of biomass harvest packages (small bales vs. big bales, vs. loose biomass vs. pellets) and the impact on transportation cost of low density packages
- Basic carbon cycling – understand that the carbon in renewable fuels originated from CO₂ in the atmosphere, was fixed into carbohydrates in plants, converted to fuels, burned in a vehicle and emitted back into the atmosphere – compared to fossil energy where carbon source has been stored underground (coal, natural gas, petroleum) for millions of years, burned in a vehicle then emitted into the atmosphere.
- Public policy decision making related to encouraging the production and use of bioenergy

C5.r1b Explain how the rate of a reaction will depend on concentration, temperature, pressure, and nature of reactant. (recommended)

C3.4A Use the terms endothermic and exothermic correctly to describe chemical reactions in the laboratory.

B2.1A Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis.

B2.5C Describe how energy is transferred and transformed from the Sun to energy-rich molecules during photosynthesis.

B3.1A Describe how organisms acquire energy directly or indirectly from sunlight.