



# An Introduction to Bioenergy: Feedstocks, Processes and Products

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Bioenergy offers farmers an alternative to petroleum-based energy sources, and new market opportunities for farm products. When biomass feedstocks are burned, fermented or reacted through an energy conversion process, they return some carbon dioxide and water and release the sun's energy. Because plants have the capability to store and then release energy in this way, they act as a natural battery. This introduction to bioenergy offers a brief and non-technical overview of bioenergy feedstock production with discussion on how bioenergy is made.

## Introduction

Bioenergy uses renewable biomass feedstocks from many sources. Renewable biomass feedstocks use the process of photosynthesis in plants to capture the sun's energy by converting carbon dioxide (CO<sub>2</sub>) from the air and water (H<sub>2</sub>O) into carbohydrates and complex oil and fiber compounds made up of carbon, hydrogen and oxygen. These energy-rich carbohydrates, oils and fibers can be harvested and used for many types of bioenergy. There are hundreds of ways to turn biological materials into energy, although currently only a few of them represent legitimate short-term opportunities for the average farm or rural landowner.

Bioenergy was used in industrial processes well before petroleum and coal-fired electricity were commonly available. Although a great deal of attention goes to solar and wind energy, bioenergy BTUs (British thermal units of energy) generated from biomass make up 53 percent of all renewable energy in the United States, according to the Energy Information Administration. That is more than all other renewable sources combined (EIA, 2009). However, bioenergy presents a complex set of energy topics. This publication will discuss many of these complex topics but will only mention others. Topics that will not be discussed in any detail in this introductory publication include most feedstock pre-processing considerations such as transporting, sizing, drying and storage.

## Feedstock Basics

Bioenergy can be produced from feedstocks such as trees, agricultural crops, plant residues,



Carbon cycling is the foundation of sustainable bioenergy. Source: BC Bioenergy Strategy.

animal parts and many other biological materials. The benefits of one feedstock versus another are regionally specific. This makes feedstock selection a key consideration in bioenergy production.

Feedstocks may be dedicated to energy production or non-dedicated. Feedstocks that are dedicated are often called energy crops. Each feedstock has advantages and disadvantages that may include how much usable biomass they produce, soil types required, water and energy inputs, energy density, air quality benefits, production cost and other considerations.

## Sugar and Oil Feedstocks

Sugar and oil feedstocks often include seeds, grains and plants that are made up of sugar, starch or oil, and animal fats or tallow. Today, these feedstocks are often used to produce the biodiesel and ethanol fuels we are familiar with.

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