

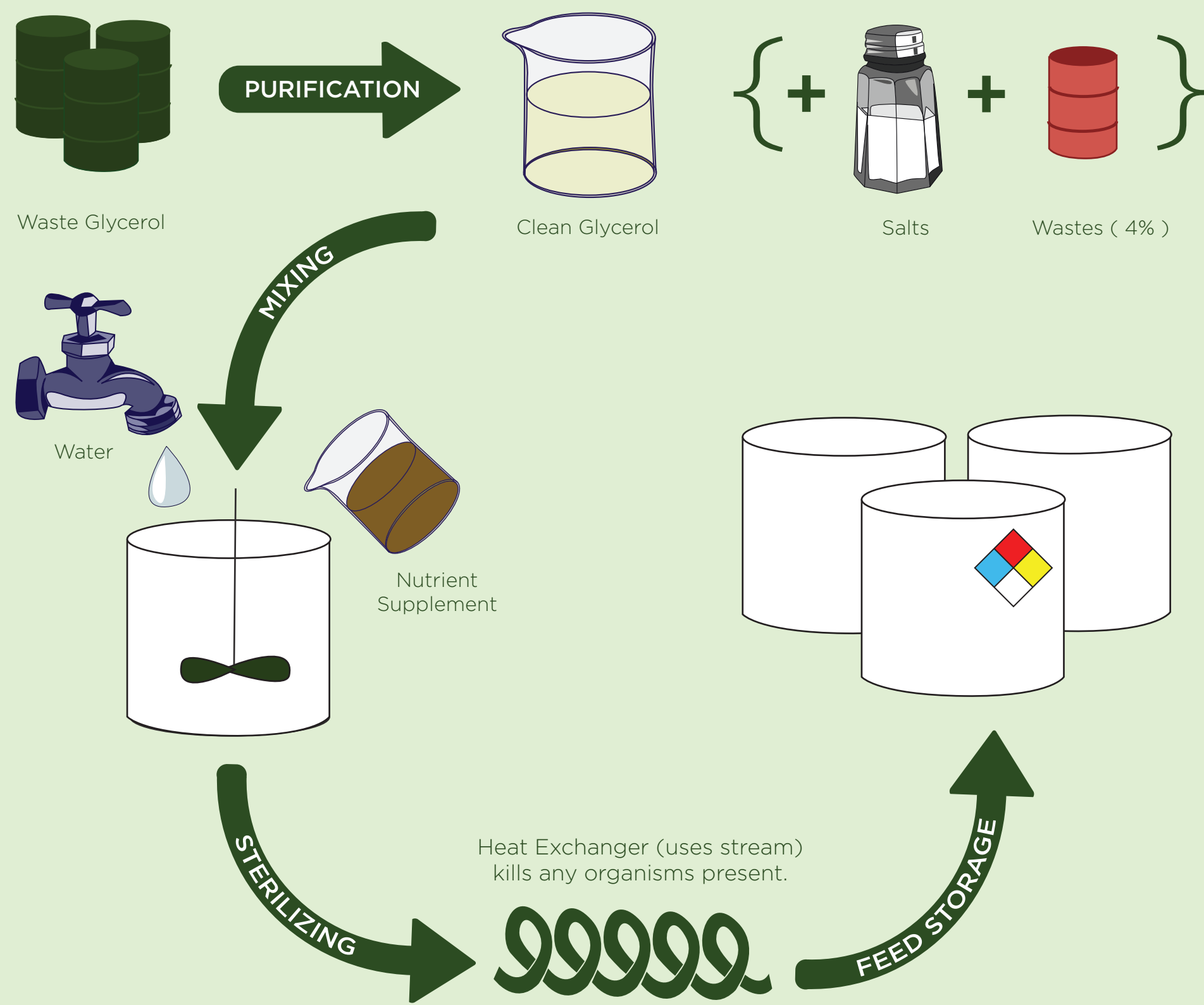
An Alternative to Corn-Derived Ethanol: Turning Waste Glycerol Into Fuel

Bacteria can grow on almost anything...

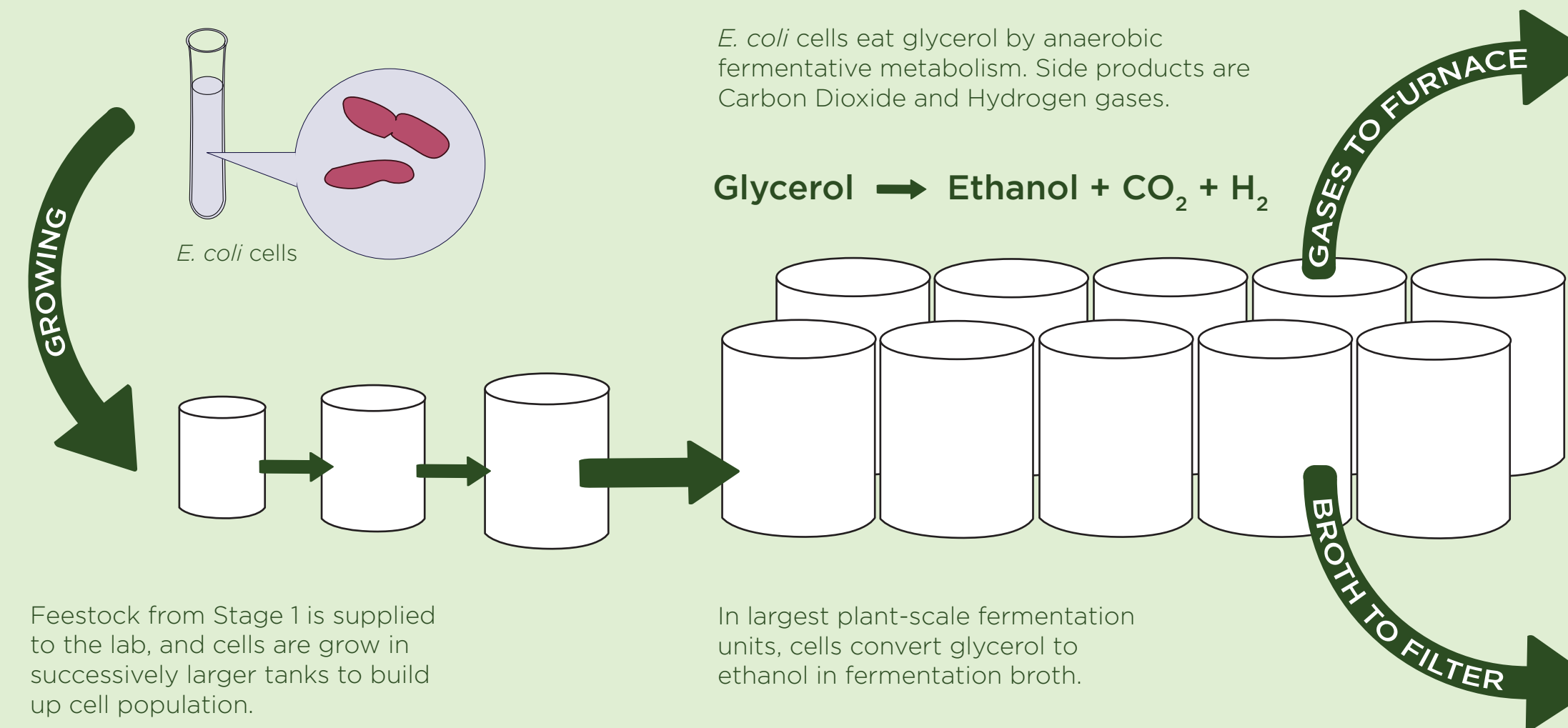
As you may know from personal experience! Do you drink beer? If you do, you may also know that when bacteria are deprived of oxygen, they ferment sugars to make ethanol in order to live. Bacteria can also ferment glycerol to make ethanol, which can be used as a fuel or as a fuel additive.

The scaled-up process for the fermentation of glycerol to ethanol has three stages, which are outlined here.

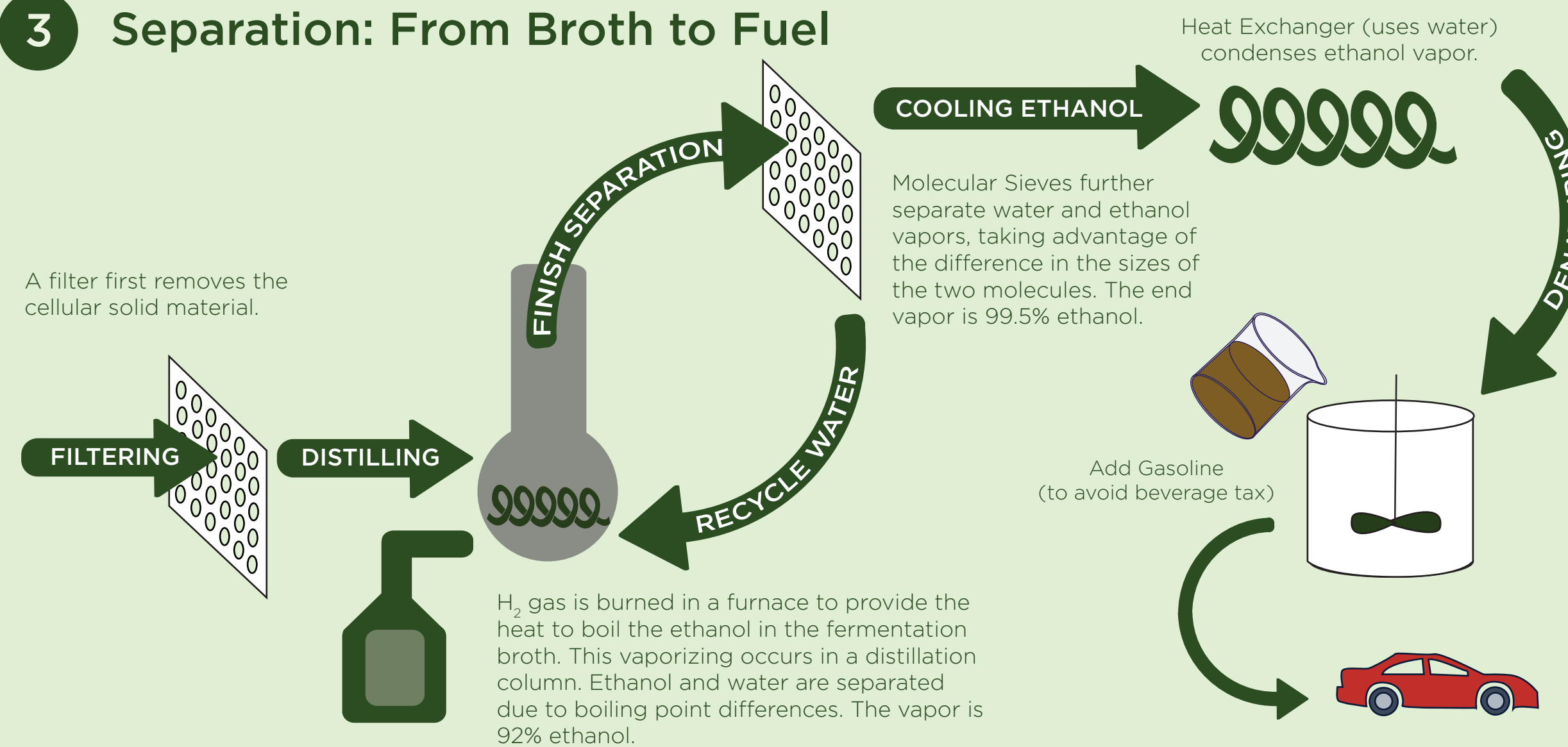
1 Glycerol Purification and Feedstock Preparation



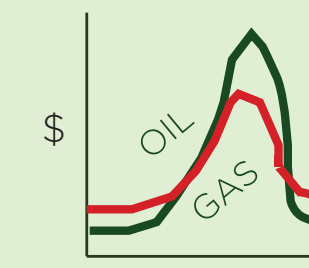
2 Fermentation: From Lab Scale to Plant Scale



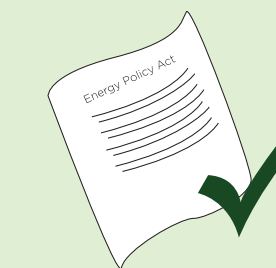
3 Separation: From Broth to Fuel



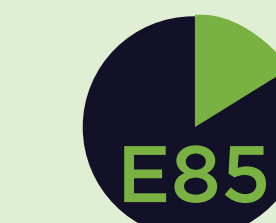
Why Make Ethanol?



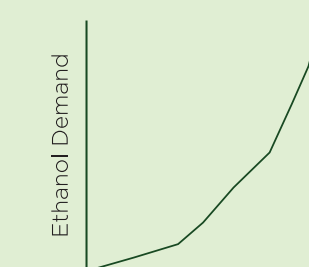
Highly variable crude oil and gasoline prices, along with political instability, have also led to the desire for energy independence in the United States.



The Energy Policy Act of 2005 established the renewable fuels standard (RFS), which directs that gasoline sold in the United States contain a specified minimum volume of renewable fuel. The total volume of renewable fuel to be used starts at 4 billion gallons in 2006 and increases to 7.5 billion gallons in 2012.



The Act also prohibits petroleum companies from restricting the sale of alternative fuels under new franchise agreements, a provision that could allow gas station owners to install more pumps for E85, a blend of 85% ethanol and 15% gasoline.



Ethanol demand is increasing. Prices will be high in light of political support for "green energy."

But, Why Use Glycerol?



Historically, ethanol has been produced by fermentation processes, which require an abundance of a sugar source as food for microorganisms.



The most abundant and cheapest sugar source in the U.S. has been corn grown in the Midwest, or "The Corn Belt." However, corn as a fuel source has been heavily debated in the "Food versus Fuel" discussion. A new sugar source is needed for truly renewable energy and energy independence.

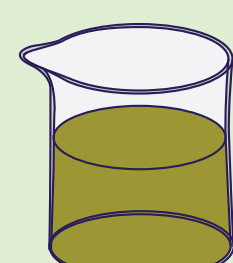
How is Glycerol Made?

Glycerol is a byproduct of the production of Biodiesel from vegetable oils.

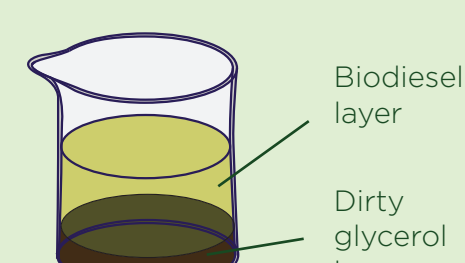
For every 100 kilograms of biodiesel produced, 10 kilograms of glycerol is produced.



Soybeans are an alternative crop that are known for restoring nutrients and balance to soil.



Soybean Oil is made from pressing the harvested beans. The oil is used for cooking, and then sent to biodiesel plants.



The used oil is reacted with alcohol to create biodiesel and glycerol, which separate into layers.



The glycerol produced during biodiesel manufacturing is not clean enough to be used for soap-making.



The crude glycerol is stored as waste. But how can it be used?

Researchers Dharmadi and Gonzales at Rice University have shown that crude glycerol can be used as a fermentation sugar source to make ethanol.