







## The Advantages of BRI Energy's Technology ... At a Glance



Features	BRI Energy	Comments
Plant capacity: millions of gallons per year (or range, if different designs available)	10-230 MG/yr	
Is plant capacity modular - i.e. capable of being increased in stages?	BRI's plants are modular and can be easily expanded. A single module combines 2 gasifiers, 2 fermenters and 2 distillation columns. A mid-sized plant could process 1 million tons of feedstock per year, producing 80 MG of ethanol and generating 50 MW of power, 35 MW of which is excess to the plant operation. Such a plant would require 10 modules and approximately 30 acres.	
Type of process 	gaseous substrate fermentation	The U.S. Department of Energy has defined this as a scientifically recognized method of producing cellulosic ethanol separate from the more widely know method called "enzymatic hydrolysis." This process can convert a much broader range of feedstock (including urban, agricultural, and forestry waste) than either sugar fermentation or enzymatic hydrolysis. It also is much more energy efficient, faster and economical.
Type(s) of feedstock used 	<b>Any carbon-based material</b> whose moisture content is less than 40% (by weight): woody plants, ag & forestry wastes, manure, noxious and invasive plants, algae, hydrilla, municipal wastes (from landfills, sewage treatment plants & other disposal sites); includes plastics, tires, paper & yard wastes, construction debris, furniture, grease, tar & hazardous wastes. Only the inorganic fraction is not converted.	Different designs utilize different feedstocks. Some are limited to a single feedstock such as: (1) corn, (2) sugar beets and sugar cane, or (3) cereal grains. Research still is being done to perfect commercially viable applications of other designs that can convert woody plants such as willow, poplar, switchgrass and miscanthus to cellulosic ethanol.
Does feedstock have to be chipped, shredded, sorted	<b>No</b>	
Can feedstock include glass, metal and other "impurities"?	<b>Yes</b>	
Can different feedstocks be mixed?	<b>Yes</b>	Feedstocks can be mixed to lower combined moisture content below 40%
Is sterilization necessary?	<b>No</b> , CO in syngas eliminates most contaminants	
Gallons of ethanol produced per dry weight ton of carbohydrate 	<b>70-85 gallons; 150+ gallons</b> if high BTU content materials are used such as plastics, used tires or coal	
Annual water requirement 	Can produce <b>surplus</b> . See next line	
Gallons of water used per gallon of ethanol produced	Depends upon the moisture content of the feedstock. With water recycled through the plant, water consumption ranges from a surplus to the use of 0.4 gallons per gallon of ethanol	
Fermentation time required to turn feedstock into ethanol	<b>2 minutes or less</b> This is one of the great strengths of the BRI Process. Rapid biochemical conversion, plus the fact that the process creates 3 revenue sources, makes the technology highly profitable, even without subsidies.	Compares with 36-48 hours for other processes currently in use

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What temperatures and pressures are used in fermentation process?	The bacterial culture operates at human body (ambient) temperatures. Ambient pressures also are used, minimizing capital and energy costs	
Does fermentation produce only ethanol or ethanol and other products?	<b>Fermentation is highly selective, only produces ethanol</b> , eliminating need for additional costly processing to separate ethanol from other products	
Power required for completion of fermentation	The power required for completion of the fermentation process is minimal. Electricity is required to operate the agitation and other systems controlling the bioreactor tank.	
Other inputs 	The first step of the BRI Process is "gasification" where the feedstock is heated to break apart the complex carbon molecules and form carbon monoxide gas (CO). The heat required for this process is generated by igniting the feedstock, then by introducing oxygen. The CO gas exits the gasifier at over 2,000° F., then must be cooled to 100° F. This cooling produces steam, which in turn generates electricity.	
Power required for annual plant operation 	Varies according to plant size. <b>BRI plants generate between 40-60% more electricity than is required to operate them</b>	Next to the purchase of feedstock, energy is the second highest cost of operation for most existing designs
Power produced 	For each gallon of ethanol produced, the BRI Process generates an excess of power for sale	
Other saleable products 	Ammonia for fertilizer and protein for animal feed (from the bioreactor purge). Excess hydrogen also is produced; when fuel cells become available to power automobiles, the BRI process can be used to create hydrogen.	
Waste products produced requiring disposal or treatment	Sludge results from the scrubbing of the synthesis gas prior to when the gas is fed to the bacterial culture	
Ash stream	Non-hazardous ash, 5-10% of raw material, can be used in concrete and paving, or if from woody plants, land applied as soil enhancer	
Purge of spent cells from fermentation	Goes to wastewater treatment or is recycled back to gasifier	
Potential pollution problems 	The bacterial culture is anaerobic and dies when exposed to air. It has a Biosafety Level 1 health hazard rating (the lowest possible for microorganisms). <b>The process creates no environmental or health hazards, ground or water contamination, and minimal air emissions.</b> Residue is a non-hazardous ash.	
Other features 	The conversion of a waste stream, the disposal of which is costly, into a valuable fuel adds both environmental and economic incentives. Yields are high because all of the raw material, except the ash and metal, is converted to ethanol.	Sugar fermentation has been the only process to commercially produce ethanol from biomass. However, production is possible in the U.S. today only because of state and federal subsidies (a 52-cents per gallon federal subsidy, plus additional incentives ranging from five to 28-cents per gallon in the corn-producing states).

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