

Advanced
Torrefaction
Systems, LLC

**Producing Biocoal at a cost on par with industrial wood pellets and
delivering them to the end user at a lower cost**

**Manufacturing and Logistics Similarities & Differences between
BIOCOAL AND INDUSTRIAL WOOD PELLETS**

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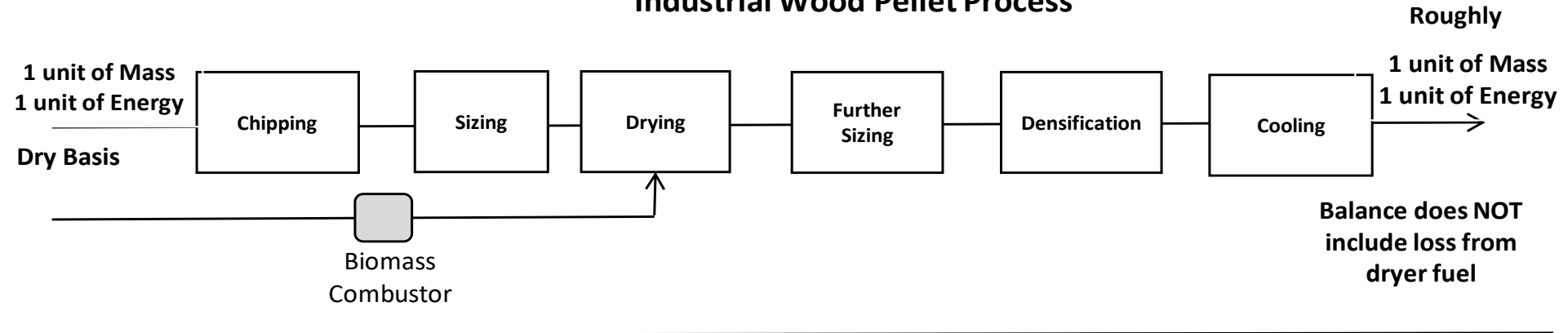
Although the processes to produce BIOCOAL and industrial wood pellets are similar, there are significant differences that impact the costs of production as described in the chart below:

	In the production of BIOCOAL:	Impact compared to Industrial Wood Pellets
-	A torrefaction step is required	Requires additional manpower – higher capital
+	Supplemental fuel for drying is reduced by as much as half	Combustor is smaller with BIOCOAL – lower capital required and lower emissions
+	The torrefaction system supplies as much as half the energy required for drying	Energy from the combustion of the volatiles
+	The electrical power for grinding post torrefaction and prior to densification is reduced by as much as 90%	Significant electrical power savings – lower capital required
+	75% less finished product requiring densification	Lower electrical power and manpower – lower capital required

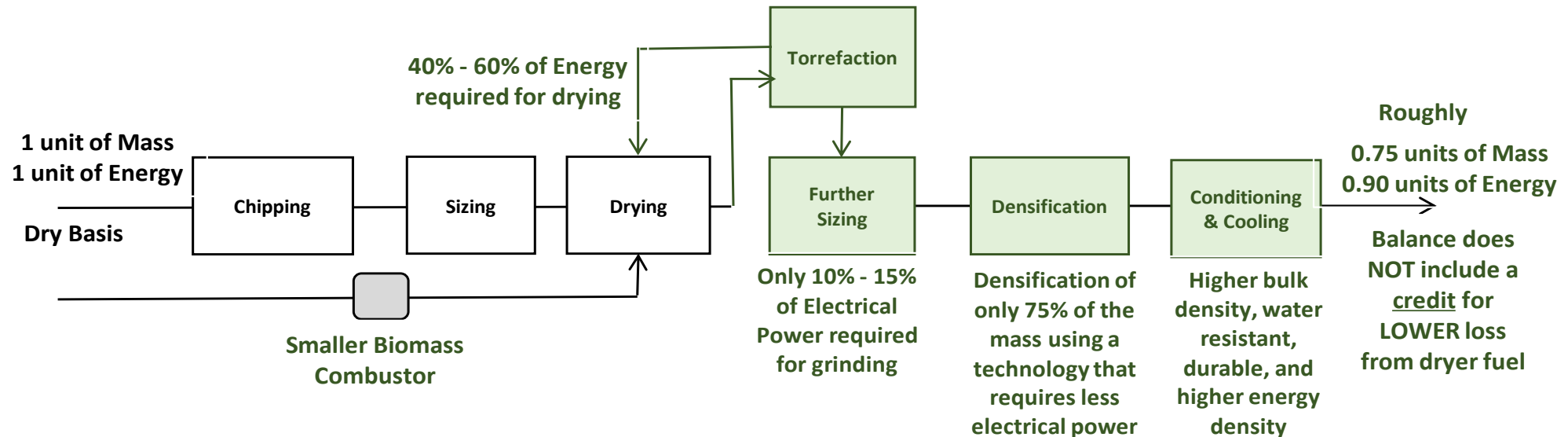
When all the pluses and minuses are netted out, on a “per unit of energy basis” the cost to produce BIOCOAL is on par with the cost to produce industrial wood pellets.

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Industrial Wood Pellet Process



Torrefaction Process



Equivalent Manufacturing Cost – Lower Logistics Cost – Lower End-User Costs – Superior Solid Fuel

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LOGISTICS COST SAVINGS ARE TREMENDOUS AND REAL:

It costs much less to ship **BIOCOAL** than it costs to ship industrial wood pellets:

- **Trucking Cost** – Transportation by truck is weight limited. A truckload of industrial wood pellets is transporting only 440 GJ of energy. A truckload of BIOCOAL is transporting approximately 550 GJ of energy – a **25% increase!**
- **Rail Cost** – Transportation by rail is volume limited. A railcar of BIOCOAL will contain over **40% more energy** than a railcar of industrial wood pellets.
- **Sea Freight Cost** – Transportation by ship is volume restricted. A shipload of BIOCOAL will contain over **40% more energy** than a shipload of industrial wood pellets.
- **Port Cost** – There are significant capital and operating cost savings at shipping and receiving ports.

Differences between BIOCOAL and Industrial Wood Pellets:

- Higher bulk density, kg/m³, by approximately 12%
- Higher energy density, MJ/Kg, by approximately 25%
- Higher energy density, GJ/m³, by 40%
- Water resistant – can be stored, shipped, and handled just like coal
- No special storage required at the manufacturing plant or at the ports

An Additional Advantage of BIOCOAL – Significantly Lower Storage & Handling Costs at the Power Plant