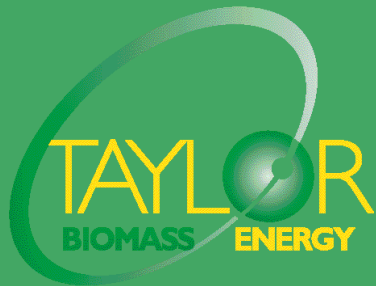


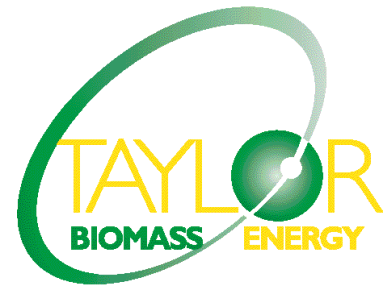
Overcoming the Biomass Barriers, the Taylor Gasification Process



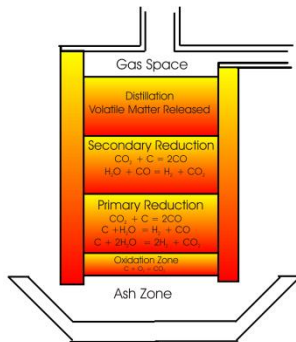
Mark A. Paisley, PE
Taylor Biomass Energy, LLC

Biomass is a Great Gasifier Feedstock - but . . .

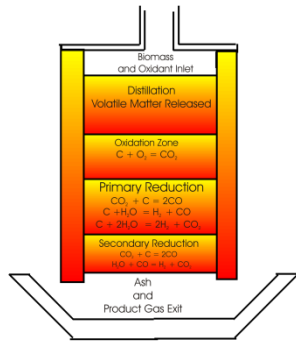
- *Supplies can be limited in a given area*
- *Feeding and Handling Issues*
- *Byproduct Differences*
- *End Use of Products*



Generic Types of Gasifiers



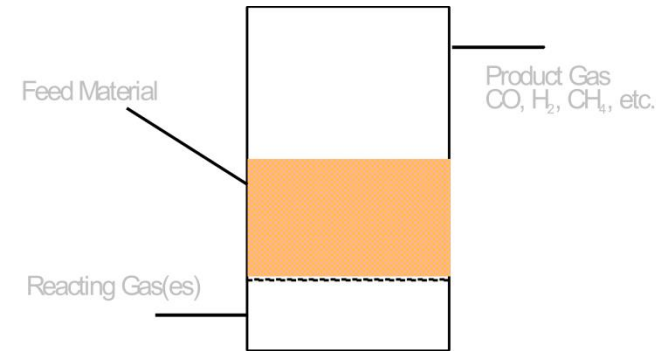
Fixed Bed Gasifier – Updraft Configuration



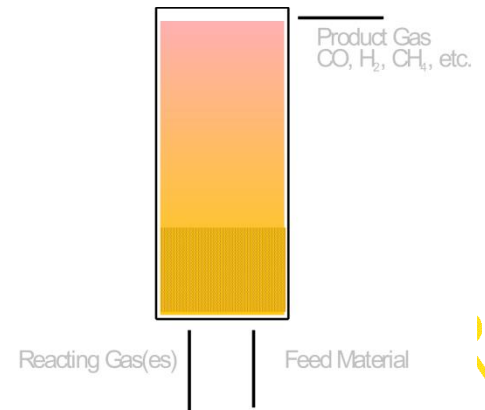
Fixed Bed Gasifier – Downdraft Configuration

All can be either “air” or “oxygen” blown

Heat generally provided by “burning” within the reactor



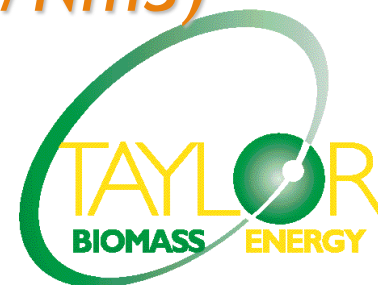
Fluid Bed Gasifier



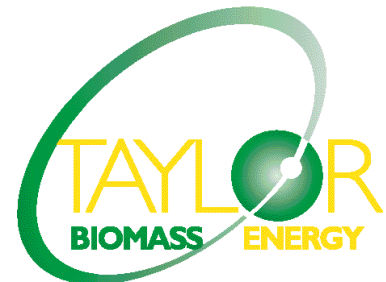
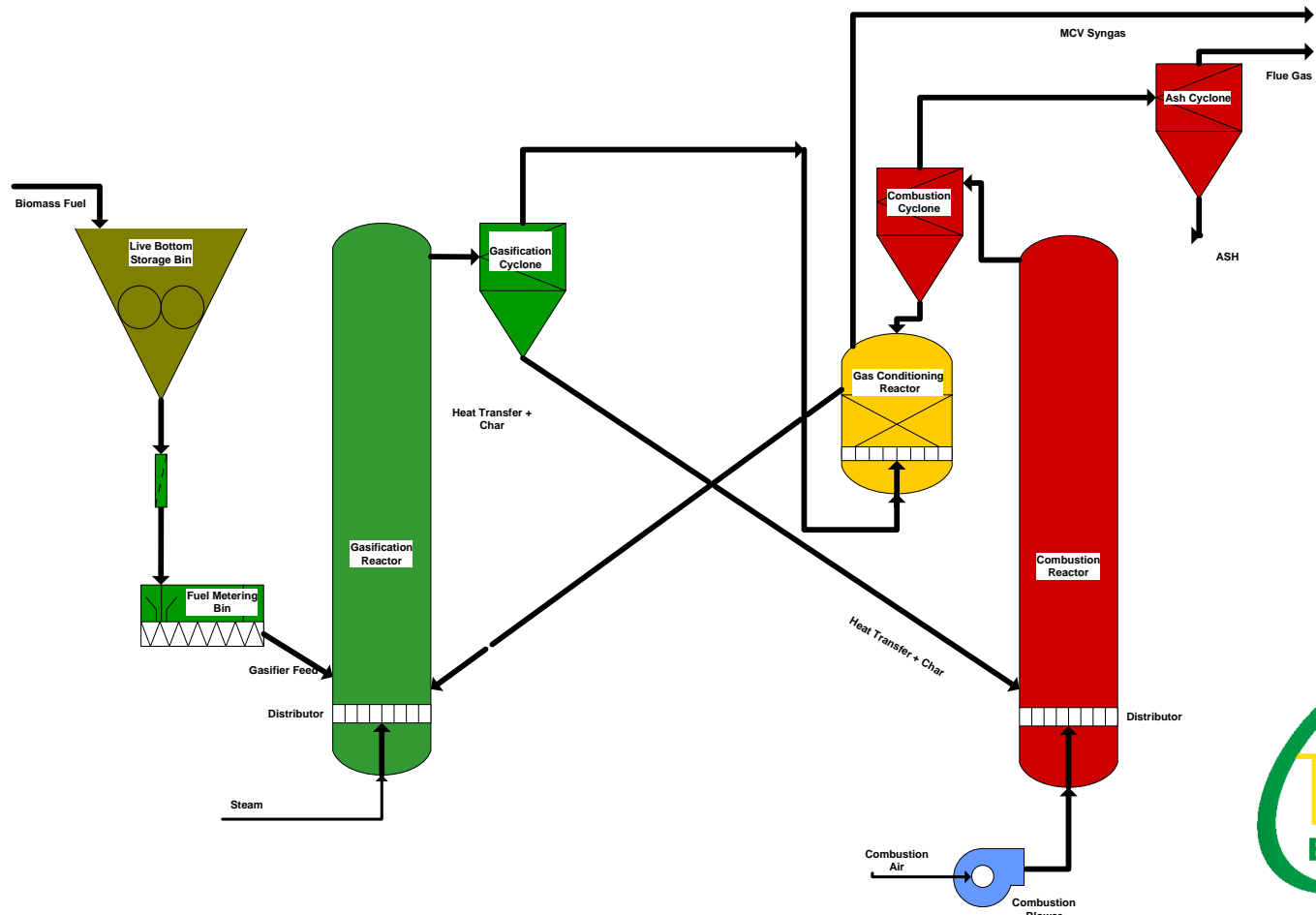
Entrained Gasifier

Types of Gasification Systems

- *Air blown* -- ~150 Btu/scf
(3.5-7 MJ/Nm³)
- *Oxygen blown* -- ~300 Btu/scf
(7-15 MJ/Nm³)
- *Indirect* -- ~350-500 Btu/scf
(13-20 MJ/Nm³)

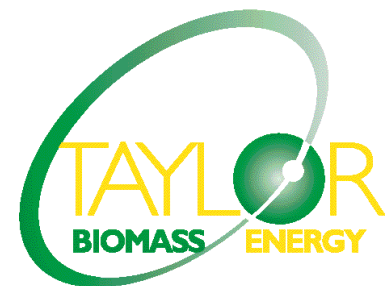


Taylor Gasification Schematic Process Diagram



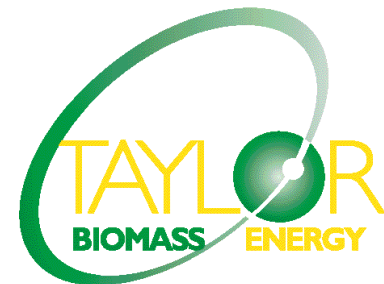
Biomass is not Coal

	<i>Coal</i>	<i>Biomass</i>
● <i>Moisture Content</i>	<i>~10%</i>	<i>~50%</i>

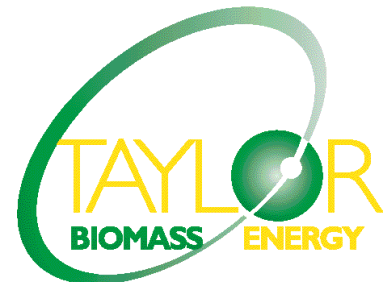
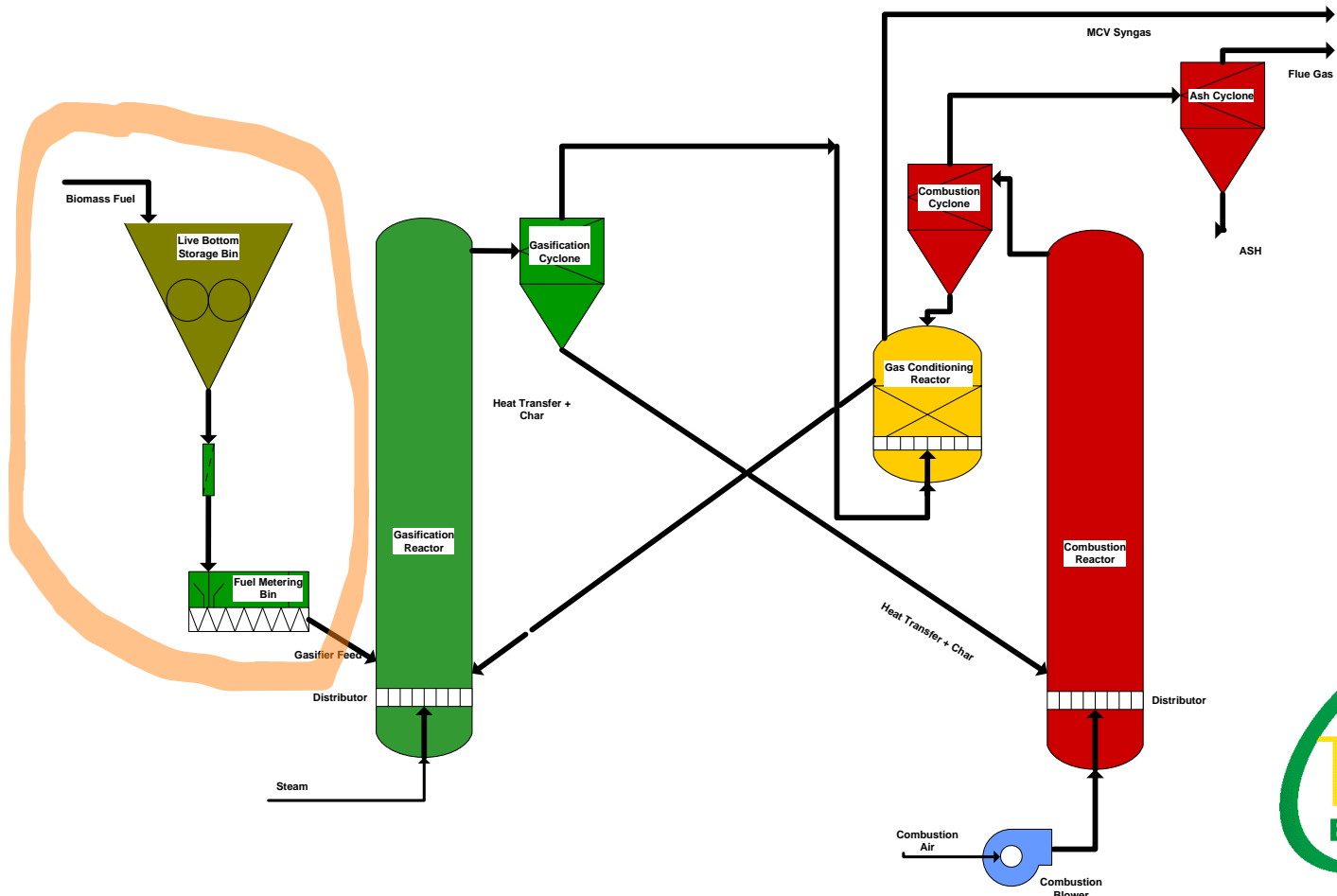


Biomass is not Coal

	<i>Coal</i>	<i>Biomass</i>
● <i>Moisture Content</i>	<i>~10%</i>	<i>~50%</i>
● <i>Density (kg/m³)</i>	<i>700 - 1100</i>	<i>150 - 200</i>

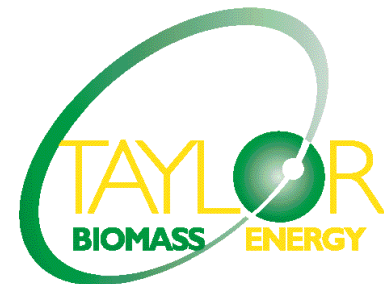


Taylor Gasification Schematic Process Diagram

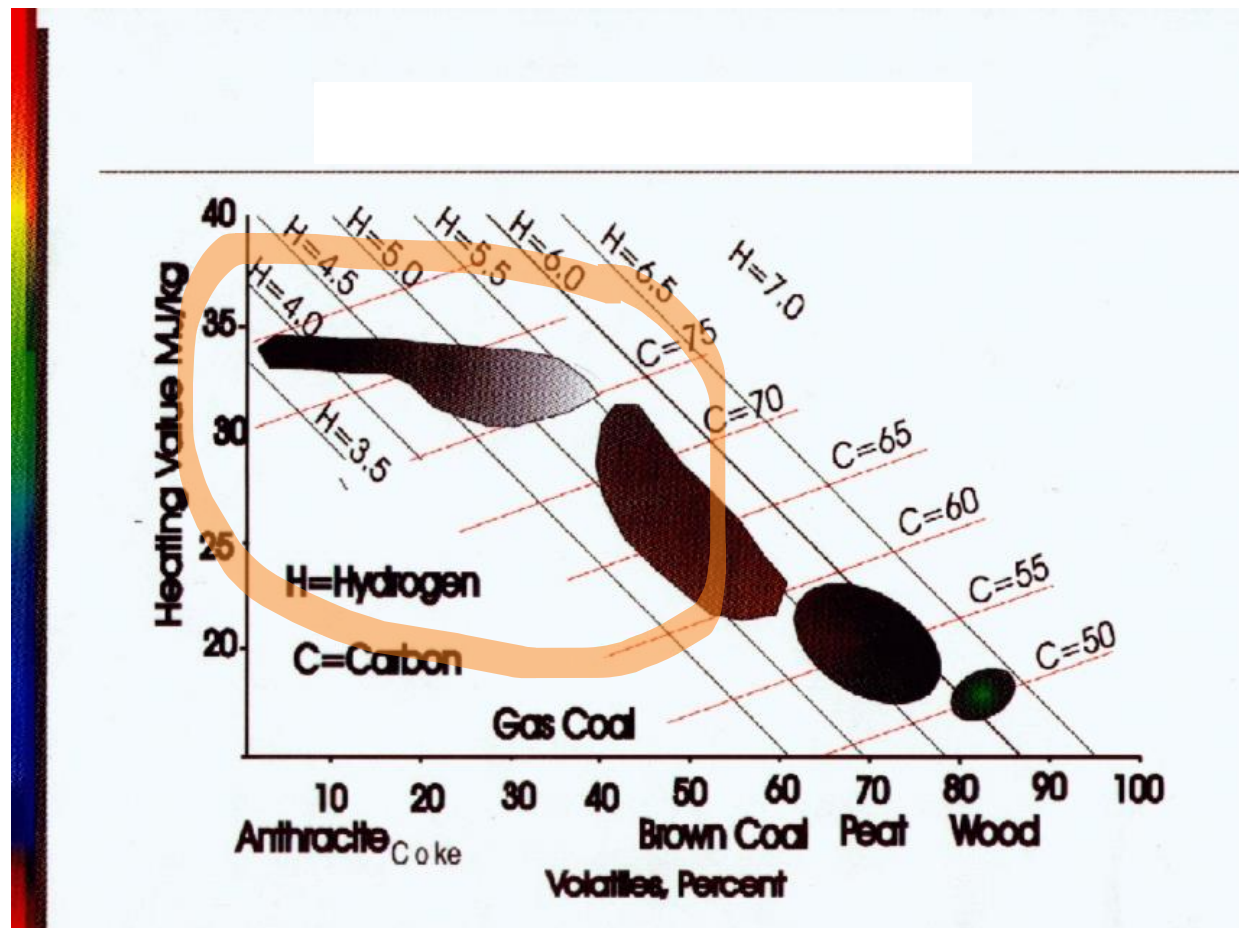


Biomass is not Coal

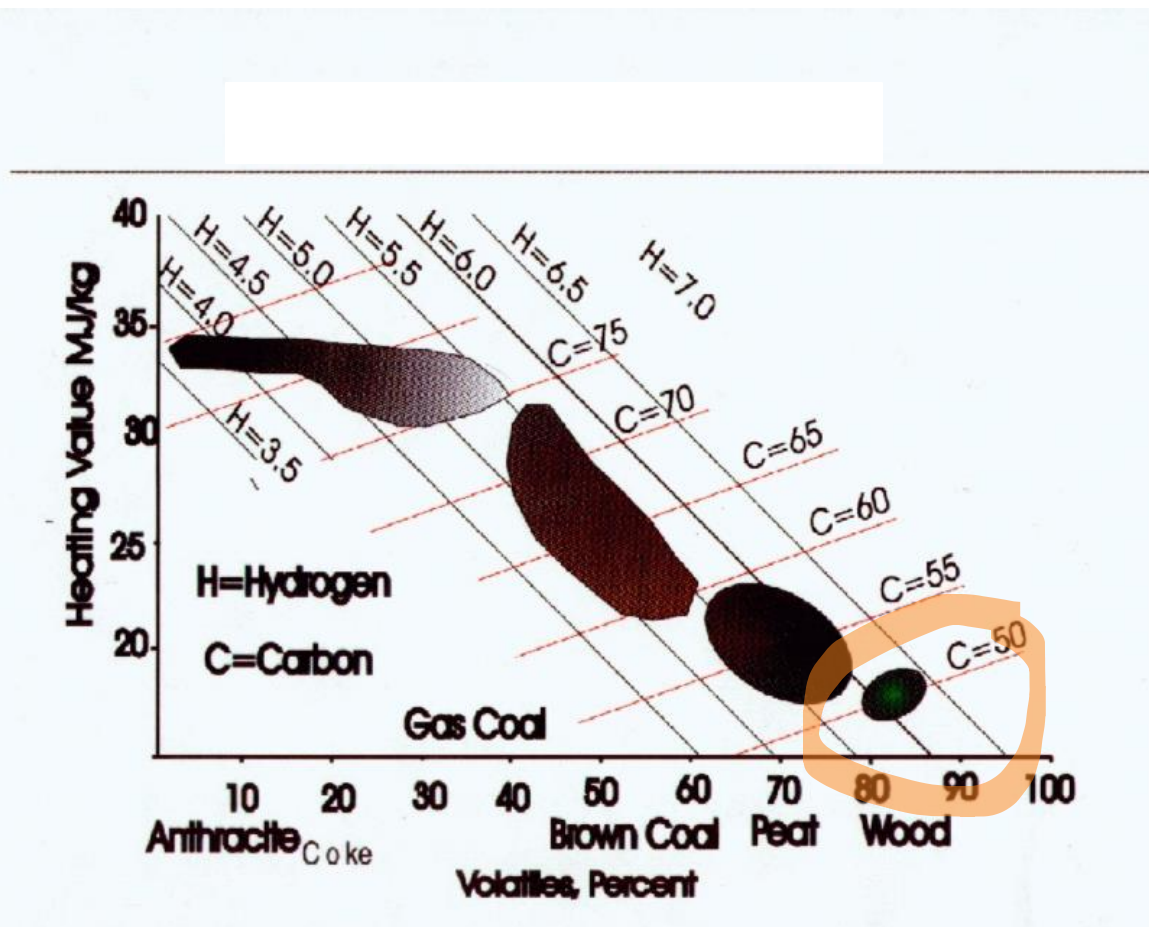
	<i>Coal</i>	<i>Biomass</i>
● <i>Moisture Content</i>	<i>~10%</i>	<i>~50%</i>
● <i>Density (kg/m³)</i>	<i>700 - 1100</i>	<i>150 - 200</i>
● <i>Chemistry</i>	<i>more “fixed” C</i>	<i>less C</i>
<i>VM</i>	<i>25-30</i>	<i>75-80</i>
<i>HHV (MJ/kg)</i>	<i>~20</i>	<i>18-20</i>



Chemical Makeup of Various Fuels

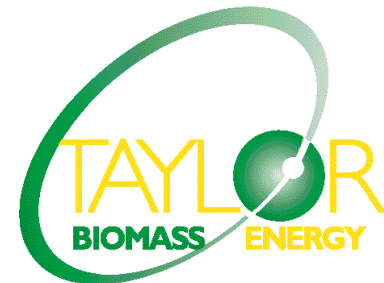


Chemical Makeup of Various Fuels

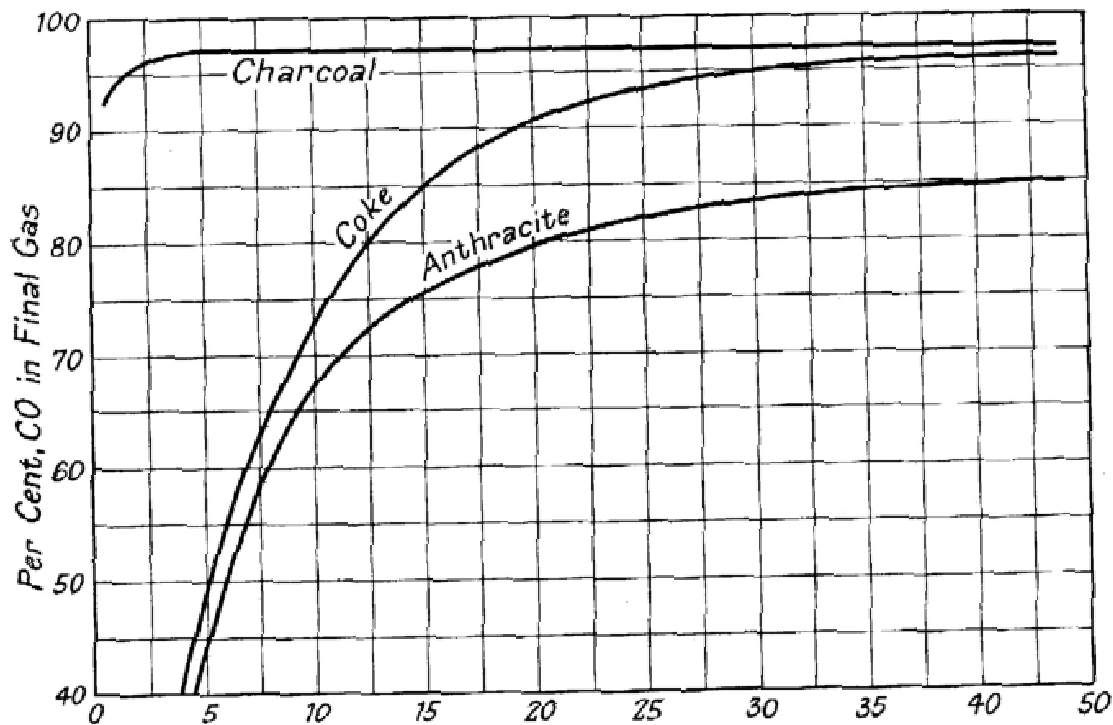


Biomass is not Coal

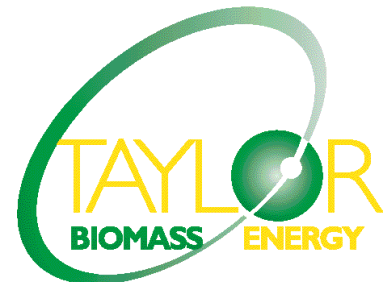
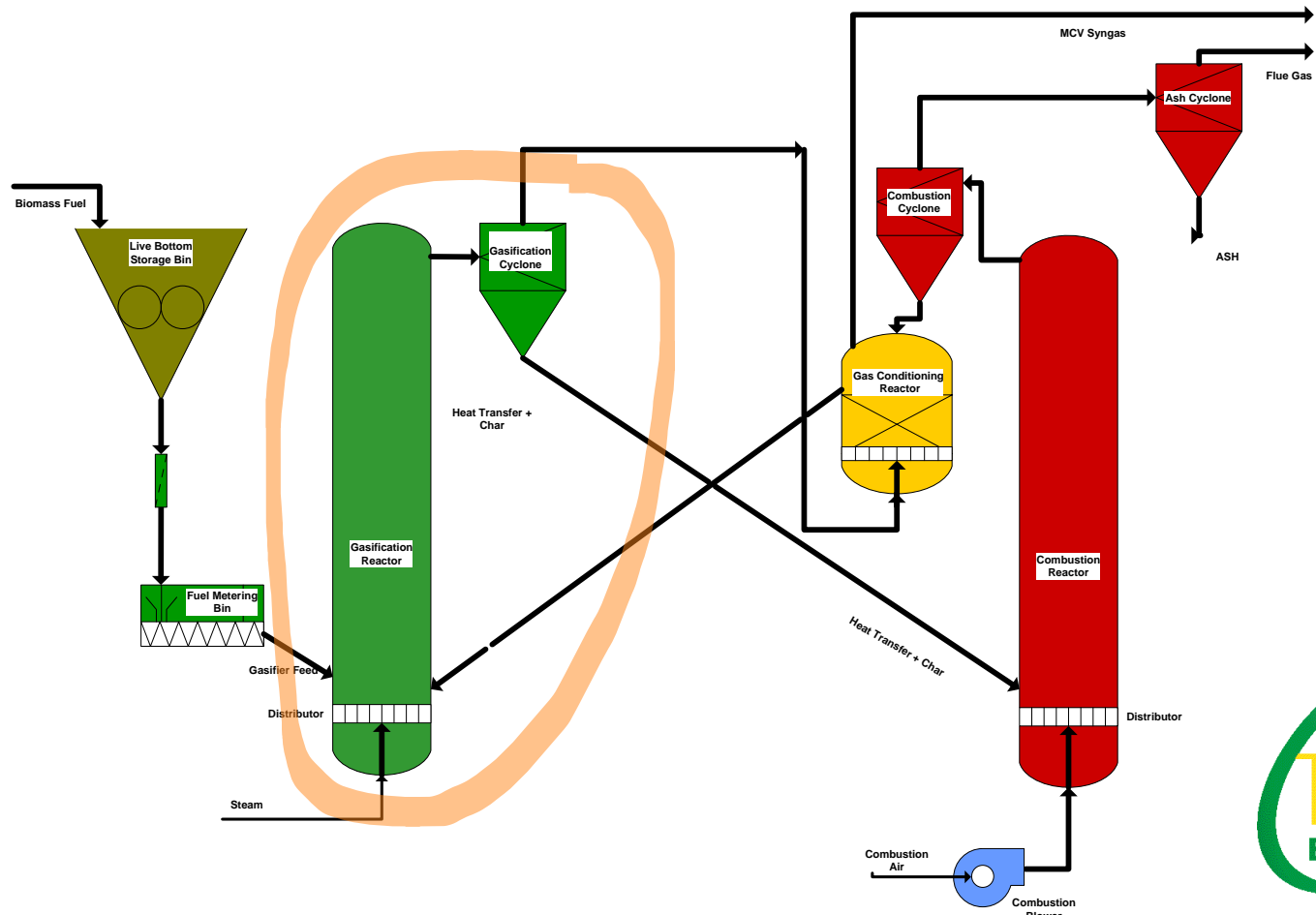
	<i>Coal</i>	<i>Biomass</i>
● <i>Moisture Content</i>	<i>~10%</i>	<i>~50%</i>
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<i>HHV (MJ/kg)</i>	<i>~20</i>	<i>18-20</i>
● <i>Reactivity</i>	<i>low</i>	<i>high</i>



Reactivity Comparison

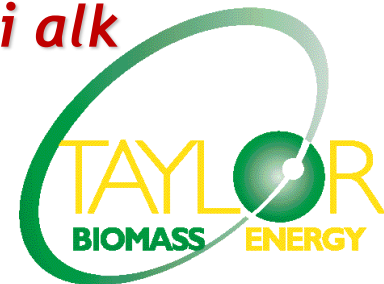


Taylor Gasification Schematic Process Diagram

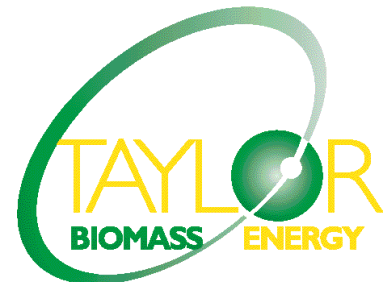
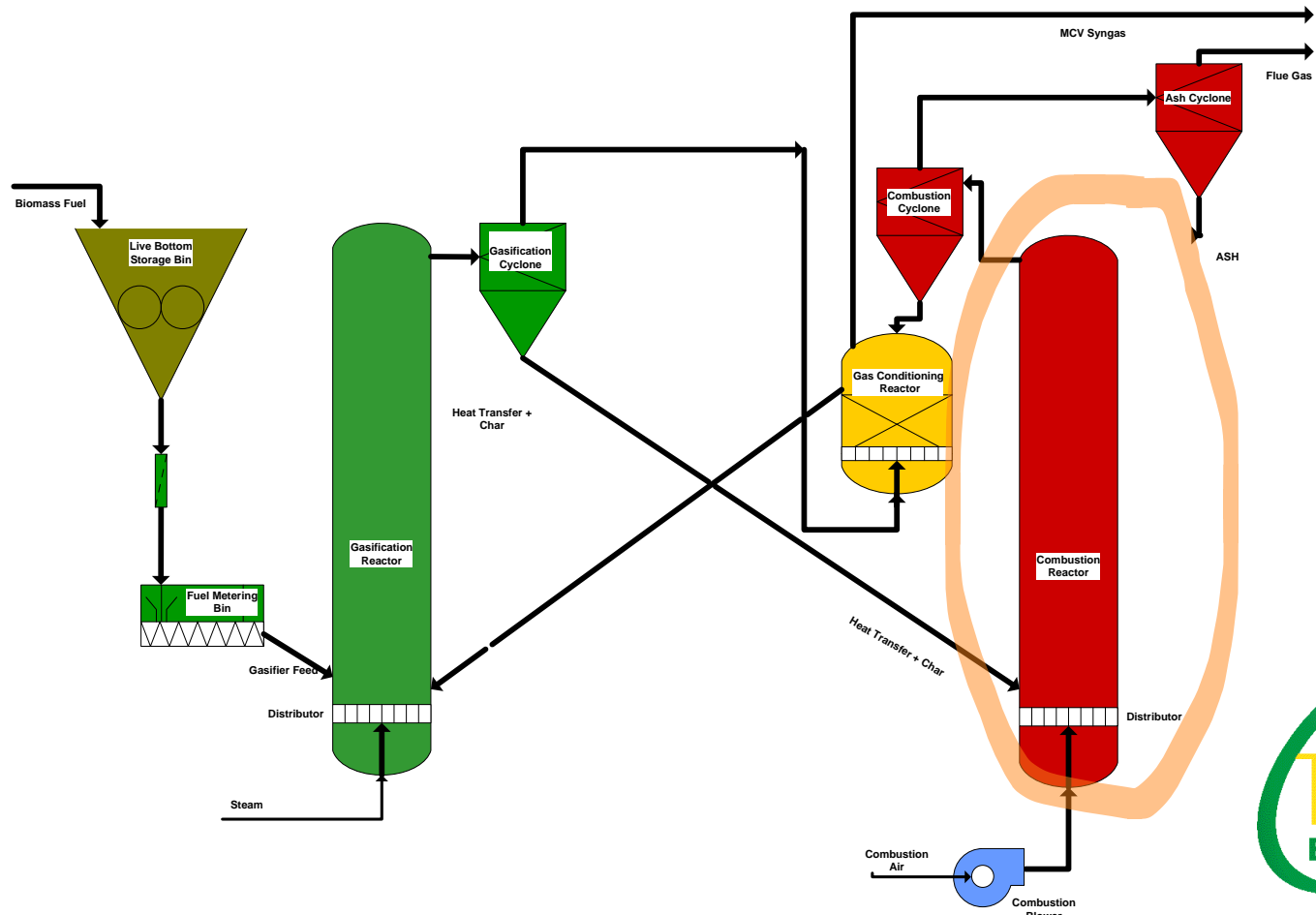


Biomass is not Coal

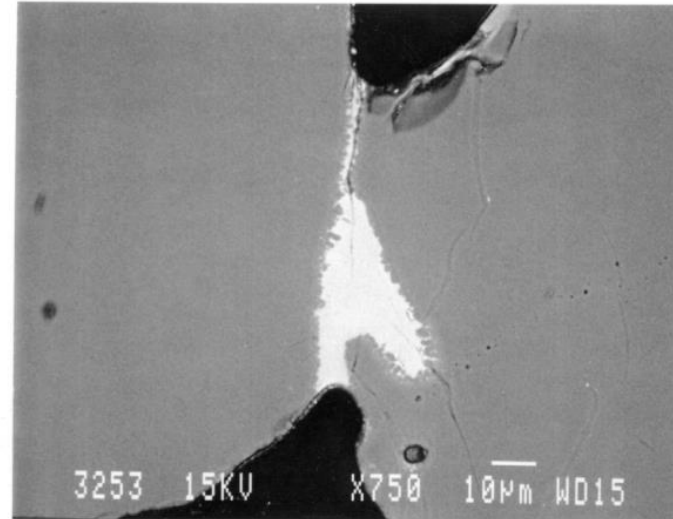
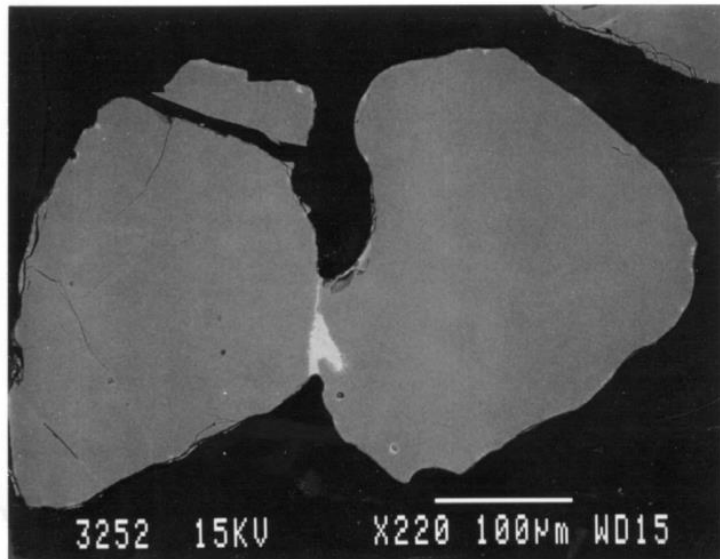
	<i>Coal</i>	<i>Biomass</i>
● <i>Moisture Content</i>	<i>~10%</i>	<i>~50%</i>
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<i>HHV (MJ/kg)</i>	<i>~20</i>	<i>18-20</i>
● <i>Reactivity</i>	<i>low</i>	<i>high</i>
● <i>Ash</i>	<i>~10 low alk</i>	<i><5 hi alk</i>



Taylor Gasification Schematic Process Diagram

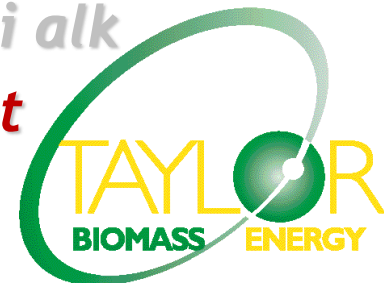


Ash Agglomeration

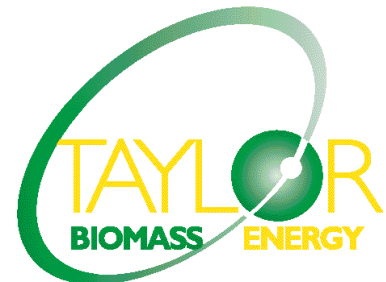
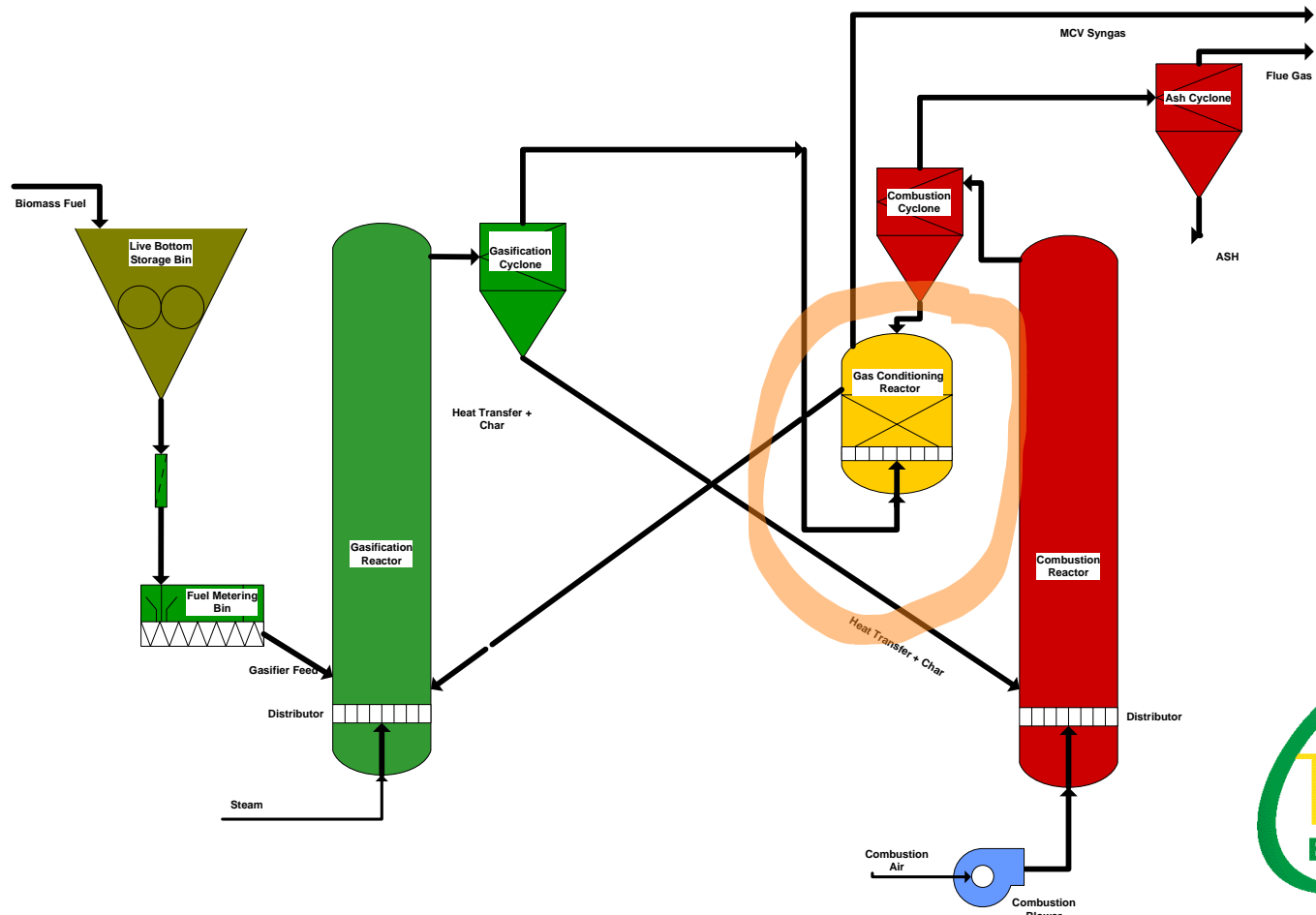


Biomass is not Coal

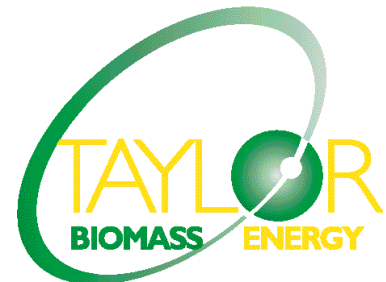
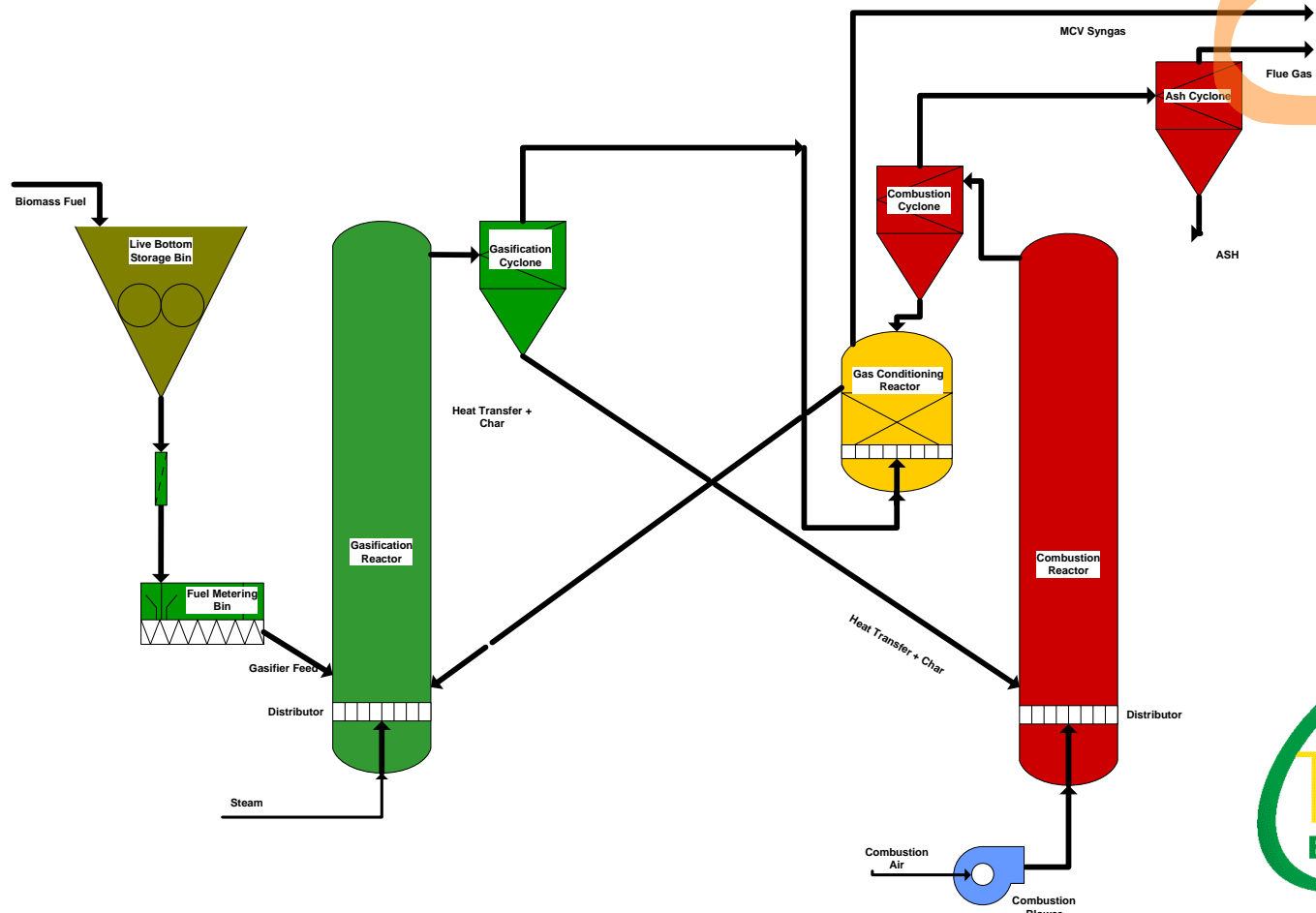
	<i>Coal</i>	<i>Biomass</i>
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● <i>Density (kg/m³)</i>	<i>700 - 1100</i>	<i>150 - 200</i>
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<i>HHV (MJ/kg)</i>	<i>~20</i>	<i>18-20</i>
● <i>Reactivity</i>	<i>low</i>	<i>high</i>
● <i>Ash</i>	<i>~10 low alk</i>	<i><5 hi alk</i>
● <i>Condensibles Produced</i>	<i>heavy</i>	<i>light</i>



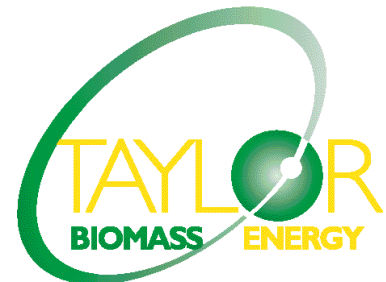
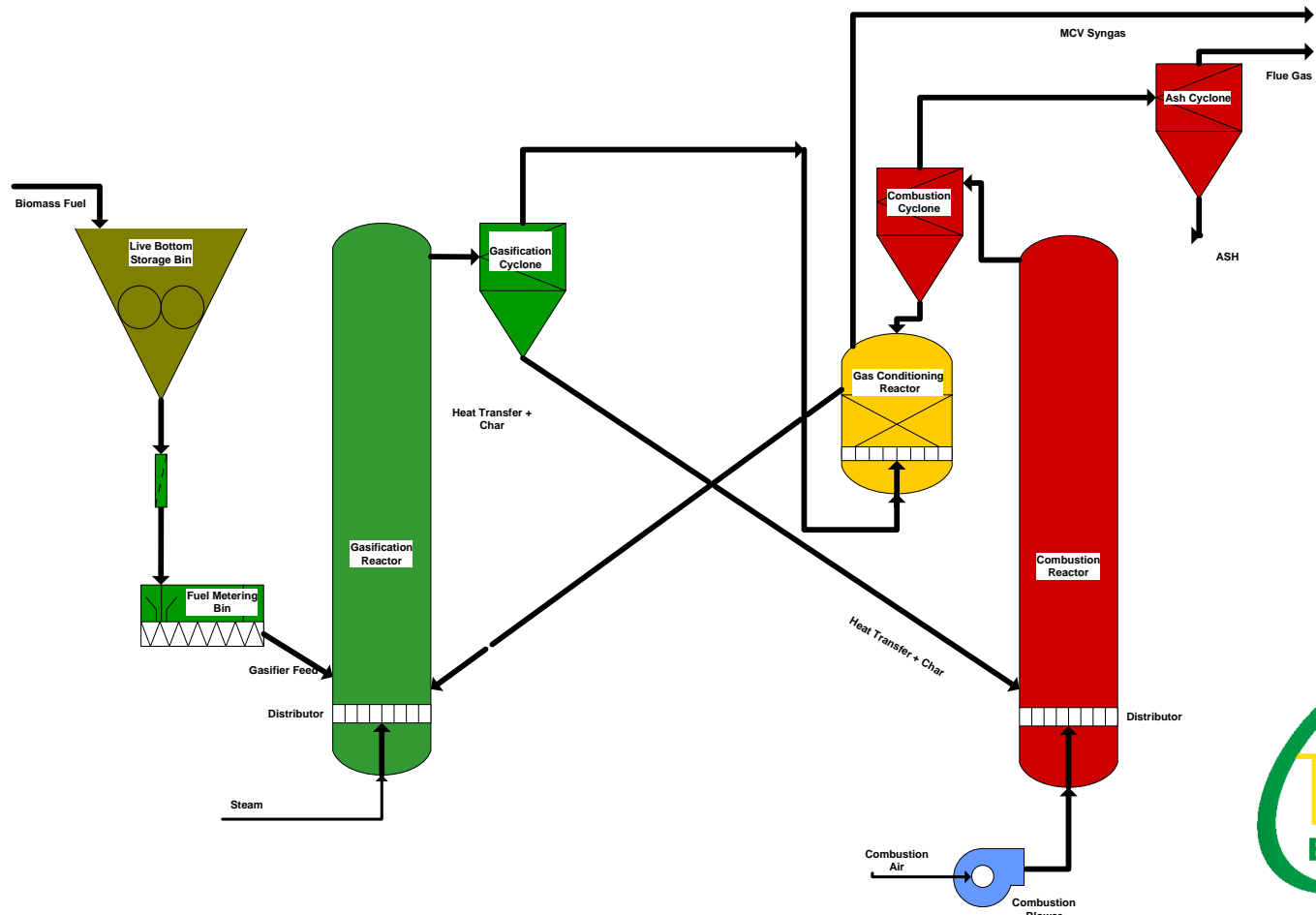
Taylor Gasification Schematic Process Diagram



Taylor Gasification Schematic Process Diagram

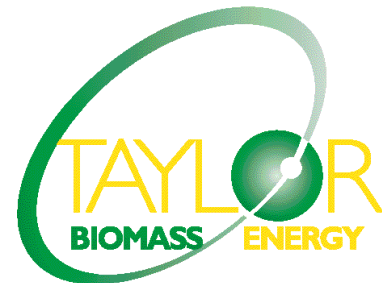


Taylor Gasification Schematic Process Diagram



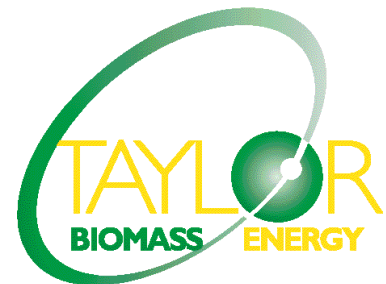
Characteristics of the Taylor Process

- *MCV gas without oxygen*
- *Stable gas composition*
- *Atmospheric pressure process*
 - *Simplifies feeding*
 - *Expands range of acceptable biomass*
- *Allows use of solid biomass as a gas turbine fuel or chemical synthesis*
 - *High process efficiencies to power*



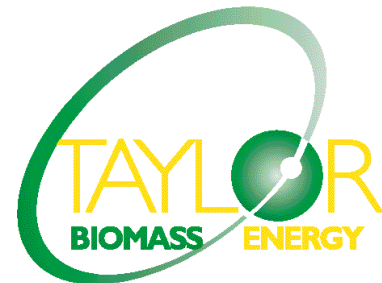
MCV Gas Advantages

- *Simplified / lower cost gas cleanup*
- *Use as synthesis gas*
- *Direct interchangeability with natural gas*



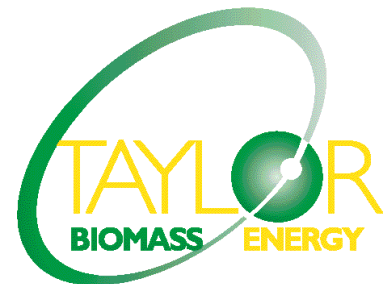
The Taylor Gasifier Provides Significant Advantages

- *Tars converted to additional syngas*
 - *Higher temperature enhances performance*
 - *90% of heavy hydrocarbons converted*
- *A significantly higher hydrogen content*
 - *Improves environmental performance*
- *Modular construction*
 - *Lowers cost*
 - *Faster assembly on site*

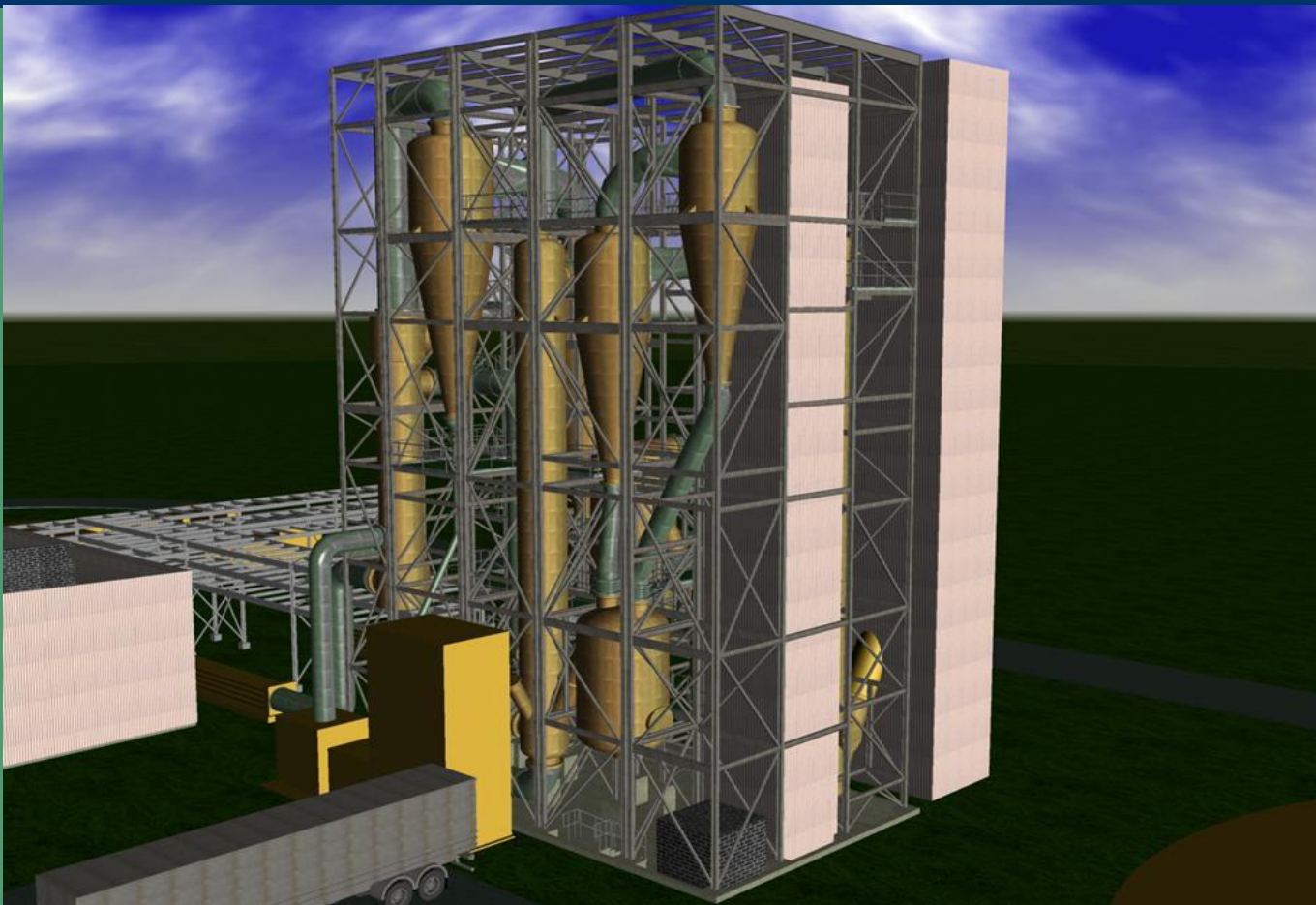


Program Underway to Utilize the Taylor Gasification Process

- *Expand capacity of the current C&D operations in Montgomery, NY*
 - *Add capacity for 500 tons per day of MSW*
- *Construct modular gasification facility*
- *Install gas turbine based combined cycle system*
- *Sell green energy to NY grid*

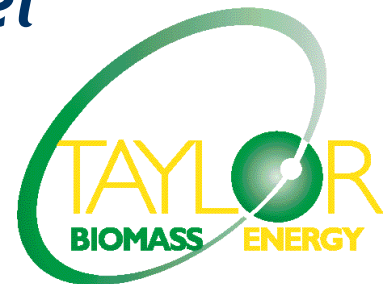


Gasifier Module Layout



Conclusions

- *Biomass can be a viable gasification feedstock*
- *Fuel differences can be overcome*
- *Gasification becomes a flexible fuel “pretreatment”*



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