COOL UNIT SYSTEM

April 3, 2018

Yields & Temperatures are projected averages

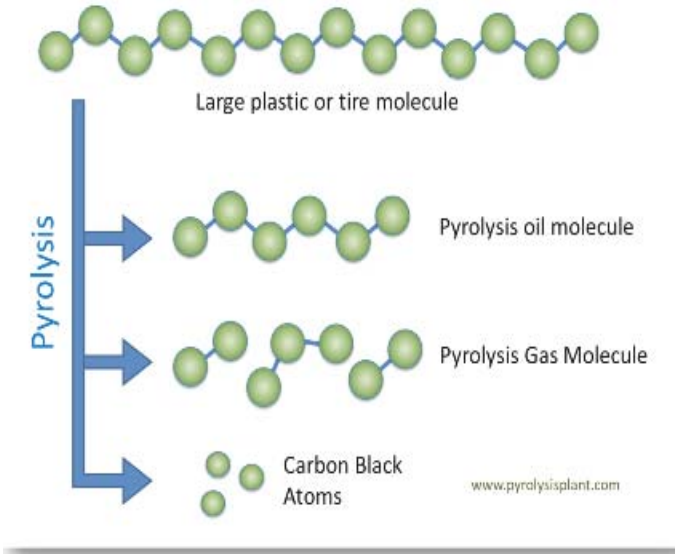
PC Cool Chemistry Background

- The PC Cool units **thermally degrade** waste plastic into mid-grade oil, syngas and bio char. Thermal degradation has a long history of industrial use. Thermal degradation systems utilize a wide range of designs, temperatures, and pressures to initiate thermal degradation reactions.

- The chemical reaction of **thermal degradation** is an endothermic process. Three stages involved include dehydration, fragmentation, and product formation which occur at different temperatures during the process. It is carried out in an inert environment in order to avoid combustion. Basically, the materials are thermally degraded in an oven with no air or oxygen present. No burning takes place. Most organic compounds are thermally unstable. At high temperatures, the organic compounds volatilize and bonds thermally crack, breaking larger molecules into gases and liquids composed of smaller molecules, including hydrocarbon gases and hydrogen gas. The temperature, pressure, reaction rates, feedstock size and internal heat transfer rates are used to control specific reactions in order to produce specific products. At lower temperatures, liquid thermal degradation oils dominate. At higher temperatures, gaseous byproducts dominate.

PC Cool Chemistry Background Cont.

- Since thermal degradation occurs in the absence of oxygen, the feed system and thermal degradation chamber are sealed and isolated from outside air during processing.
- The PC Fibre Cool unit is a batch process that utilizes slow thermal degradation to maximize the liquid production and inevitably the production of char.
- Typical reactions that show the thermal degradation of long chain radicals to light hydrocarbons and eventually basic methane are:



- $C_{10}H_{22} \rightarrow C_8H_{17} + C_2H_5$ (1)
- $C_6H_{13} \rightarrow C_5H_{10} + CH_3$ (2)
- $CH_3 + H \rightarrow CH_4$ (3)

These thermal degradation reactions are endothermic, meaning they require externally supplied heat to occur. The syngas produced by thermal degradation comes from the fraction of the non condensable organics as CH_4, C_2H_4, C_3H_6 etc. The syngas can be used as a source of external heat.

PC Cool Chemistry Background Cont.

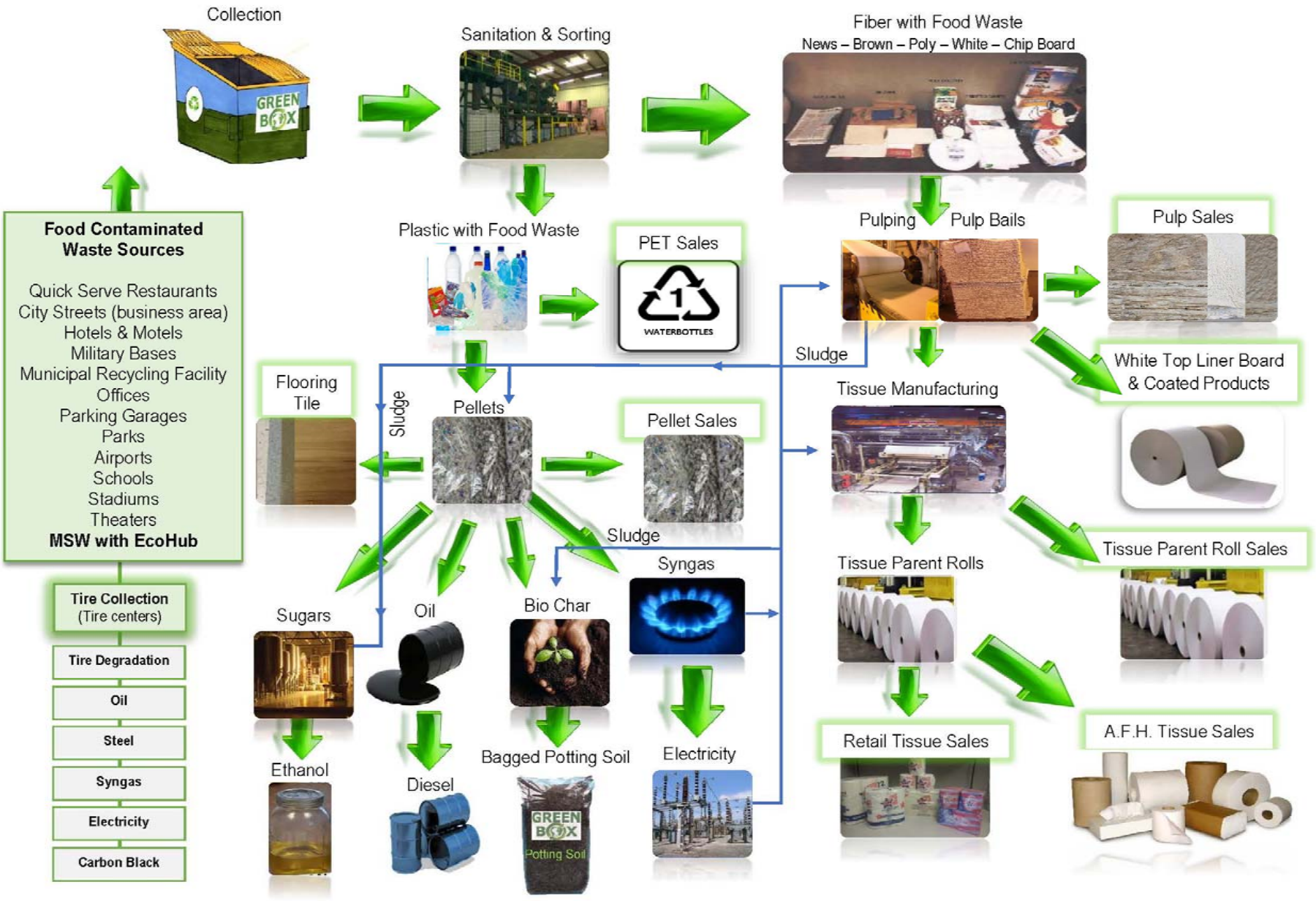
- High oil production requires favoring reaction (1) over the methane formation - reaction (3). This is done by setting the temperature at lower level. The low temperature will slow the kinetics of this reaction and a long residence time will be required to complete the reaction.

- During the product formation, some other chemical reactions compete with the main path. Some of them such as aromatic formations are exothermic. .Also, some partial oxidation (from trapped air as well as oxygen in the organic compounds) of the methane gas occurs to form CO, with some CO2 formed as the carbon reacts:

- The combination of these reactions with the above mentioned aromatic formation yields to more heat release, helping to maintain the internal temperatures required for thermal degradation. Another set of reactions that occurs is reformation, where the products of the reactions noted above begin to combine with each other, forming other reaction byproducts. Since PC Fibre pellet feedstock has a large higher heating value (HHV) measured in Btu/lb in the range 12,000 to 15,000 BTU/lb, the process becomes more self-sufficient (more exothermic reactions), and once the process starts, it uses an extremely small amount of fossil fuel.

ZERO LANDFILL - ZERO WASTE WATER DISCHARGE

NO INCINERATION - 100% RECLAMATION



ZERO LANDFILL - ZERO WASTE WATER DISCHARGE

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Linear Economy...

The Way Resources Are Currently Handled

Raw Materials → Products → Consumer Use → Recycling & Landfill

Only 47% Reclamation

Circular Economy...

Closed Loop
96 hours to
100% new products

TRUE SUSTAINABILITY

22.7 Million Cubic Feet of Landfill Avoidance

PC Cool Unit

4 Tons of Tires Every 12 Hours

Tires Payment	(296) (50c)	$148
Carbon Black	2560 LBS	$2048
Oil	400 (100)	$400
Steel	1,120	$290
Syn Gas	NA	NA
Revenue Per 12 Hours		$2,886
Revenue Per 24 Hours		$5,772
Revenue Per 360 Days		$2,077,920

10 Hours Maintenance per Month

$803,000 of Labor and Benefits Per Year Per Unit Running 1 Unit

$614,000 of Labor and Benefits Per Year Per Unit Running 2 Units

Receipt of Baled Raw Material

- Product is a baled post consumer waste rubber or plastic material. Bales are approximately 5’ x 5’ x 2.5’ high.
- Currently the baled product will be stored in trailers on site and will only be used as needed.

Thermal Degradation Unit

- The processing chamber in the unit is 6' in diameter and 20' long. It will accept up to 6 tons of bales per charge, depending on the density and configuration of the bales. The unit is a double-double wall unit, which the baled product is loaded in the inside core, and the air space between the inner core and the shell is heated by gas burners to operating temperature. The unit has 4 segregated thermal chambers within the unit in which low PSI regulated gas heat is piped and ignited by electronic ignition.
- The unit has four exhaust ports manifold together and is assisted by a variable speed exhaust fan. Each exhaust stack has a slide gate baffle system to help maintain the temperature in the unit. The slide gate baffles will be set at time of commissioning and depending on the product being reclamaited.
- The unit has 2 to 8 thermal couplers mounted on the side which is wired back to the control panel digital readout. These read the inside temperature.
- Once charged, the unit is raised to its operating temperature of approximately 830 F, which is held until all organics have been volatilized. This typically takes 4 to 6 hours.
- During operation the chamber pressure is approximately 2 psi, resulting from the volatilization of the organics and the back pressure from the cooling system. As the gas passes through the cooling system, it begins to condense
- Electrical power to the control panel is a 120 volt, 15 amp feed.
- There are also several manual read temperature gauges mounted on the side of the unit and on other tanks and pipes.
- There is a nitrogen purge line with valve mounted at the front gate used to purge the inside core prior to opening the unit if needed.
- A manifold feed system, which operates with no oxygen present and under vacuum, consists of main gas line feeding 8 separate gas burners to the Degradation Unit totaling less than 12 tons annually. The main gas line has a manual shut off and a condensate trap. Each of the 4 systems to the thermal heat systems (2-4 PSIs) have a feed pipe which has a gas regulator, electronic and manual shut off valves, a venturi, an orifice, and electronic ignition system. The system is controlled at the main control panel. There are also 2 electronic safety switches which shuts system shuts down if any pressure is too low or too high. The unit is controlled by a control panel off to the side of the manifold feed system.

Cooling Gas Transfer Pipe

- Distilling/transfer pipe is a thin wall 6” steel pipe, 120’ long that runs from the Thermal Degradation Unit to the Oil/Gas Separator Tank
- The Pipe is looped to allow for expansion and pitched to allow drainage from the degradation unit to system 4 tank. Its supports allow movement with temperature change as the TDU goes through its cycle.
- The pipe has an emergency 5 PSI pressure relief valve at the top and a temperature gauge near the degradation unit along with high heat expansion joints.
- Gas temperature leading into the pipe from the degradation unit should be between 400 and 700 degrees F. Outgoing gas temperature should read 160 degrees F until the degradation unit has emitted all of its gas.
- Exhaust gas from the degradation unit is pushed through the pipe from the degradation unit at 2 psi to the system 4 tank that is operated at 1.5 psi. Gas passes naturally to a lower pressured area.
- As the gas pass through the pipe, the gas cools and liquefies.
- There is a temperature gauge prior to entering SYSTEM 4 tank. This should read 160 degrees during operation.
- When the temperature falls below 160, the degradation process has ended.
- All 14 gauges should be read every 30 minutes and recorded to ensure stable operation and identification of any upset condition
- There is a manual valve sample port to allow for sample taking prior to reaching SYSTEM 4 tank.

Oil/Gas Separator Cleaning and Cooling Tank

- Tank is 1,100 gallon tank
- Operation pressure is 1.5 psi
- Temperature of incoming gas/fuel is 160 degrees f.
- Tank will become 100 percent full of fuel should be controlled between ¼ and 7/8 full at all times.
- The fuel will be allowed to cool down to room temperature after each run during the 4-8 hour cooling down period of the Degradation Unit.
- When each batch from the Degradation Unit is released into the tank, the fuel will transfer itself when the tank is full through the transfer pipe which leads to the fuel storage tank at SYSTEM 5. The cooled fuel will take the incoming gas from 160 degrees f to 85 degrees or room temperature.
- The tank has a vacuum relief valve, an oil purge line for start up, and a pressure relief pipe leading to the exterior.

Oil Storage Tank

- The 3,000 gallon storage tank operates at 1.5 psi and 85 degrees F or room temperature
- The tank is allowed to fill to 50 percent full of fuel and then be transferred through an orifice at the bottom of the tank and pumped to an outside 10,000 gallon fuel storage tank with 1.5 times retainment.
- Gases above the fuel will be allowed to flow through SYSTEM 6 to SYSTEM 7 which operates at 1 psi. Gas will flow naturally to the lower operating pressure of SYSTEM 6.
- The tank has thermometer and should be read every 30 minutes and recorded.
- The tank has a pressure relief valve.

Rubber to Pyro Oil--Demonstration

Assumptions

1.	# of 8 tpd		2 units						
	Loading & efficiency ratir		6 tpd ea batch						
	Batches per day		2						
	Tire tons/day processed		24						
2.	Yields & Revenue				$/ton	$/gal	#/gal	$/day	
	Payment for tires				$0.00			$0	
	Pyro oil	39%	9.4	tpd	$514	$1.80	7	$4,814	
	Carbon Black	45%	10.8	tpd	$500			$5,400	
	Syngas	6%	1.4	tpd	$0			$0	
	Steel	10%	2.4	tpd	$250			$600	
			24.0	tpd				$10,814	$451 /ton revenue
3.	Operational Cost								
	Operators	2	$22.5	/hr	2 (12 hr shifts)			$1,080	
	Utilities							$160	
	Propane							$320	
	Sulfur Removal							$104	
	Maintenance							$320	
	Rent (4000 SF/unit)							$92	
	SG&A @ 5% sales							$541	
	Total Cost							$2,617	$109 /ton cost
					Value/ton of tires			**$342**	
					Value/tire @ 70 tires/ton			**$4.88**	
4.	Days/year	350							
5.	Capital								
	Liquefaction		$1,500,000						
	Gas cleaning								
	Gas compression & storage								
	Electrical Generation								
	Biochar								
	Land & Building		Exist						
	Closing Costs		Exist						
	Total Capital		$1,500,000						

10 Year Proforma ($000,000's)

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Gross Revenue											
Tires used		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pyro oil		$1.10	$1.68	$1.68	$1.68	$1.68	$1.68	$1.68	$1.68	$1.68	$1.68
Carbon Black		$1.23	$1.89	$1.89	$1.89	$1.89	$1.89	$1.89	$1.89	$1.89	$1.89
Syngas		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Steel		$0.14	$0.21	$0.21	$0.21	$0.21	$0.21	$0.21	$0.21	$0.21	$0.21
Total Revenue		$2.46	$3.78	$3.78	$3.78	$3.78	$3.78	$3.78	$3.78	$3.78	$3.78
Costs											
Operators		$0.38	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38	$0.38
Utilities		$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06	$0.06
Propane		$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11
Maintenance		$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11	$0.11
Rent		$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03
SG&A @ 5% sales		$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19
Total Costs		$0.88	$0.88	$0.88	$0.88	$0.88	$0.88	$0.88	$0.88	$0.88	$0.88
EBITDA	**-$1.50**	**$1.58**	**$2.91**	**$2.91**	**$2.91**	**$2.91**	**$2.91**	**$2.91**	**$2.91**	**$2.91**	**$2.91**
EBITDA IRR	**142%**										

Waste Tires to Pyroil, Carbon Black & Steel

Assumptions

1.	# of 8 tpd		4 units						
	Loading & efficiency rating		4 tpd ea batch						
	Batches per day		2						
	Tire tons/day processed		32						
2.	Yields & Revenue				$/ton	$/gal	#/gal	$/day	
	Payment for tires @$1.00 each				$70.00			$2,240	
	Pyro oil	39%	12.5	tpd	$286	$1.00	7	$3,566	111 gal/ton
	Carbon Black @ $0.75	35%	11.2	tpd	$1,500			$16,800	
	Syngas	6%	1.9	tpd	$0			$0	
	Ash/misc materials	10%	3.2	tpd	$0			$0	
	Steel	10%	3.2	tpd	$600			$1,920	
		100%	32.0	tpd				$24,526	$766 /ton revenue
3.	Operational Cost								
	Operators (3 for 2 units)	6	$23.5	/hr	2 (12 hr shifts)			$3,384	
	Utilities							$100	
	Propane							$200	
	Sulfur Removal							$200	
	Maintenance							$640	
	Rent @ $16,000/month							$533	
	SG&A @ 5% sales							$1,226	
	Total Cost							$6,284	$196 /ton cost
					Value/ton of tires			**$570**	
					Value/tire @ 70 tires/ton			**$8.14**	
4.	Days/year	350							
5.	Capital								
	Liquefaction		$4,000,000						
	Gas cleaning & Compression		$0						
	Oil refining		$0						
	Gas Generator		$0						
	Carbon Purification		$0						
	Mobile Equipment		$0						
	Baler		$0						
	Building modifications		$0						
	Contingency		$0						
	Closing Costs @ 5%		$0						
	Total Capital		$4,000,000						

10 Year Proforma ($000,000's)

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Gross Revenue											
Tires used		$0.51	$0.78	$0.78	$0.78	$0.78	$0.78	$0.78	$0.78	$0.78	$0.78
Pyro oil		$0.81	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25
Carbon Black		$3.82	$5.88	$5.88	$5.88	$5.88	$5.88	$5.88	$5.88	$5.88	$5.88
Syngas		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Steel		$0.44	$0.67	$0.67	$0.67	$0.67	$0.67	$0.67	$0.67	$0.67	$0.67
Total Revenue		$5.58	$8.58	$8.58	$8.58	$8.58	$8.58	$8.58	$8.58	$8.58	$8.58
Costs											
Operators		$1.18	$1.18	$1.18	$1.18	$1.18	$1.18	$1.18	$1.18	$1.18	$1.18
Utilities		$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04	$0.04
Propane		$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07
Maintenance		$0.22	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22	$0.22
Rent		$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19
SG&A @ 5% sales		$0.43	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43	$0.43
Total Costs		$2.13	$2.13	$2.13	$2.13	$2.13	$2.13	$2.13	$2.13	$2.13	$2.13
EBITDA	**-$4.00**	**$3.45**	**$6.45**	**$6.45**	**$6.45**	**$6.45**	**$6.45**	**$6.45**	**$6.45**	**$6.45**	**$6.45**
EBITDA IRR	**120%**										

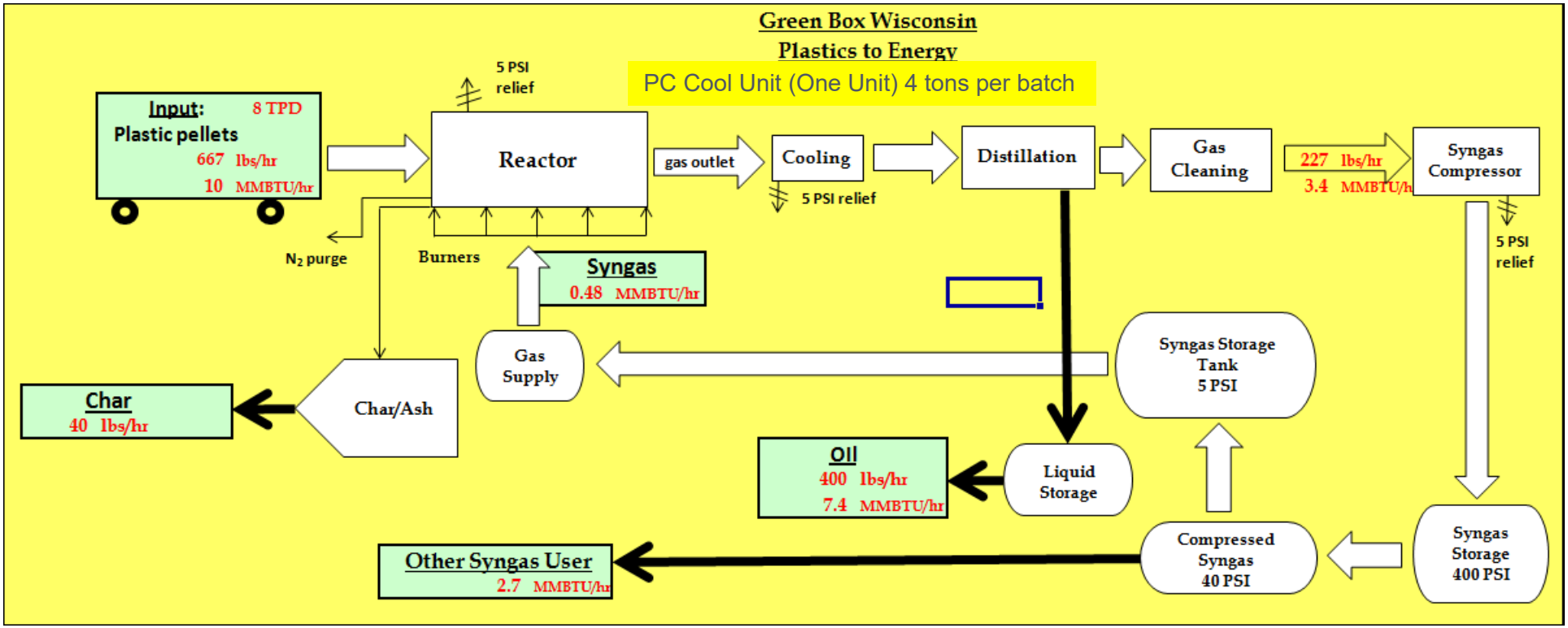
Waste Tires to Pyroil, Carbon Black & Steel

Assumptions

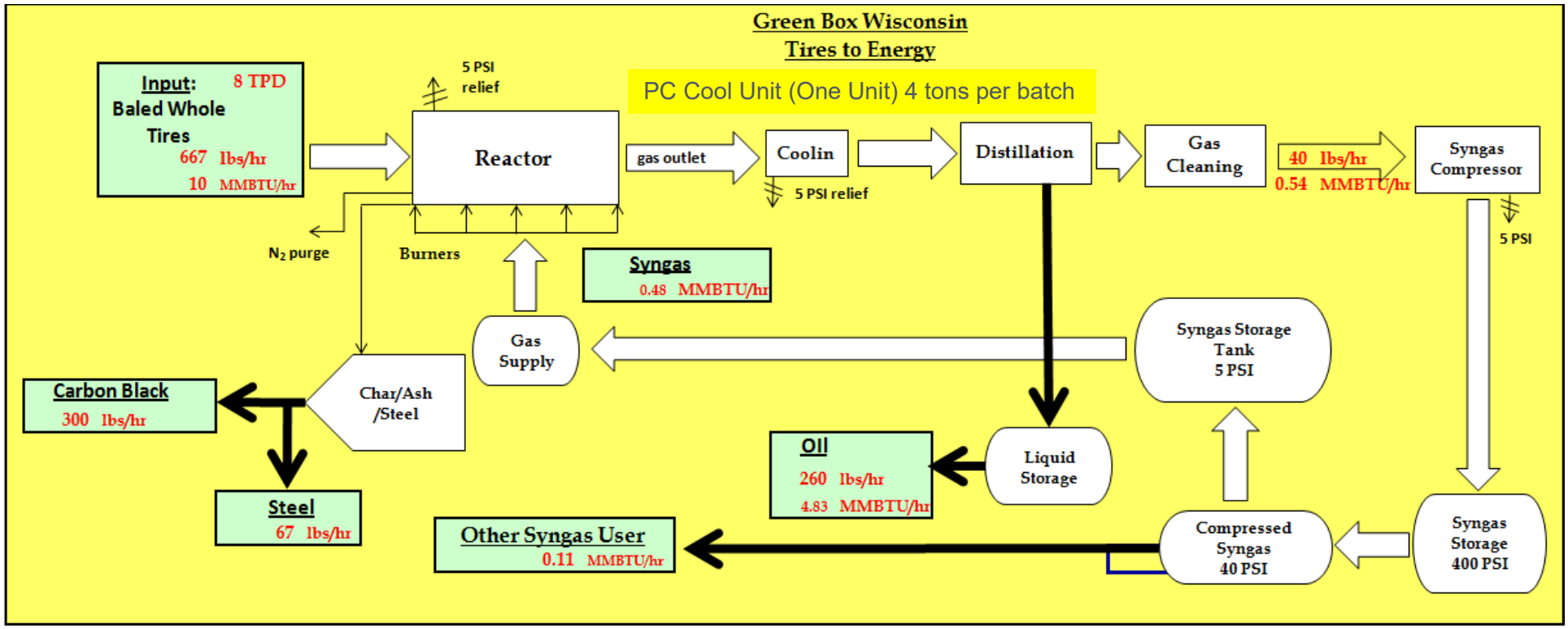
1.	# of 8 tpd		8 units						
	Loading & efficiency rating		4 tpd ea batch						
	Batches per day		2						
	Tire tons/day processed		64						
2.	Yields & Revenue				$/ton	$/gal	#/gal	$/day	
	Payment for tires @$1.00 each				$70.00			$4,480	
	Pyro oil	39%	25.0	tpd	$286	$1.00	7	$7,131	111 gal/ton
	Carbon Black	35%	22.4	tpd	$2,500			$56,000	
	Syngas	6%	3.8	tpd	$0			$0	
	Ash/misc materials	10%	6.4	tpd	$0			$0	
	Steel	10%	6.4	tpd	$600			$3,840	
		100%	64.0	tpd				$71,451	$1,116 /ton revenue
3.	Operational Cost								
	Operators (3 for 2 units)	12	$23.5	/hr	2 (12 hr shifts)			$6,768	
	Utilities							$200	
	Propane							$400	
	Sulfur Removal							$400	
	Maintenance							$1,280	
	Rent @ $16,000/month							$533	
	SG&A @ 5% sales							$3,573	
	Total Cost							$13,154	$206 /ton cost
					Value/ton of tires			**$911**	
					Value/tire @ 70 tires/ton			**$13.01**	
4.	Days/year	350							
5.	Capital								
	Liquefaction		$8,000,000						
	Gas cleaning & Compression		$600,000						
	Oil refining		$0						
	Gas Generator		$0						
	Carbon Purification		$0						
	Mobile Equipment		$0						
	Baler		$0						
	Building modifications		$0						
	Contingency		$0						
	Closing Costs @ 5%		$0						
	Total Capital		$8,600,000						

10 Year Proforma ($000,000's)

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Gross Revenue											
Tires used		$1.02	$1.57	$1.57	$1.57	$1.57	$1.57	$1.57	$1.57	$1.57	$1.57
Pyro oil		$1.62	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50	$2.50
Carbon Black		$12.74	$19.60	$19.60	$19.60	$19.60	$19.60	$19.60	$19.60	$19.60	$19.60
Syngas		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Steel		$0.87	$1.34	$1.34	$1.34	$1.34	$1.34	$1.34	$1.34	$1.34	$1.34
Total Revenue		$16.26	$25.01	$25.01	$25.01	$25.01	$25.01	$25.01	$25.01	$25.01	$25.01
Costs											
Operators		$2.37	$2.37	$2.37	$2.37	$2.37	$2.37	$2.37	$2.37	$2.37	$2.37
Utilities		$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07	$0.07
Propane		$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14	$0.14
Maintenance		$0.45	$0.45	$0.45	$0.45	$0.45	$0.45	$0.45	$0.45	$0.45	$0.45
Rent		$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19	$0.19
SG&A @ 5% sales		$1.25	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25
Total Costs		$4.46	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46	$4.46
EBITDA	**-$8.60**	**$11.79**	**$20.54**	**$20.54**	**$20.54**	**$20.54**	**$20.54**	**$20.54**	**$20.54**	**$20.54**	**$20.54**
EBITDA IRR	**174%**										



Pellets to Energy
PC Cool Unit (one unit)



Tires to Energy
PC Cool Unit (One unit)