Taylor Energy
May 2017

Technology Solution to High-Capital Cost RNG Production Systems

Validate the technical performance
of a two-stage thermal-catalytic gasification process

Verify the economic viability
of the integrated waste gasification process

Design, Fabricate, Construct, Start-Up, Test

Operate the gasification/reforming process
Using RDB input of 3-pounds per minute,

Operate the thermal-chemical gasification process
with over-all Stoichiometric Ratio (SR) =0.28,

Operate pulse-deflagration burners
that heat and power the gasification & reforming process
firing the pulse-detonation burners with excess air.

Evaluate, Transfer Knowledge

Establish Process Heat & Mass Balance
using ASPEN process modeling.

Confirm the projected installed-capital cost
based on a 300-ton/day modular system.

Estimate Carbon footprint
Life Cycle Analysis through GREET.


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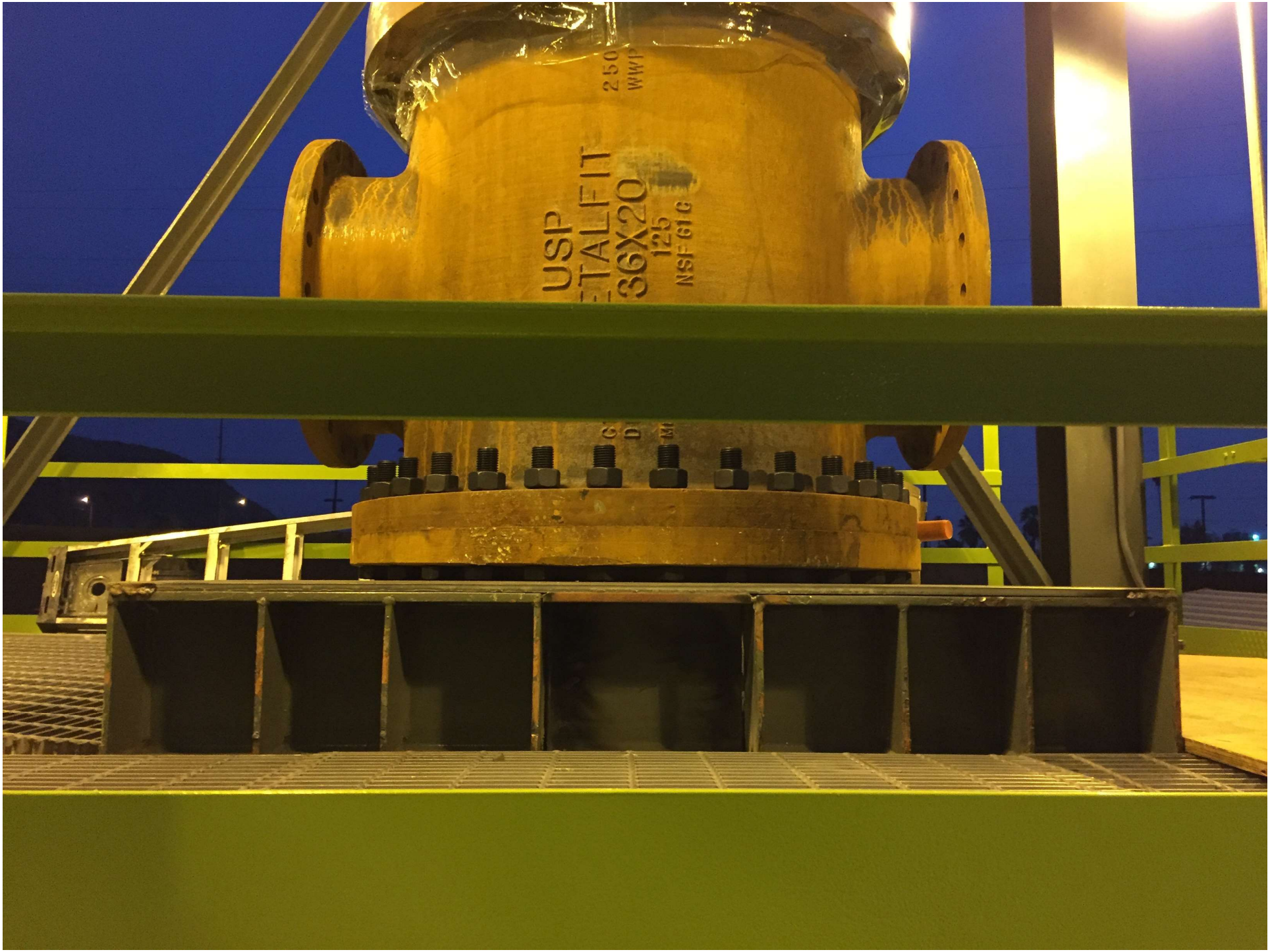
SKYTRAK


WERNER
#8


SONOTUBE


USP
36X20
125
NSF 61G

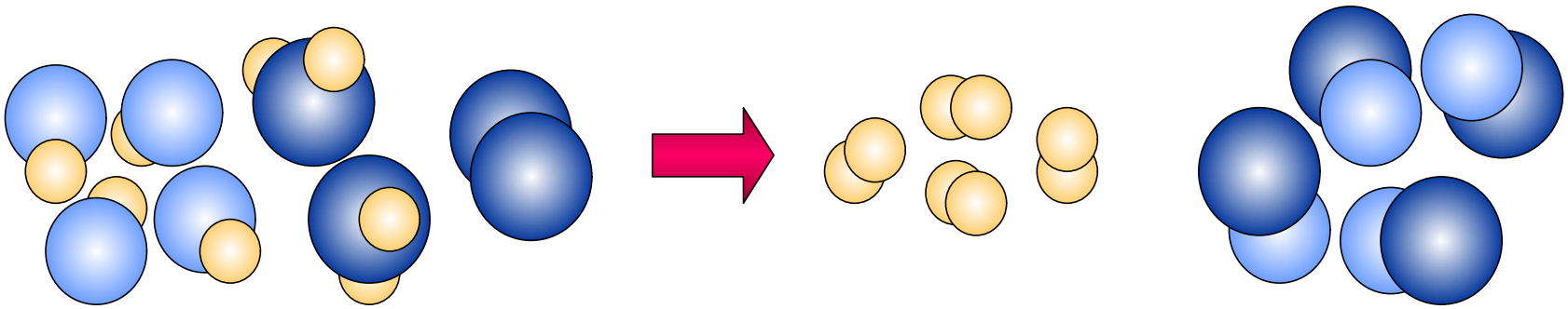

USP
METALFIT
96/24
125


Genie Z-30/20N RJ

The Basic Chemistry of Gasification

$$C_xH_y + H_2O + O_2 \rightarrow aH_2 + xCO$$

For example:



$4\ CH + 2\ H_2O + O_2$ ➡ **$4\ H_2$ + $4\ CO$**

(Hydrocarbon) (Water) (Oxygen) (Hydrogen) (Carbon Monoxide)

Water Shift Reaction: $CO + H_2O \Rightarrow CO_2 + H_2$

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Gasification

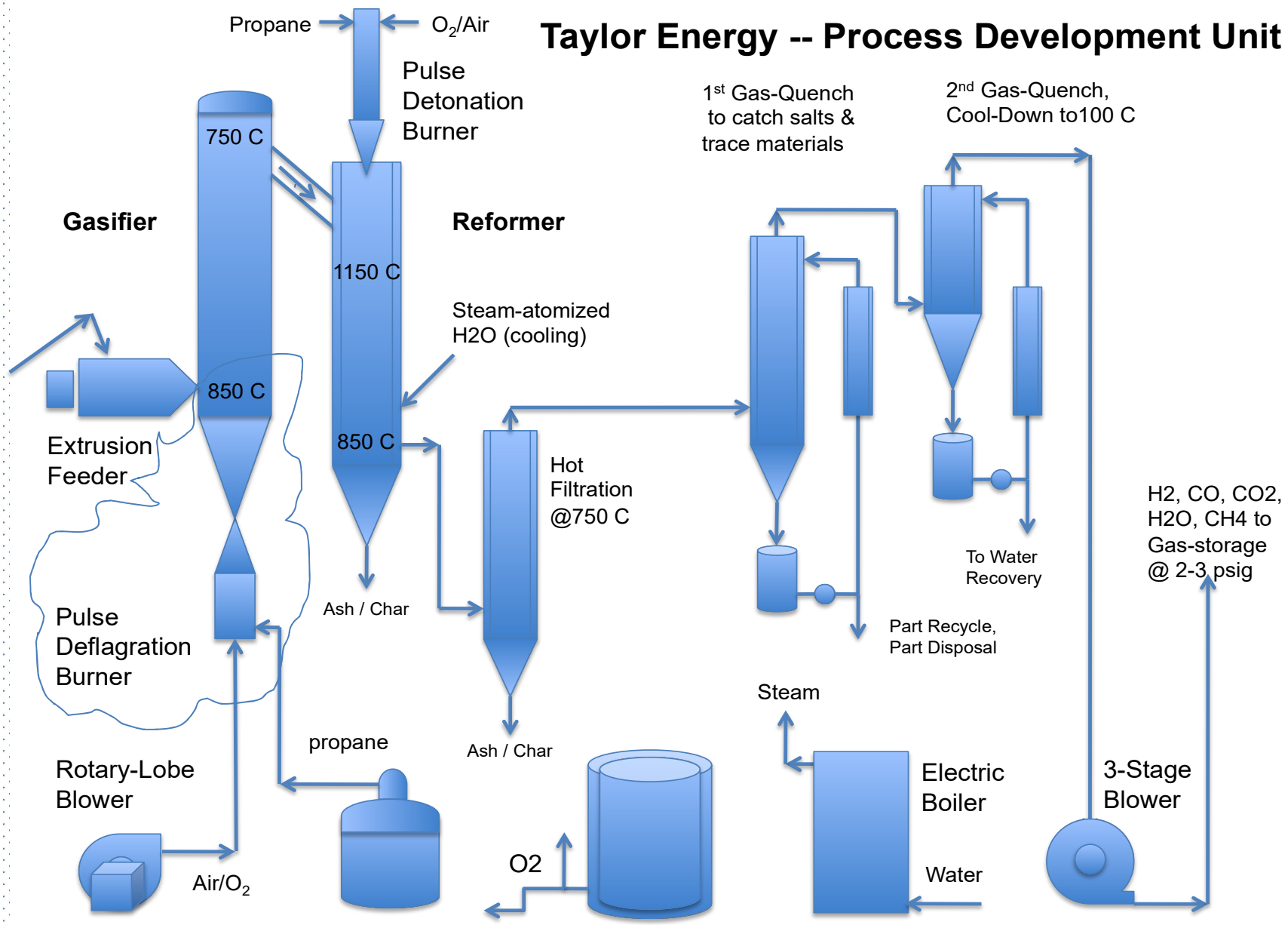
Gasification Technology

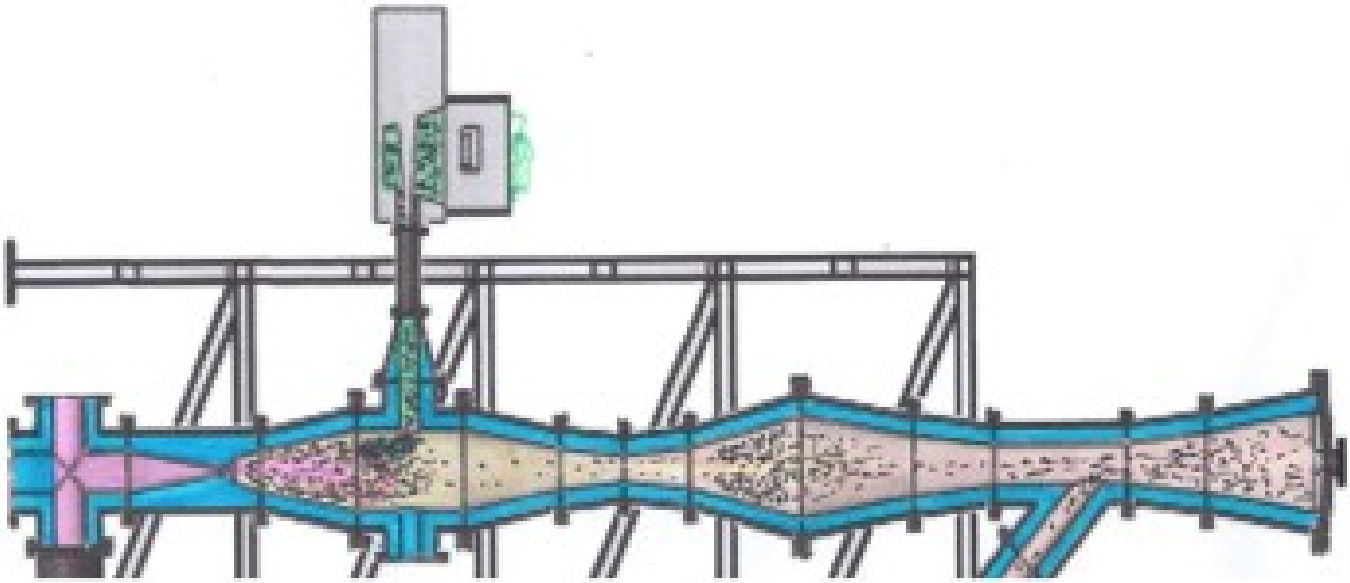
Syngas

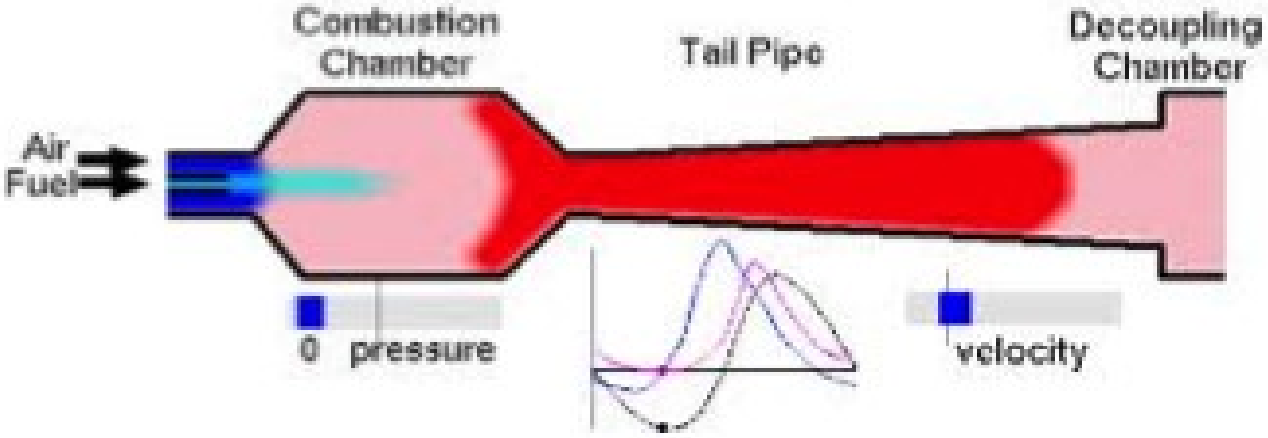
$(H_2 + CO)$

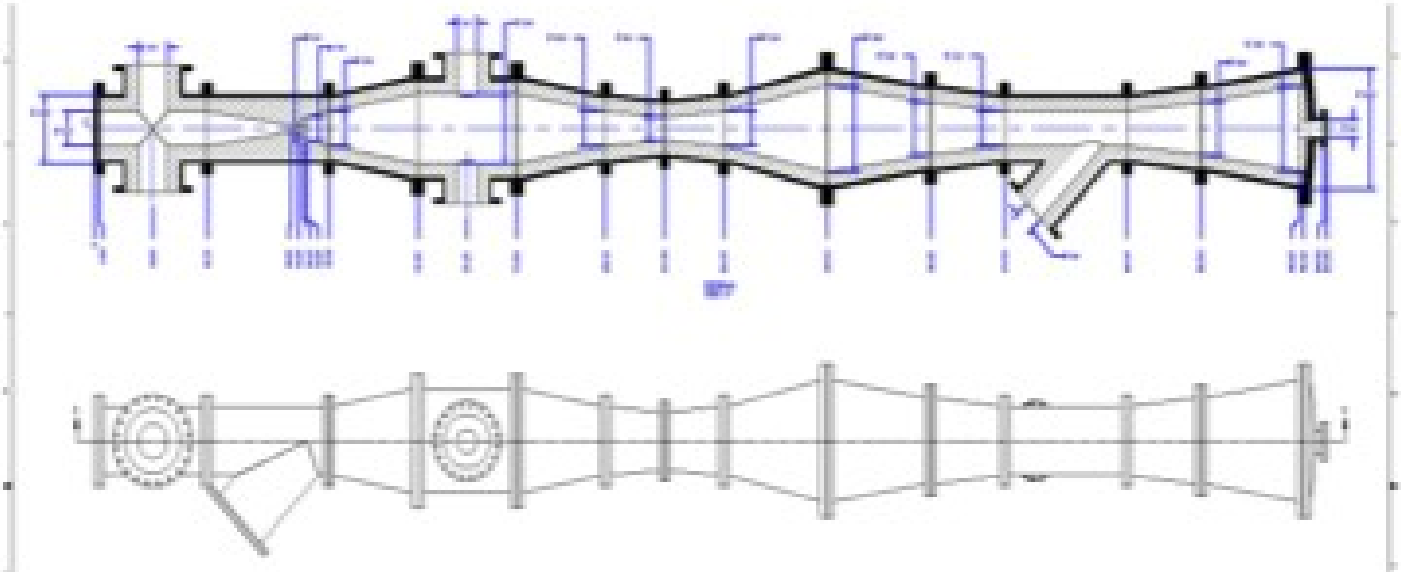
Feedstocks
- Coal
- Pet coke
- Asphalt
- Heavy Oil
- Vacuum Residue
- Natural Gas

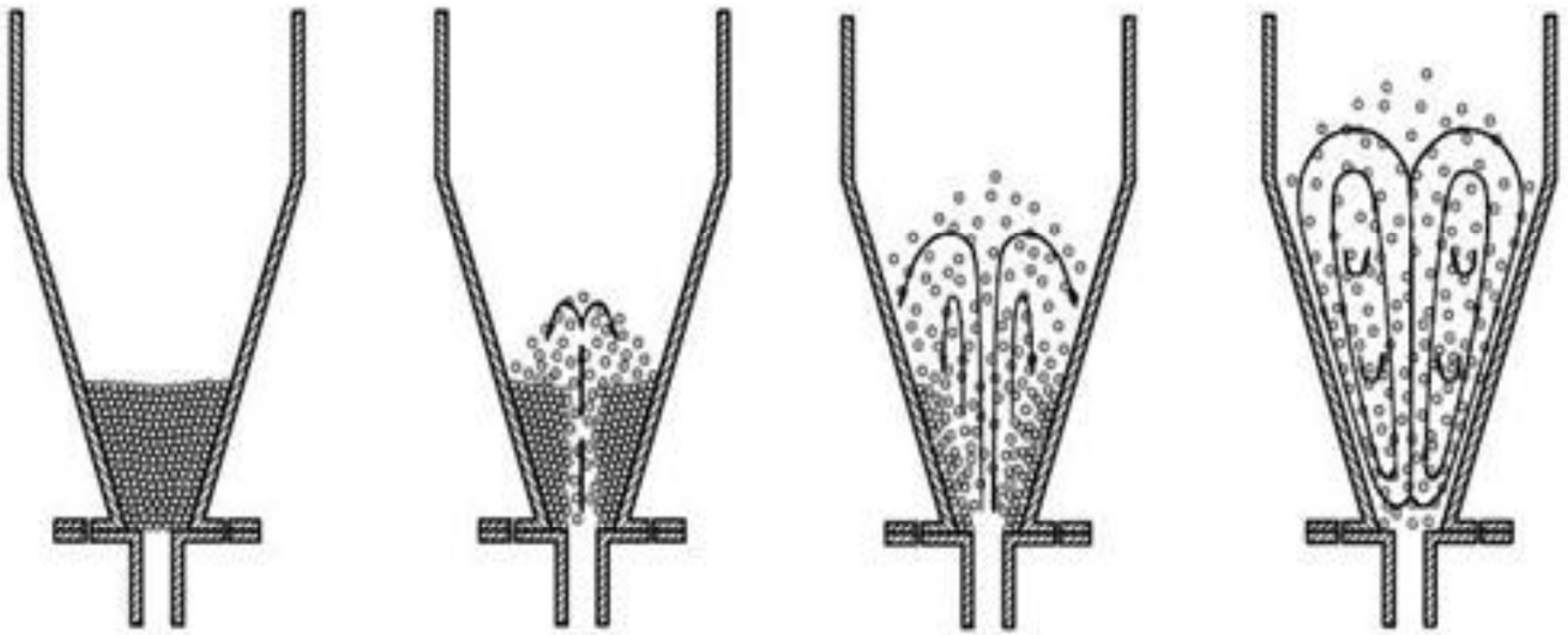
- **Power (IGCC)**
  - Greenfield
  - Polygen
  - Refueling
  - Site repowering
- **Refineries**
  - Hydrogen
  - Steam
  - Power
- **Chemicals**
  - Methanol
    - Formaldehyde
    - MTBE
    - Acetic acid
    - Amine
    - DME
  - Ammonia
    - Urea
    - Ammonia nitrate/sulfate
  - Oxochemicals: Butanol, Ethylhexanol
- **Methanation** → Substitute natural gas
- **Coal to liquids** → Transportation fuels


Taylor Energy -- Process Development Unit
Propane
O_2/Air
Pulse Detonation Burner
750 C
Gasifier
Reformer
1150 C
Steam-atomized H2O (cooling)
850 C
850 C
Extrusion Feeder
Hot Filtration @750 C
Ash / Char
Pulse Deflagration Burner
propane
Rotary-Lobe Blower
Air/O_2
Ash / Char
O2
1st Gas-Quench to catch salts & trace materials
2nd Gas-Quench, Cool-Down to100 C
To Water Recovery
Part Recycle, Part Disposal
Steam
Electric Boiler
Water
3-Stage Blower
H2, CO, CO2, H2O, CH4 to Gas-storage @ 2-3 psig

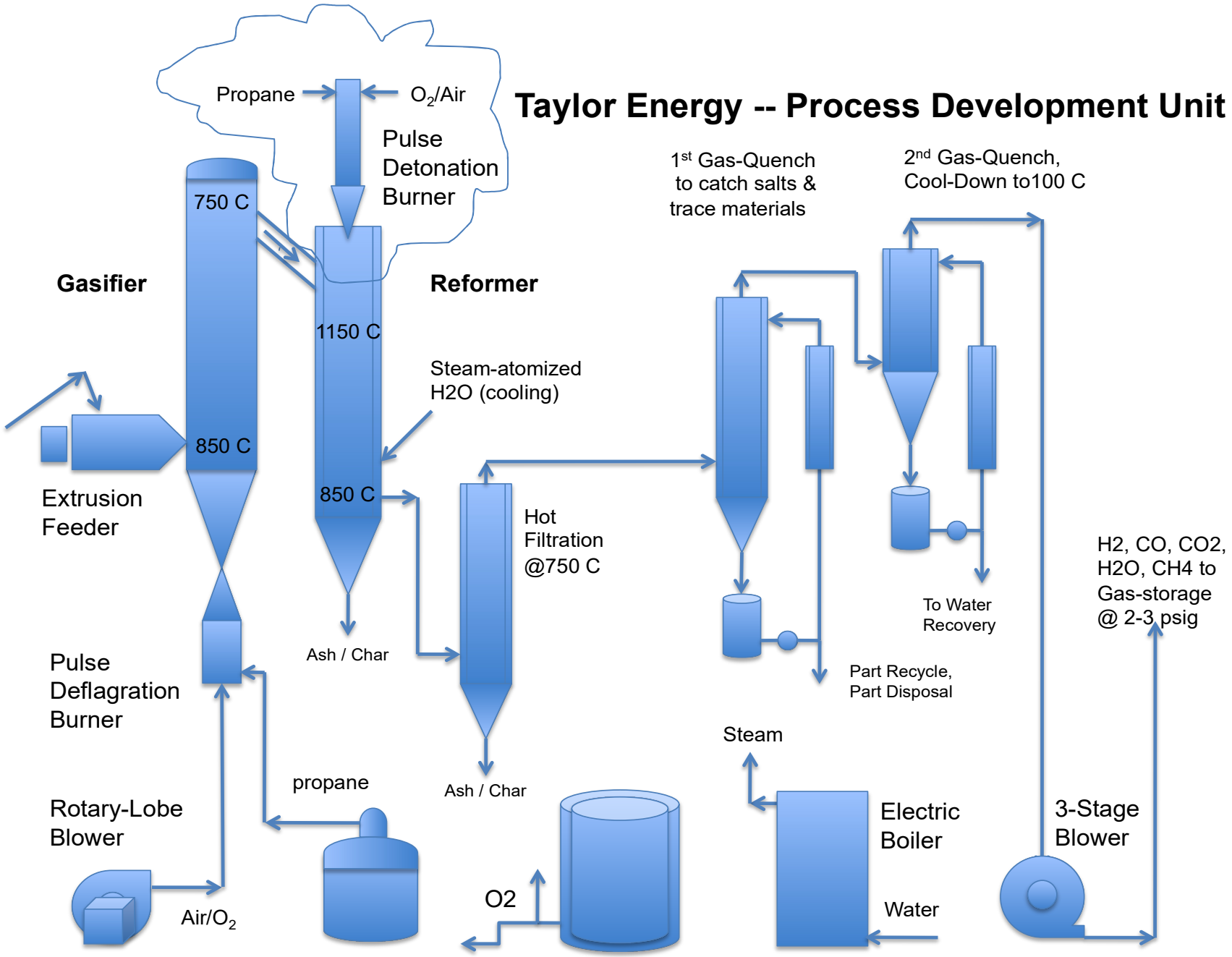



Combustion Chamber
Tail Pipe
Decoupling Chamber
Air
Fuel
0 pressure
velocity




(a)
(b)
(c)
(d)


NBR Tube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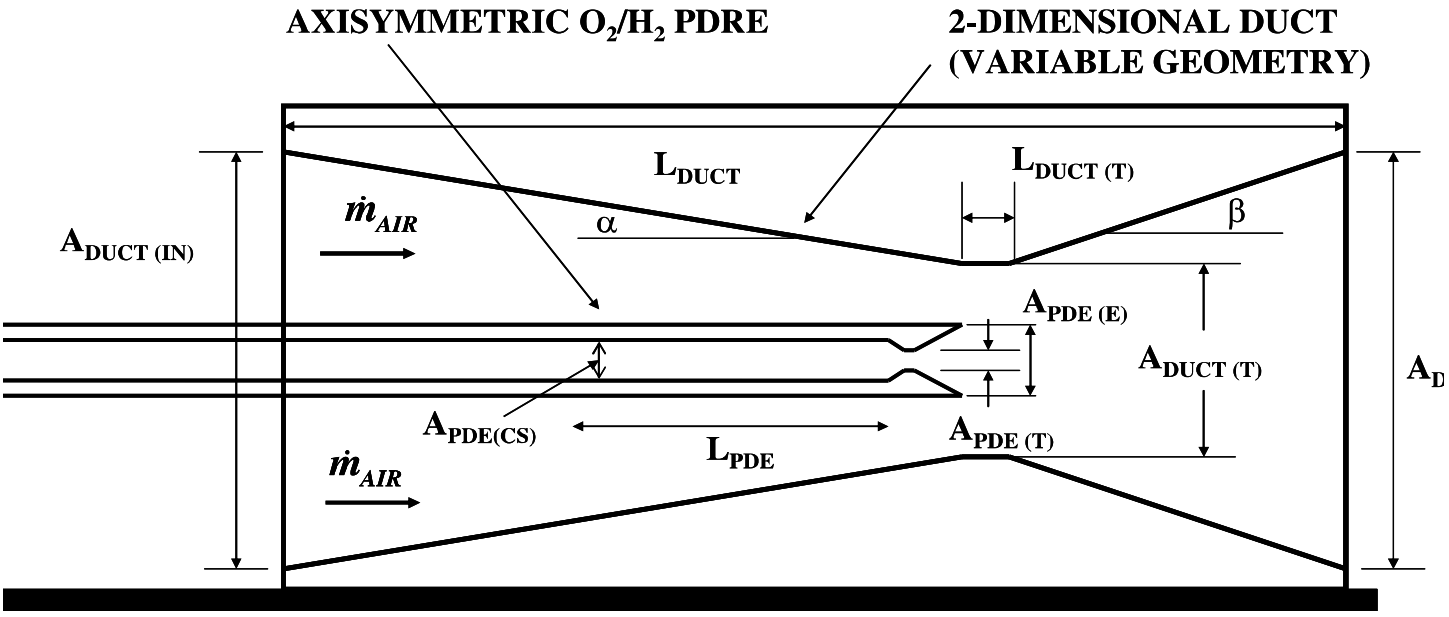
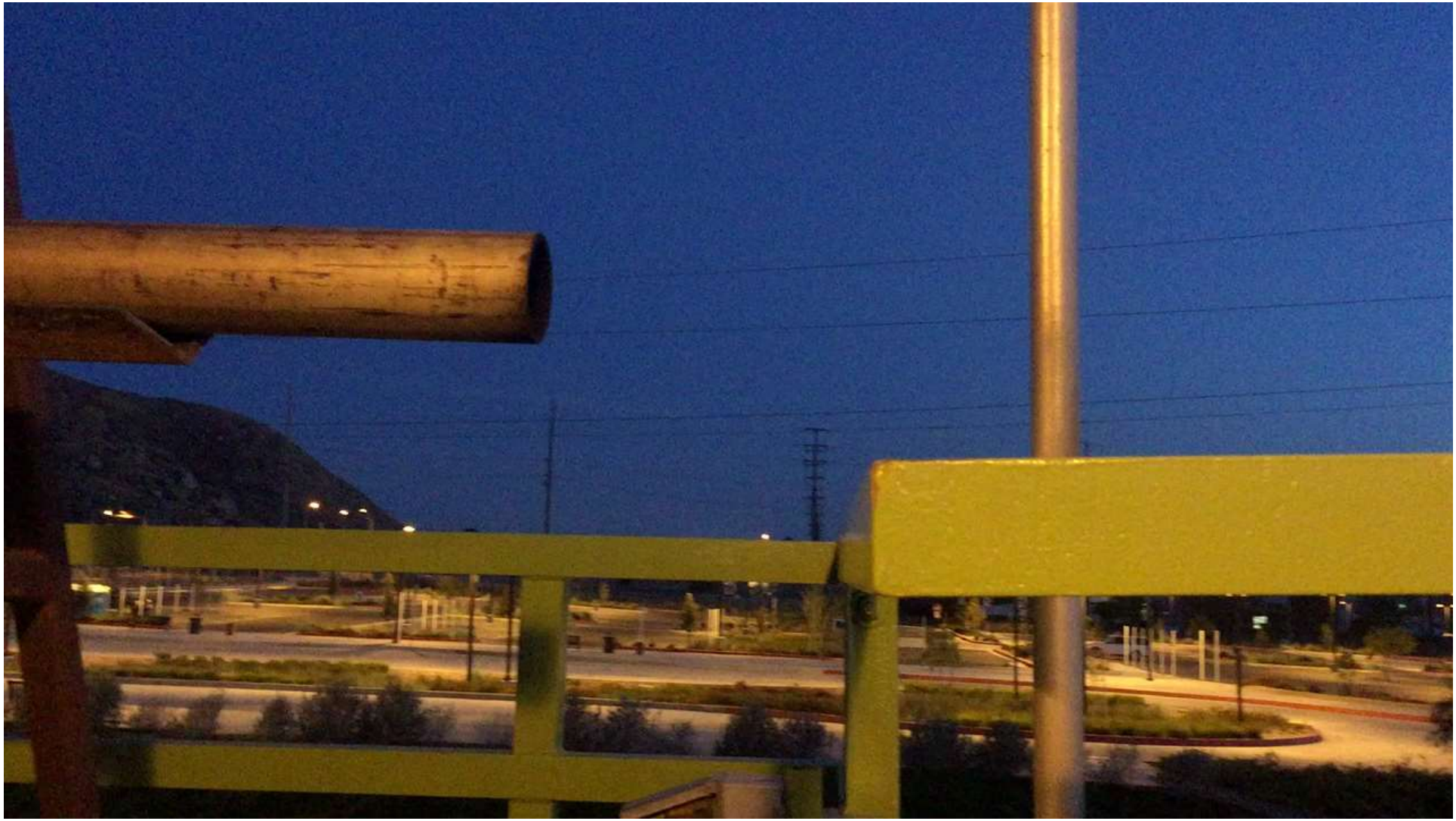

AXISYMMETRIC O_2/H_2 PDRE
2-DIMENSIONAL DUCT
(VARIABLE GEOMETRY)
L_{DUCT}
$L_{DUCT\ (T)}$
$\dot{m}_{AIR}$
α
β
$A_{DUCT\ (IN)}$
$A_{PDE\ (E)}$
$A_{DUCT\ (T)}$
A_D
$A_{PDE(CS)}$
L_{PDE}
$A_{PDE\ (T)}$
$\dot{m}_{AIR}$

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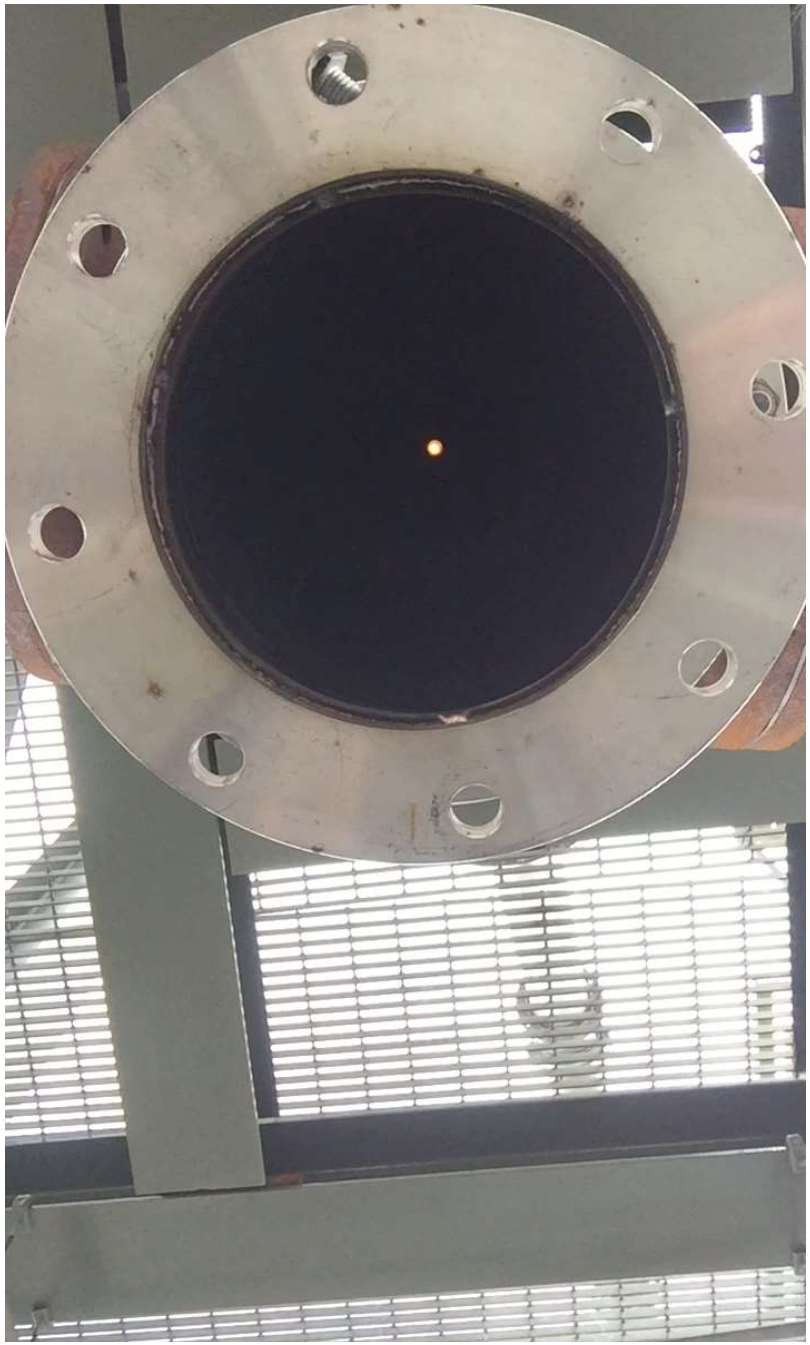
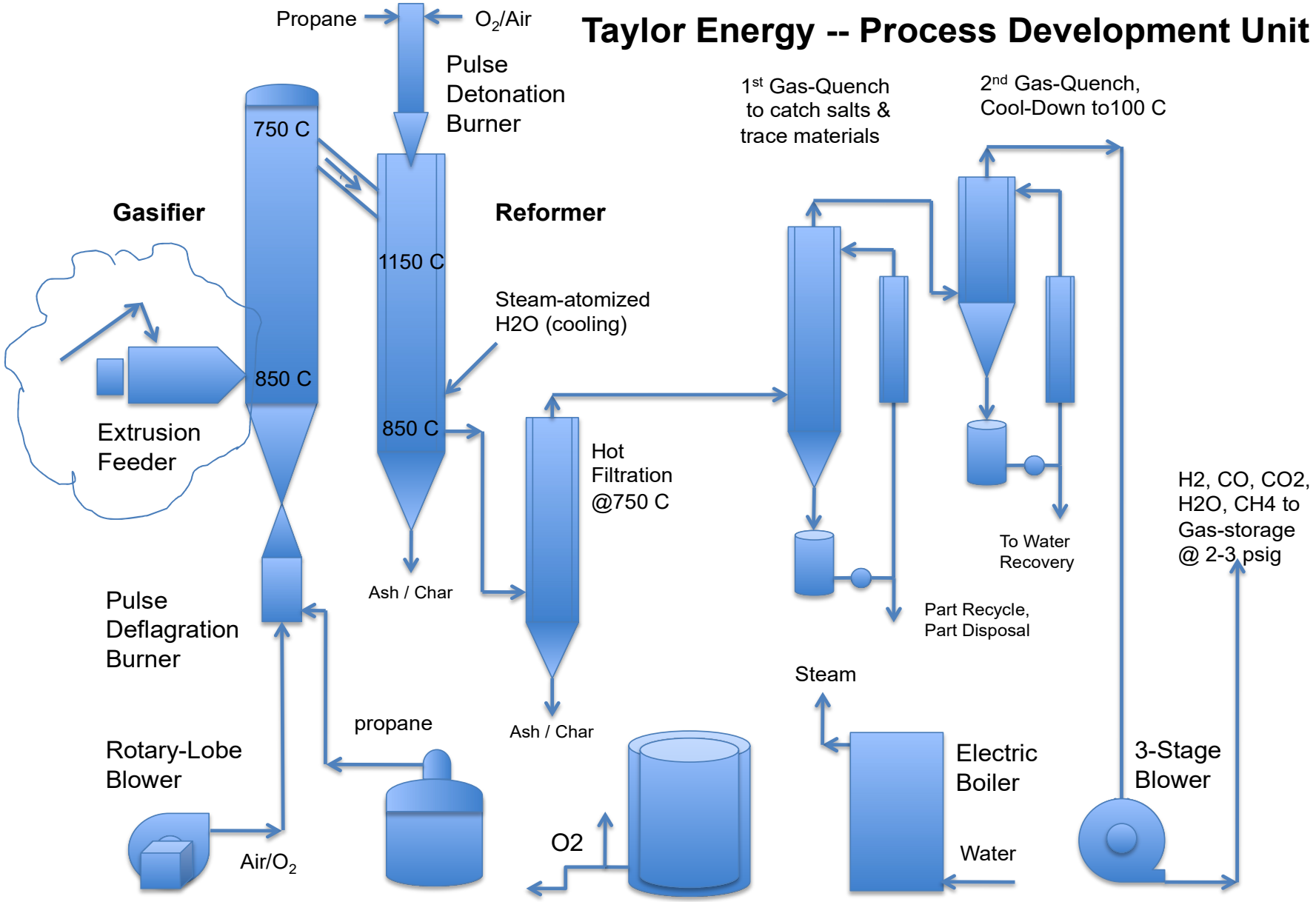
HYSTER

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Air/O_2
O2
Electric
Boiler
Water
3-Stage
Blower


3
2
1

Refuse Derived Biomass (RDB)
Compared with MSW, Plastic, Pulp

										Rev 1
		Pilot	Pilot	Pilot	Demo					Proposed
					40t/d		Pap+Plas		Battelle	Design
		700 °C					Mixed	Raw		
	HHV,	MunWast	MunWast	Plastic	MW	Pulp	Waste	MSW	RDF	
	Btu/scf	Mol%	Mol%		Mol%					
C		37.74	37.74	75.4	33.4	37.5	55.1	48.43	47.31	47.6-31
H		5.01	4.93	12.2	4.42	4.88	8.6	7.06	6.61	6-4.5
N		1.79	1.61		1.26	1.28	0.2	0.99	0.68	1.2-1
S		0.5	0.7	0.1	0.47	4.63	0.3	0.15	0.14	0.4-0.3
Cl		0.7	0.43	2.1	1	0.29	1.2	0.64	0	1.5-1.0
O		26.9	30.6	9.7	28.05	28.1	20.8	29.92	34.71	34-27.2
ASH		27.4	23.8	0.5	31.1	23.2	13.8	13.31		20-12


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