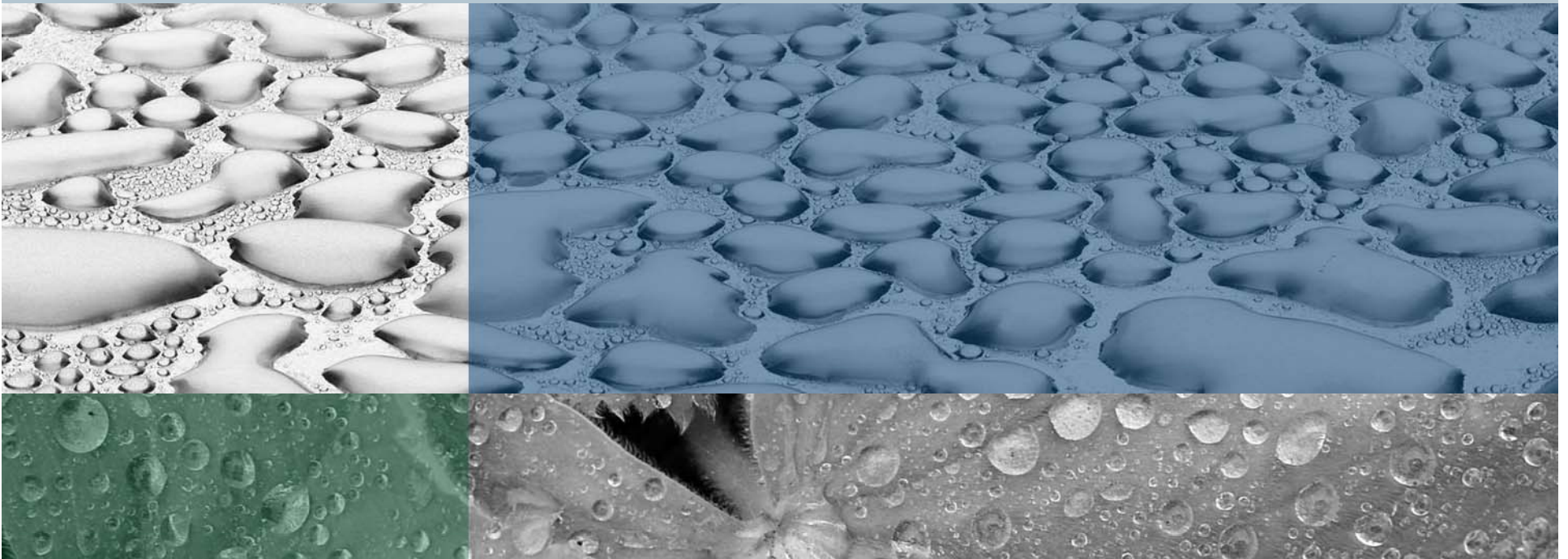


SUSTAINABLE DISPOSAL OF BIOSOLIDS through THERMAL REDUCTION





Presentation Overview

- Challenges
- Available Options
- Thermal Destruction Methods
- Fuel Value
- Case Study
- Constraints/Benefits



Challenges

- Increasing volume of biosolids
- More restrictive regulations
- Increasing cost of ultimate disposal
- Increasing cost of transportation
- Greater demand for being “green”
- Increasing concerns relating to carbon footprint



Volumes of BIOSOLIDS in California 2008

- ~680,000 dry metric tons “prepared”
- Class B ~ 178,000 dmt
 - 15,000 dmt to city owned lands
 - 35,000 dmt private lands in same county
 - 52,000 dmt private lands outside county
 - 75,000 dmt to AZ
 - 1,000 dmt to NV
- Class A ~ 341,000 dmt
 - 225,000 dmt composted in CA
 - 6,500 dmt composted in AZ
 - 30,500 dmt alkali treated & applied in CA
 - 65,000 dmt therm digested & applied in CA
 - 4,000 dmt heat dried & distr. In CA
 - 10,000 dmt air dried & applied in CA
- Landfilling ~ 74,000 dmt
- Other methods incl incineration 97,000 dmt



BIOSOLIDS Disposal Options

- Class B Alternatives
 - Contract Reuse/Disposal
 - Landfill
 - Solids Reduction (i.e. Cannibal[™])

- Class A Alternatives
 - Composting
 - Chemical Stabilization
 - Class A Digestion
 - Heat Drying
 - Thermal Combustion
 - Drying Beds
 - Pasteurization



Types of Thermal Reduction

- Incineration
 - Multiple Hearth Furnace
 - Fluidized Bed
 - Electric Arc (minimal use)
- Gasification/Oxidation
 - Fixed Grate



Thermal Reduction Process

- Reduces Overall Vol. of Biosolids for Ult. Dispose
 - Approx. 15-30% Ash
- Destruction of Pathogens
- Reduces Carbon Footprint
 - Reduces Free Release of Methane & Other GH Gases
 - Reduces Emissions from Hauling
 - Reduces Energy Importation Requirements
- Energy Recovery Potential
- Agency Controls Own Destiny

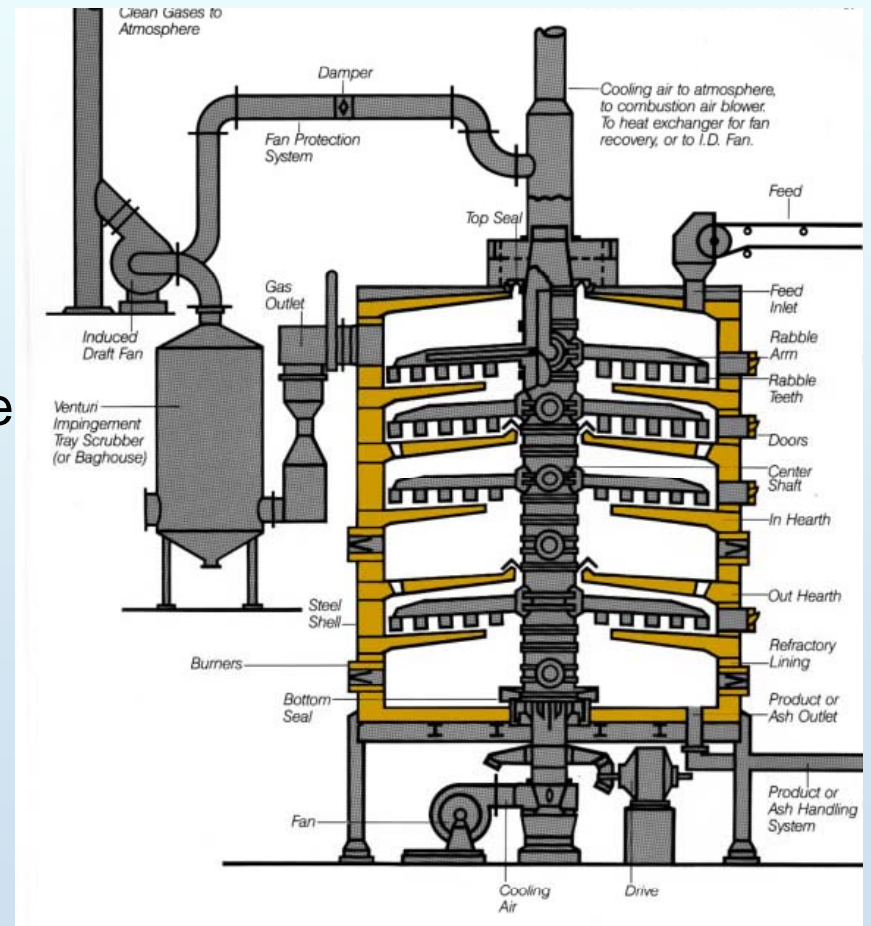


Multiple Hearth Furnace

- Dry and then combust
- First used for biosolids in 1935 Dearborn, MI
- 150 +/- still in use USA
- Typically not autogenous (requires external fuel)
- Sensitive to fuel feed quality
- Low exhaust gas temperature
- Higher emissions
- Lower heat recovery potential

Multiple Hearth Furnace

- Three zones:
 - The upper hearths (drying zone) between 800 and 1000° F.
 - The middle hearths (combustion zone), between 1500 to 1700° F. A series of burners are installed in the combustion zone to maintain the combustion temperature.
 - The lower hearths (cooling zone) from 350 to 400° F.



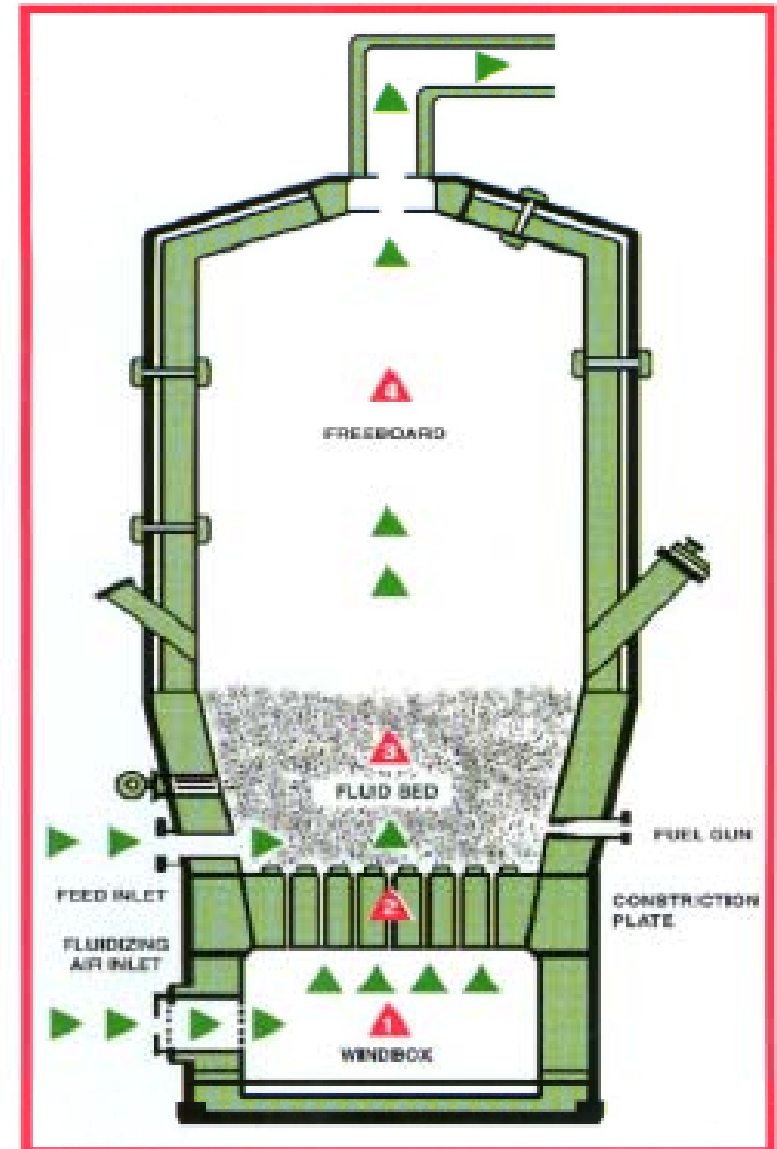


Fluidized Bed

- Water flashes (evaporates) then solids burned
- First used for biosolids in 1962 Dearborn, WA
- 125 +/- installed in USA
- Can be autogenous
- Exhaust gases approx 1500° F – 1700° F
- Lower emissions
- Higher heat capture potential

Fluidized Bed

- Four Zones:
 - Windbox (combustion air either ambient or preheated.
 - Refractory arch heats combustion air up to 1250° F.
 - Fluid bed (sand) where biosolids, combustion air and additional fuel (if needed) are mixed. 1350 to 1500° F.
 - Freeboard which provides residence time and settles rising sand/ash





Fixed Grate

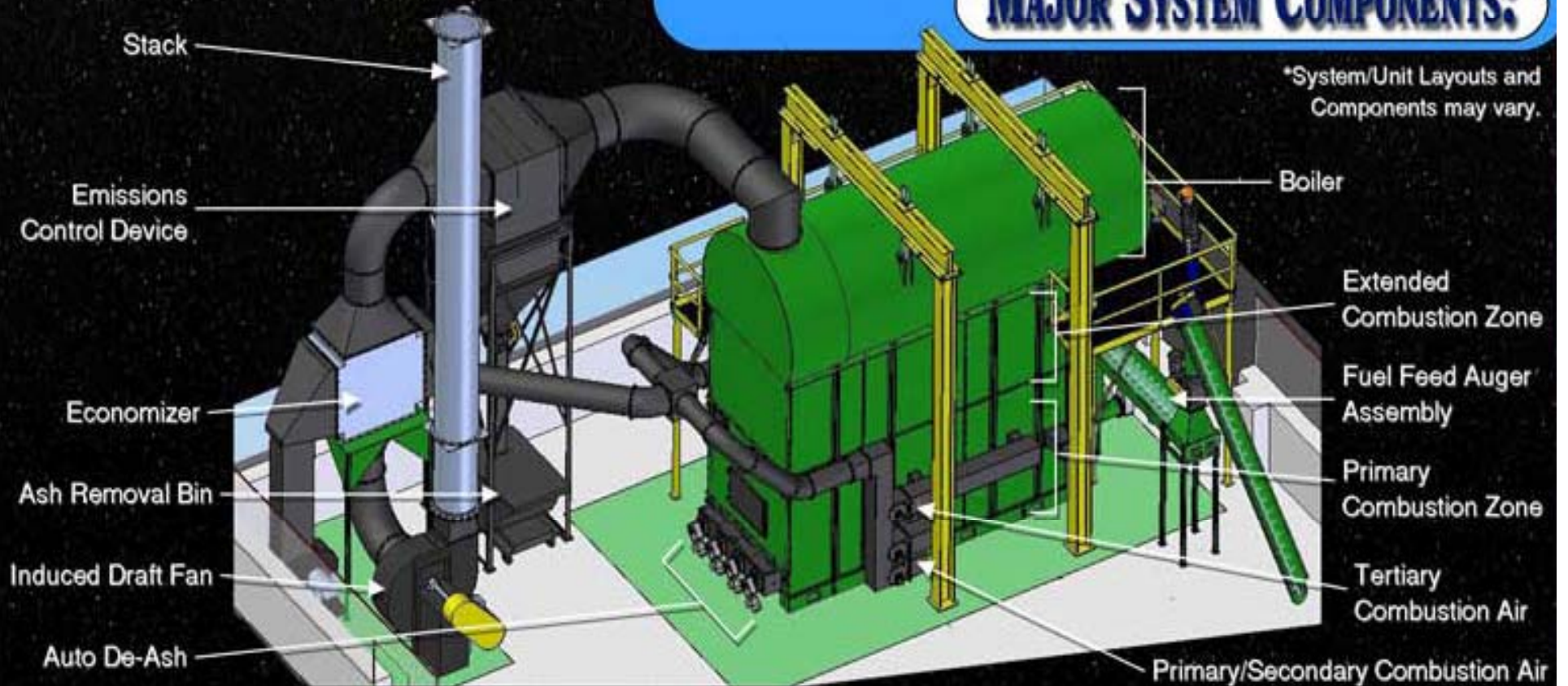
- Oxidation/Gasification process
- Dry and then combust
- Prototypes being used on east coast
- Can be autogenous
- Exhaust gases approx 1500° F – 1700° F
- Lower emissions
- Higher heat recovery potential
- Somewhat sensitive to fuel feed quality
- Can blend with other biomass fuel sources

Fixed Grate

*Extended Combustion Zone increases height by 6-ft.
**All dimensions shown are outside of Firebox.

MAJOR SYSTEM COMPONENTS*

*System/Unit Layouts and Components may vary.





SMWD – Chiquita Case Study



BIOSOLIDS Fuel Value

- Dewatered/Digested RAS
 - 4,000 - 5,300 Btu/dry lb solids
- Undigested RAS
 - 6,000 - 10,300 Btu/dry lb solids
- Undigested Primary
 - 8,000 – 11,000 Btu/dry lb solids



SMWD BIOSOLIDS Disposal Options

- Class B Alternatives
 - Contract Reuse/Disposal
 - Landfill
 - Solids Reduction (Cannibaltm)

- Class A Alternatives
 - Composting
 - Chemical Stabilization
 - Class A Digestion
 - Heat Drying
 - Thermal Combustion
 - Drying Beds
 - Pasteurization

Potential Volume of Biosolids

Production (wt/day)	Chiquita	J.B. Latham	Joint Regional	3A	Michelson	Total
Current	22.4	23.6	46.2	7.3	25.0	124.50
Ultimate	34.4	27.1	53.1	8.4	25.0	148.0



Heat Content of BIOSOLIDS

- Santa Margarita - Chiquita WRP
 - Primary – 8,800 Btu/lb
 - WAS – 7,400 Btu/lb
 - Digested – 6,450 Btu/lb

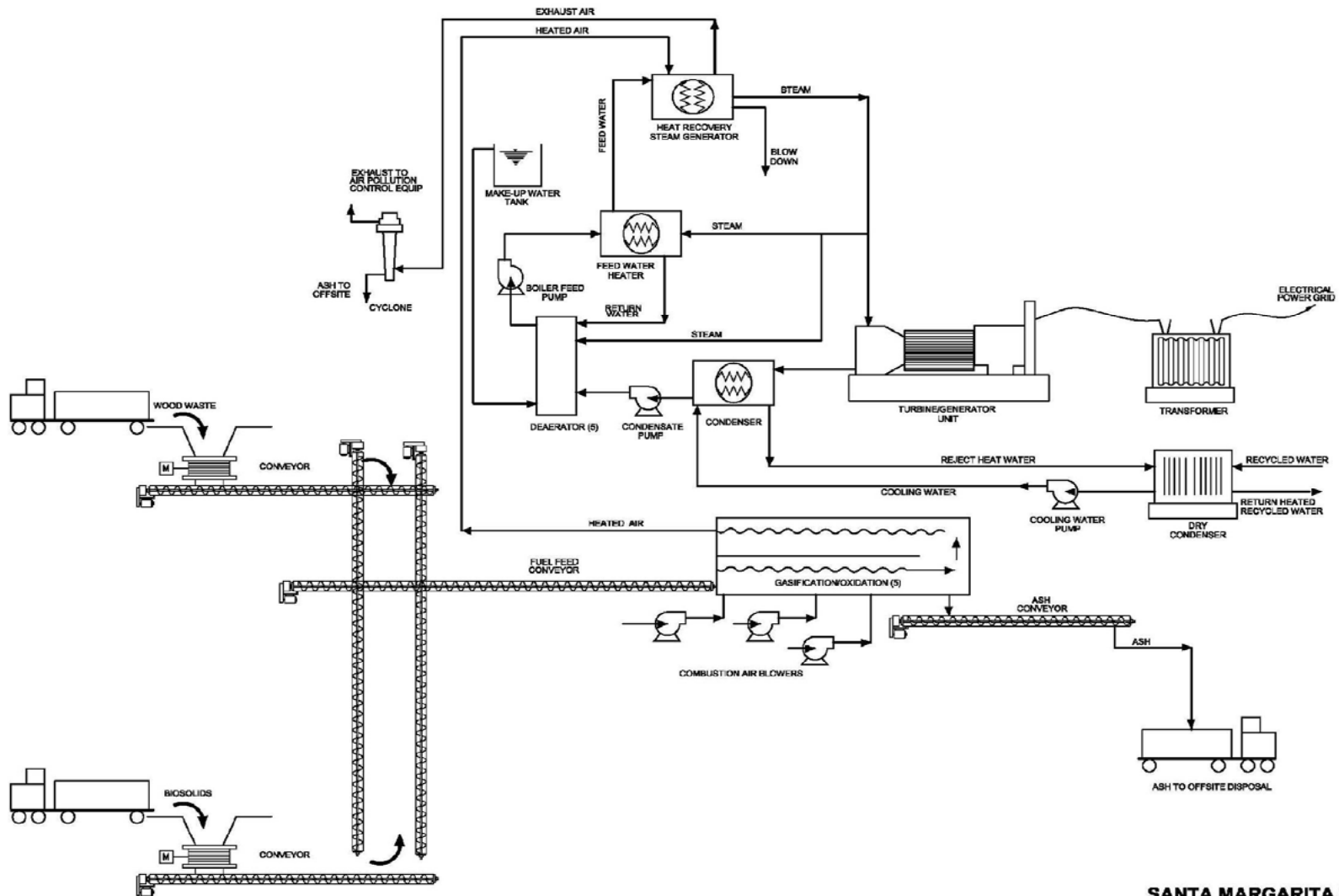
- Irvine Ranch - Michelson WRP
 - Primary – 8,000 Btu/lb
 - Cake Solids – 4,415 Btu/lb

Potential Power Production

Source	Solids (wt/day)	Est Power Generated (MW)	Est. Parasitic Load (MW)	Potential Power to Grid (MW)
Chiquita	28	2.11	0.7	1.41
Chiquita/SOCRA	116	8.64	1.9	6.74
Chiquita/IRWD	53	3.96	1.7	2.26
All Combined	141	10.49	1.9	8.59

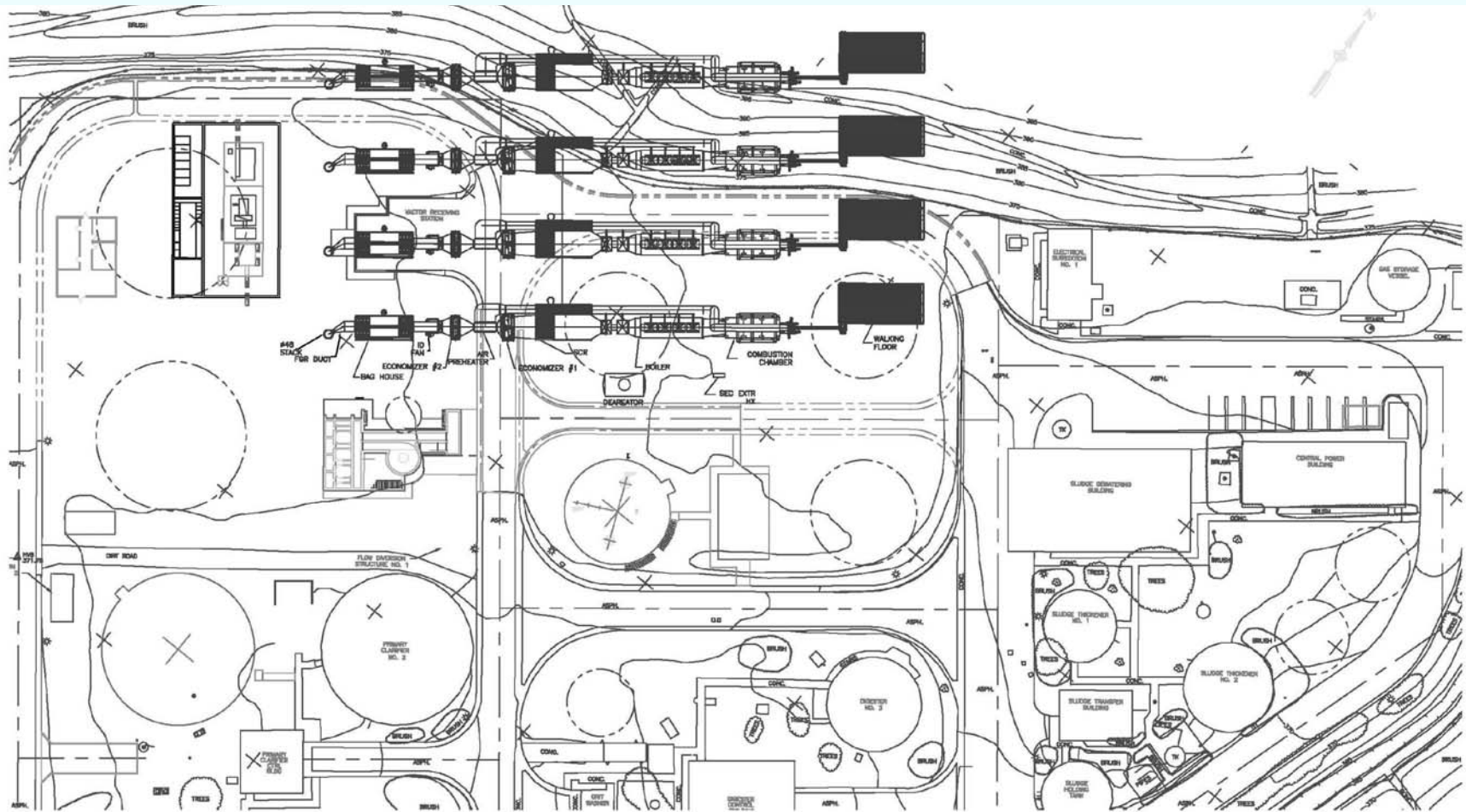
Assuming 2:1 wood waste to bio-solids blend

Proposed SMWD Flow Diagram



**SANTA MARGARITA WATER DISTRICT
CHIQUITA WATER RECLAMATION PLANT**

Possible Process Site Layout



SANTA MARGARITA WATER DISTRICT
CHIQUITA WATER RECLAMATION PLANT
PRELIMINARY SITE PLAN

Thermal Reduction Economics

Source	Rev Rec'd for BioSolid (\$1,000)	Annual Power ¹ (\$1,000)	Project Cost ² (\$1,000)	Amor. Proj. Cost (\$1,000)	Annual Oper. Cost ³ (\$1,000)	Net Rev (\$1,000)
Chiquita	747	1,123	10,287	897	451	522
Chiq/SOCRA	3,060	4,100	41,679	3,634	2,467	1,059
Chiq/IRWD	1,404	1,598	30,594	2,668	1,407	(1,073)
All Comb	3,717	5,133	51,480	4,489	3,228	1,133

1 Combined avoided power cost and excess power sold to grid.

2 Construction cost minus the avoided project cost.

3 Ash disposal and O&M costs.

4 Based on 2:1 dilution ratio

Solids Feed Equipment



Thermal Reduction Equipment



Inside of Combustion Unit



Combustion Unit in Operation

Thermal Reduction Equipment



Heat Recovery Equipment – Boiler & Cyclone





Universal Constraints

- Emissions Controls
 - NO_x
 - SO_x
 - VOC's
 - Metals
 - Dioxins/Furans
 - PM-10/PM-5
- Public Perception
- Need for additional fuel source (wood waste/green waste)



Benefits

- Reduces ult volume of biosolids to dispose
- Reduces uncontrolled GHG emissions (AB-32)
- Reduces oil requirements for hauling (~ 5 mpg)
- Meets growing “Environmental Justice” expectations
- Provides partial or total “sustainability” of the treatment process
- Using 680,000 dt/yr could translate to over 10,000 MW of power