Biosolids Alternatives

Woodward Ave Facility

Hamilton, Ontario

CDM Smith

October 10, 2014

Overview

- 409,000 cubic meters/day rated capacity WWTP
- City is currently producing 40,000 wet tonnes of biosolids per year with growth rate of 1% per year
- Truck dewatered biosolids offsite for land application as a soil additive
- During winter biosolids are stored in an approved facility

CDM Smith

Existing Hamilton Facility

CDM Smith

Challenges

- Limited service providers in Ontario with the capacity to handle the volume of biosolids produced
- Uncertainty about the continued availability of land for application of Class B biosolids
- Looking to advertise DBFOM for biosolids handling with a 30 year operating period

Wastewater Plants Are Being Viewed as Resource Centers

Fuel

Energy
(Heat, Power)

Organic
Waste

Resource Supply
(wastewater)

Fertilizer &
Nutrients

Reclaimed Water
& Hydrothermal

BNEW Center
(**B**iosolids, **N**utrients, **E**nergy, **W**ater)

CDM Smith

Biosolids as a Resource

Thickened Sludge Storage

Dewatering

Lime Stabilization

Alkaline Biosolids Land Application

Composting Facility

Compost

Wet Cake Appl.

Amendment

Manufactured Soil

Anaerobic Digestion

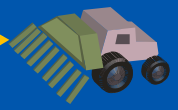
Dewatering

Chemical Addition (VitAg)

Dryer

Pellet Processing

Class A Pellet Land Application



Biochar

Pyrolysis Kiln

Biocoal

Incineration

Ash (Landfill)

CDM Smith

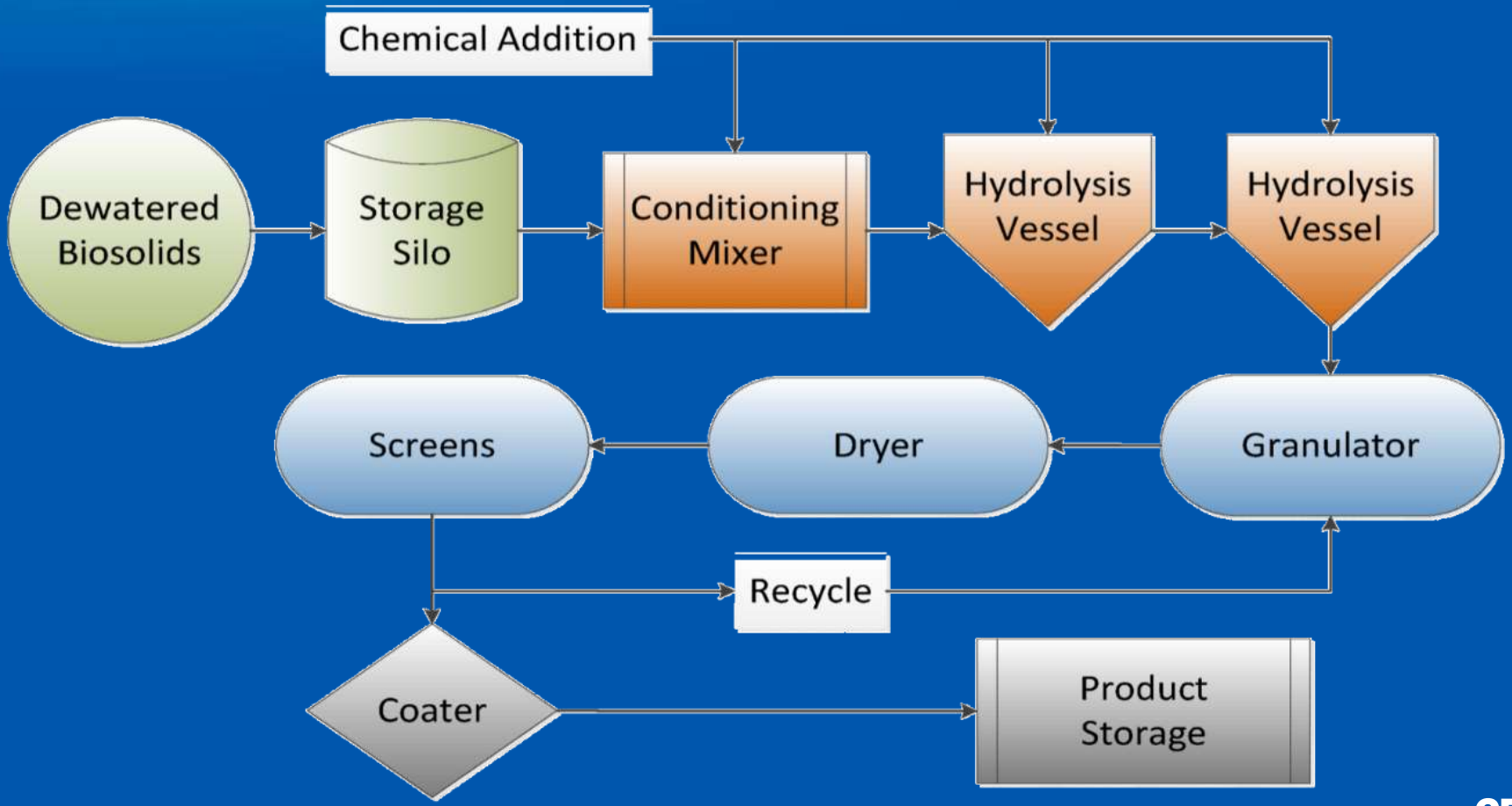
Potential Biosolids Process Applicable to Hamilton

Process	Biosolids Final Product
VitAg	*Enhanced Organic Fertilizer*
Biosolids Dryer	*Dried Pellet*
Pyrobiomethane	*Biochar*
Mitsubishi Biocoal	*Biocoal*
Fluidized Bed Incinerator	*Ash*

CDM Smith

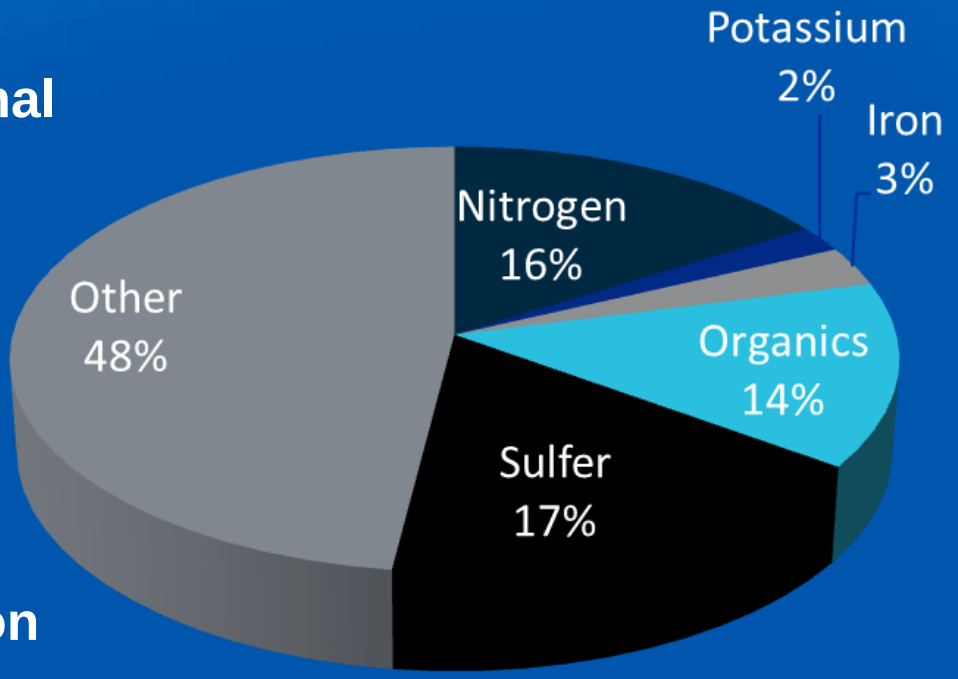
VitAg Alternative

VitAg Process Schematic



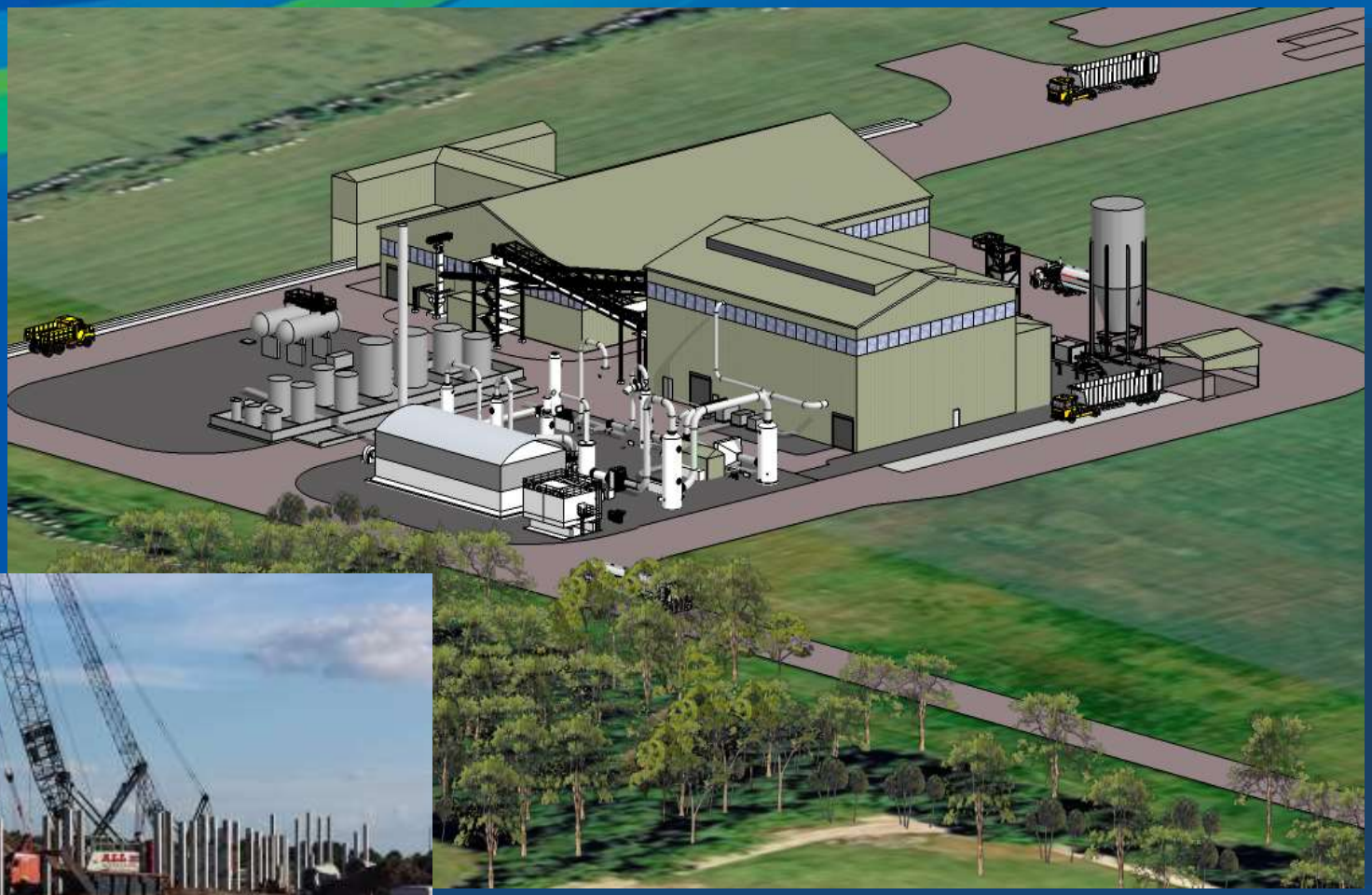
Key Product Characteristics

- Meets USEPA Class A, Exceptional quality standards
- Key fertilizer properties
  - 5-7 # hardness
  - 0.5 to 3 mm diameter
  - <1% moisture
- Ideal for standard farm application equipment
- Application rates: Pound per acre – not tons
- N-P-K-S-Fe-Organic (16-0-2-17-3-14)



CDM Smith

VitAg Florida Facility Under Construction



VitAg Site Specific Considerations

Facility Capacity:

Standard VitAg	*Up to 60,000 tonnes/year*
Hamilton Production	*40,000-52,000 tonnes/year*

Chemical Used:

Ammonia	*25 tonne/day*
Sulfuric Acid	*80 tonne/day*
Ferrous Sulfate	*25 tonne/day*
Product Production	*53,000 tonnes/year*

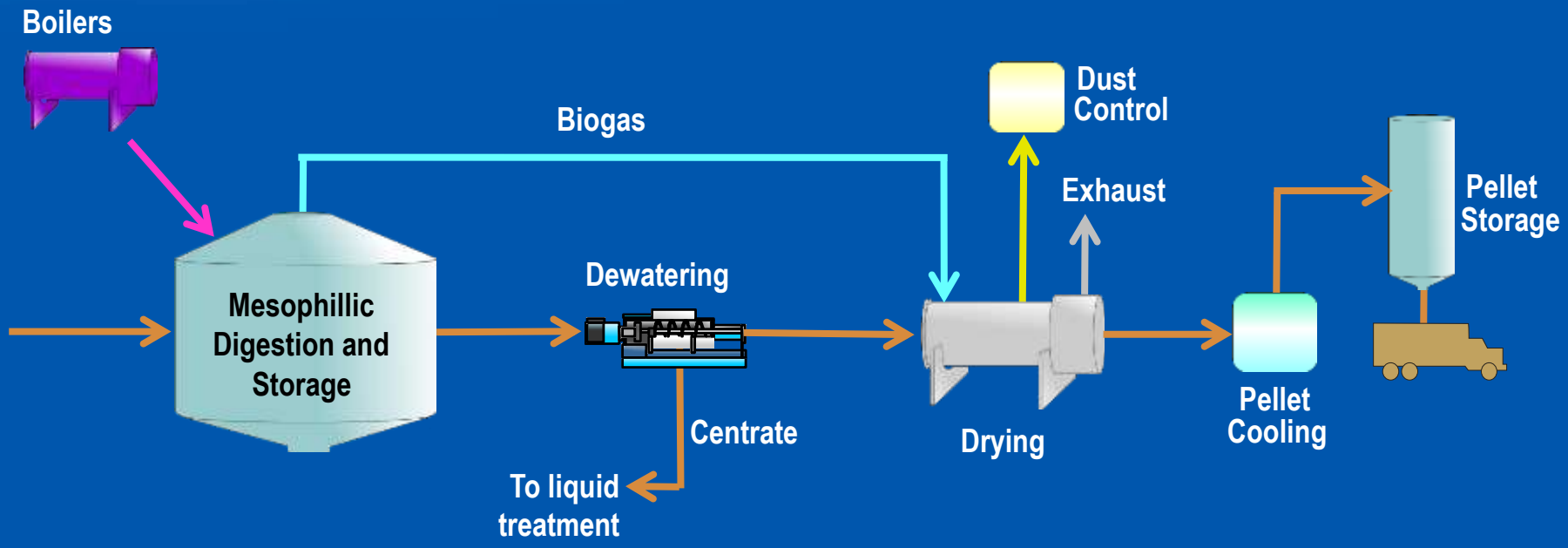
Area Requirements:

Process/Chemicals/Odor Control	*12,000 m^2*
Warehouse	*6,000 m^2*
Utility Needs	*Water, sewer, biogas (if available)*

CDM Smith

Dryer Alternative

Dryer Process Schematic



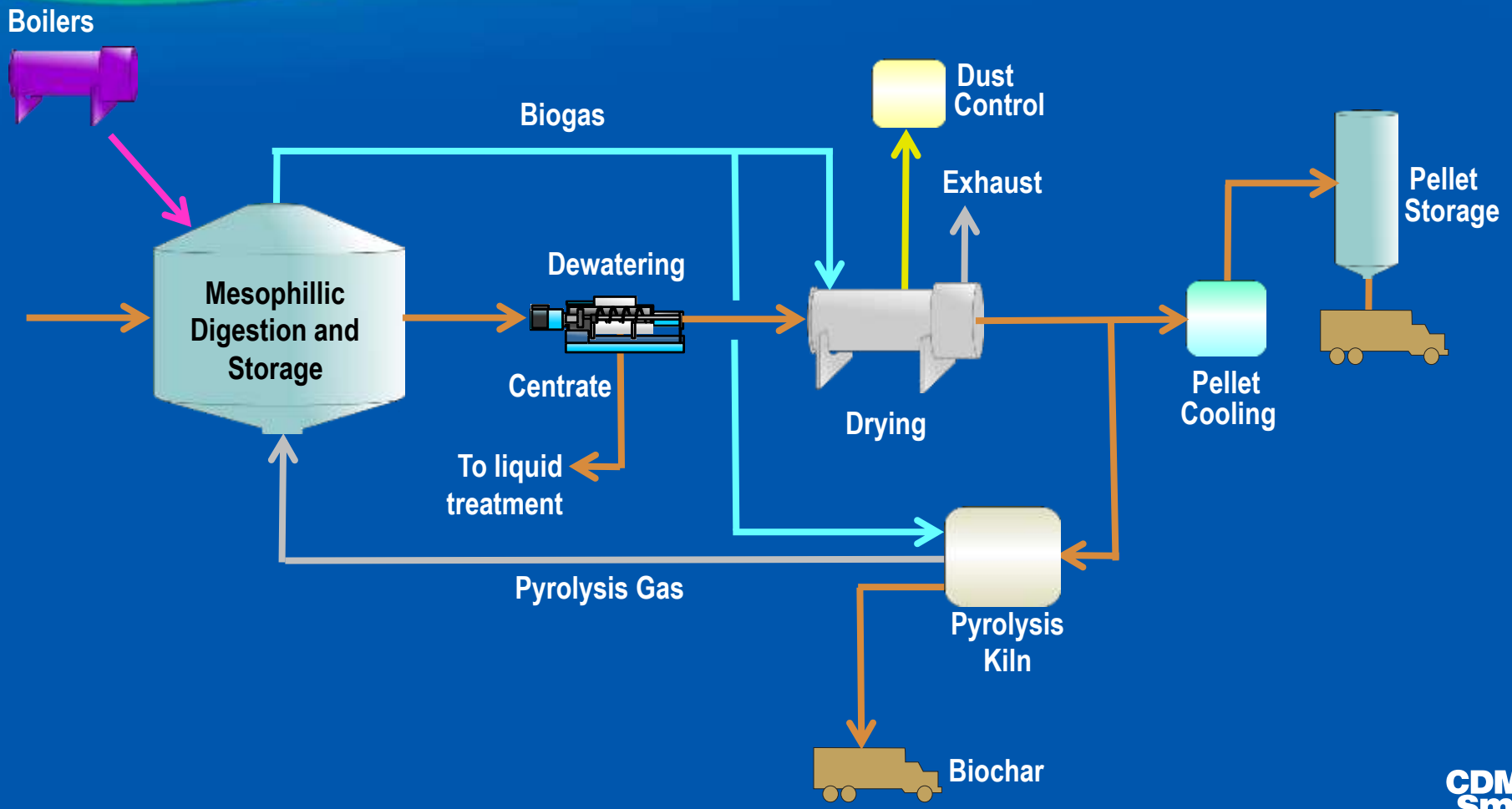
Dryer Installation Considerations

- Uses heat to evaporate water leaving Class A product at 90% solids
- Customizable to wide range of solids loadings
- Produces low value Class A product that can be use as a fertilizer or supplemental fuel
- Multiple different designs available from relatively simple belt dryers to complex drum dryers
- Complexity of equipment dependent on product pellet quality and consistency

CDM Smith

Pyrobiomethane Alternative

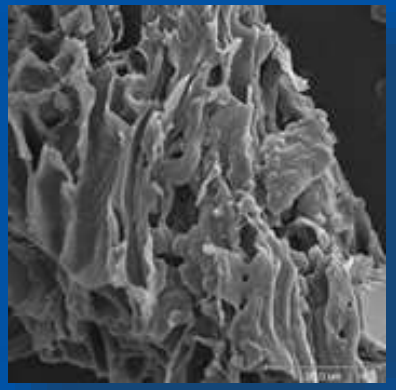
Pyrobiomethane Process Schematic



CDM Smith

Pyrobiomethane Process

- **Slow, low temperature pyrolysis process**
- **Converts recalcitrant lignins and other organics in dried, digested biosolids into:**
  - Reduce the amount of residual biosolids
  - Reduce odor of biosolids product
  - Create high value biochar product
  - Increase biogas production for beneficial use using proven gas treatment technology



Microscopic view of biochar surface

CDM Smith

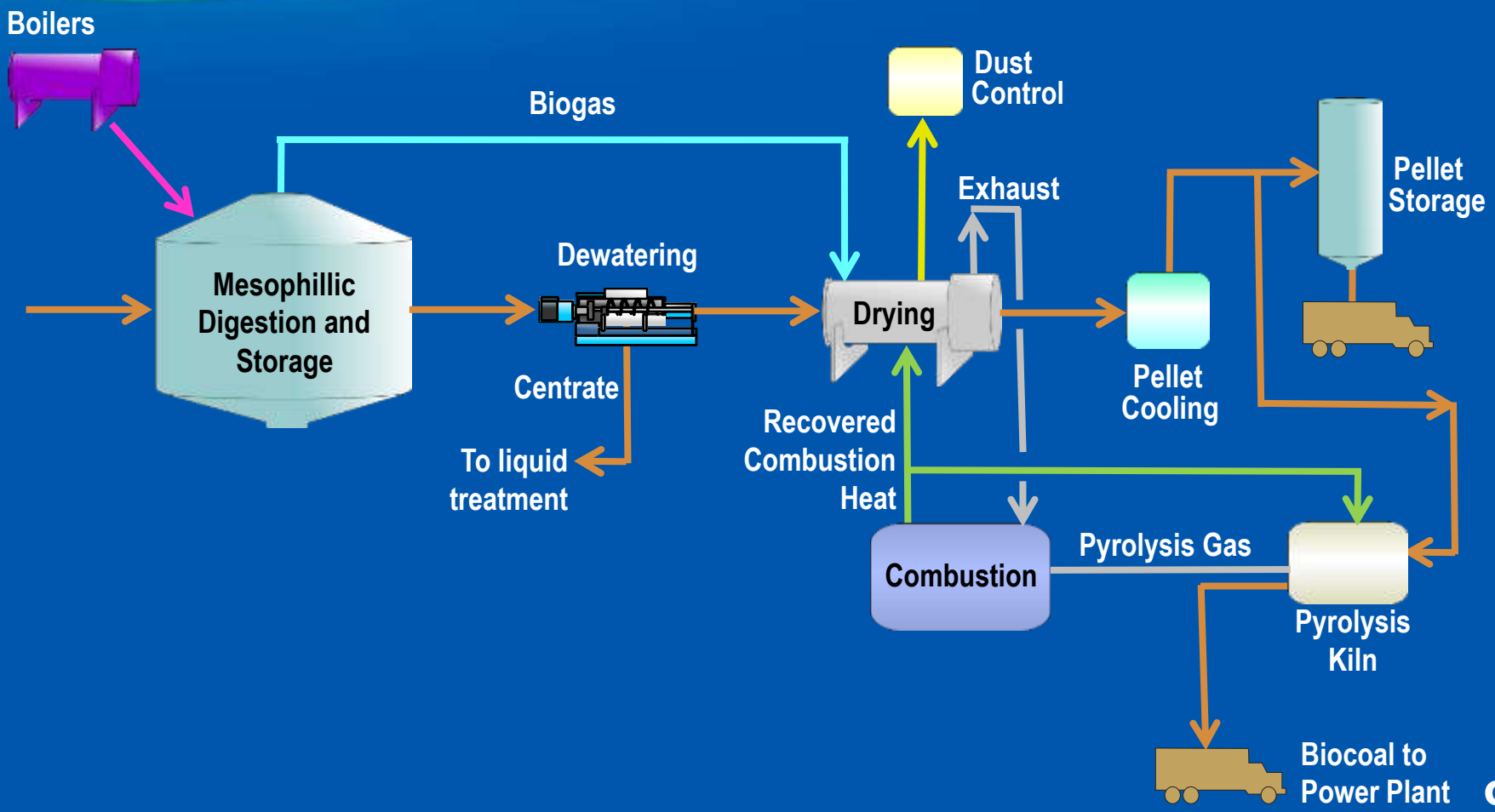
Pyrobiomethane Installation Considerations

- Dryer process with pyrolysis kiln and pyrogas/liquid handling system on back end
- One full scale application at Encina treatment plant in Carlsbad, CA (in startup)
- Market of biochar is not developed
- Increased complexity compared to drying
- Biochar product more valuable than dried product
- Increased potential for metals contamination
- Opportunity to start with drying and add pyrolysis system later

CDM Smith

Mitsubishi Biocoal Alternative

Mitsubishi Biocoal Process Schematic

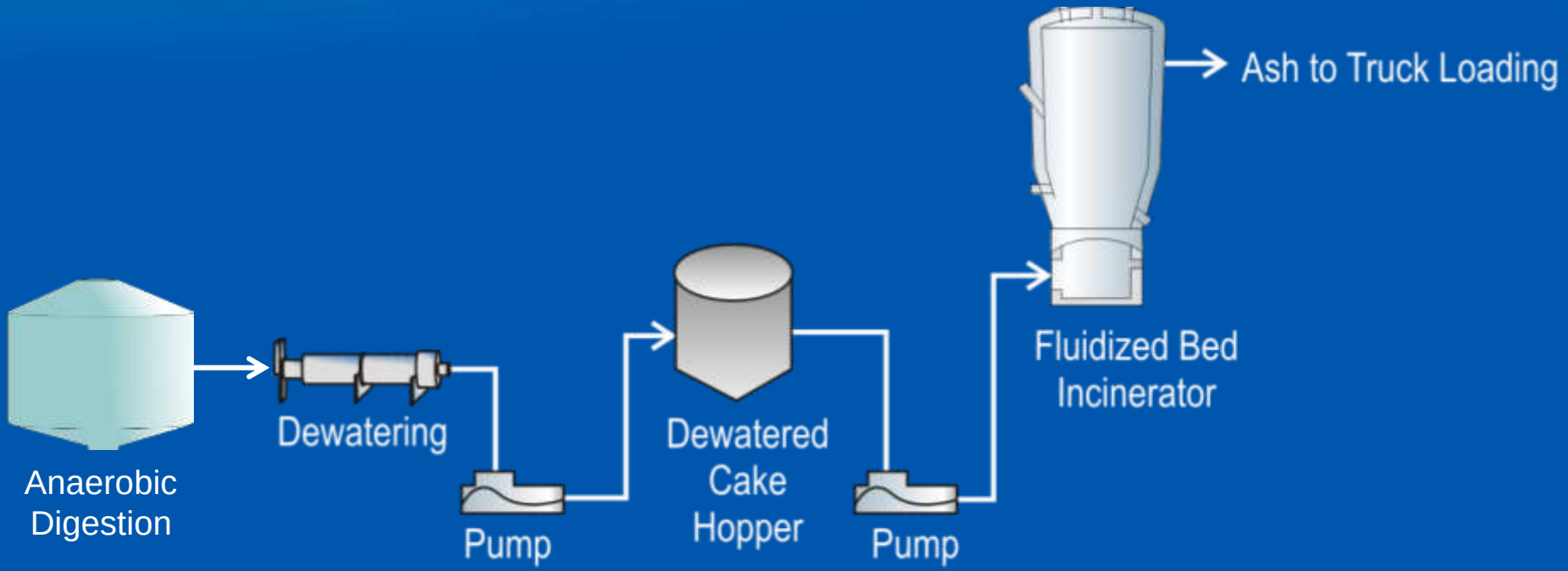


CDM Smith

Mitsubishi Biocoal Installation Considerations

- One full scale installation with only biosolids
- Adds pyrolysis kiln and coal combustion chamber to dryer
- Some of product to be used in process
- Product is a renewable carbon coal substitute

Incineration Alternative



Incineration Installation Considerations

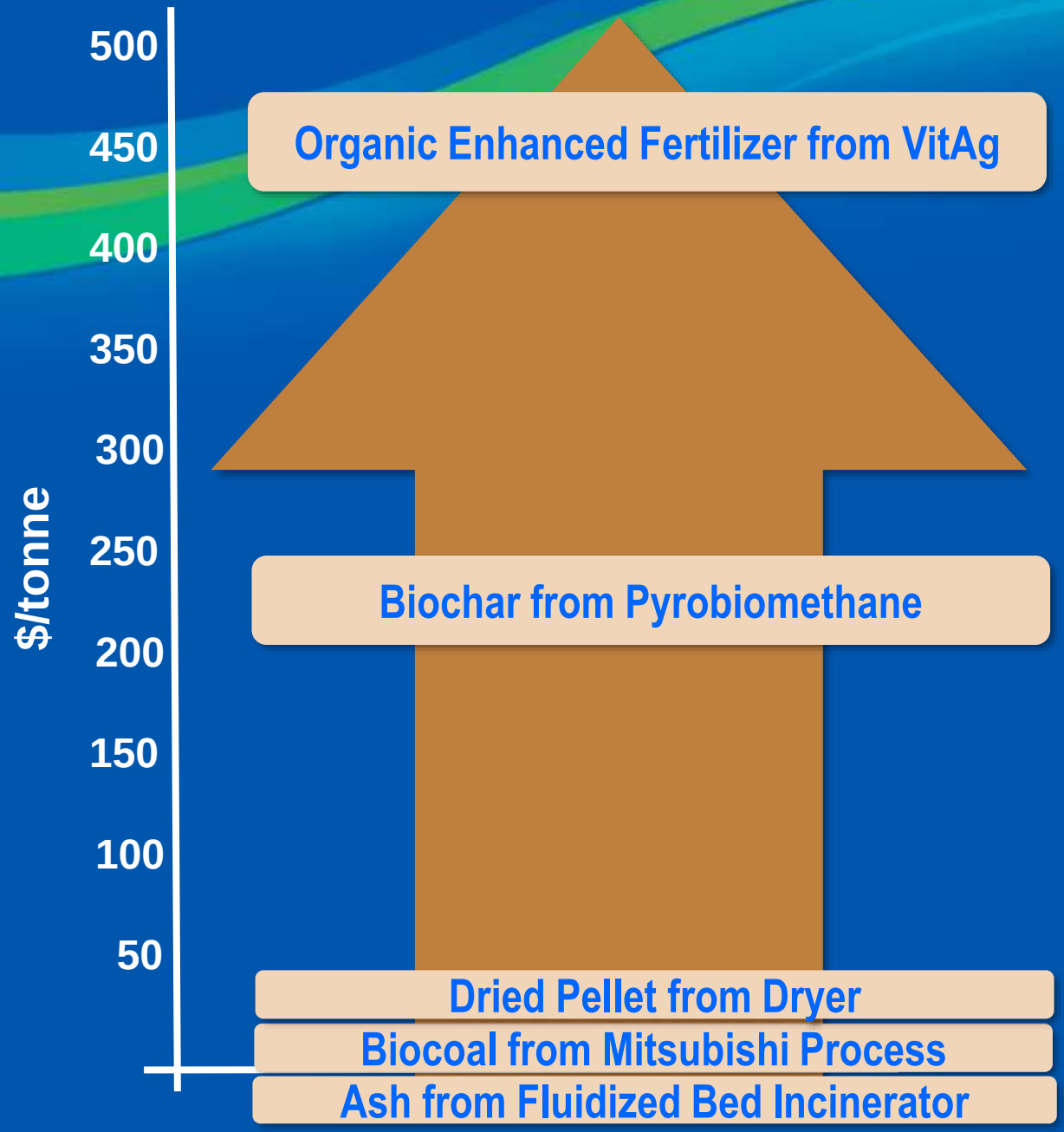
- Multiple vendors with experience in manufacturing at Hamilton's size
- Latest Fluidized Bed technology is simpler than previous incineration technologies
- Likely to require external energy
- Product is landfilled with no market value

Comparison of Alternatives – Unique Process Components and Product Production

* Not required, but recommended for phasing and product flexibilty

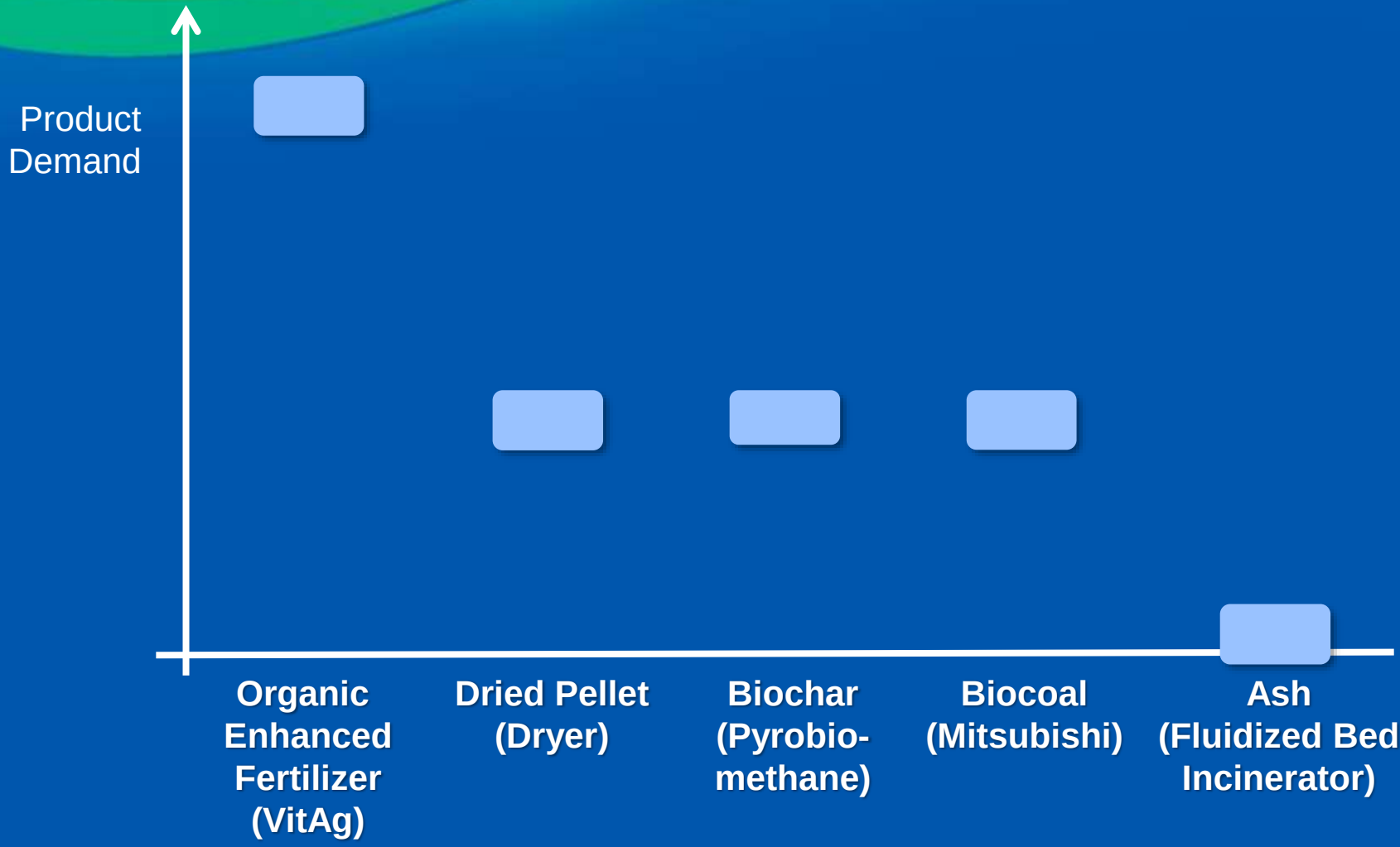
CDM Smith

Potential Value of Process Products



CDM Smith

Product Demand



Comparison of Process Products

Process	Solids Product		Gaseous Product	
VitAg	Fertilizer	• High value • High demand • Ideal for standard spreaders • Reduces greenhouse gases? • Non offensive odour	N/A	
Dryer	Pellet	• Low Value Fertilizer • Low Value Fuel • Renewable carbon source • Odour Potential	N/A	
Pyrobiomethane	Biochar	• High Value Fertilizer • Renewable carbon source • Non offensive odour	Pyrolitic gas	Fed to digester to increase biogas production
Mitsubishi Biocoal	Biocoal	• Coal substitute • Used internally in dryer • Renewable carbon source • Non offensive odour	Pyrolitic gas	Combusted in combustion chamber
Incineration	Ash	• Landfilled • Non offensive odour	Exhaust	Economically recoverable to heat. Recoverable for power generation with economic challenges

Suggestions for RFP Language to Help Limit the Options for Consideration

- Class A or high value product equivalent
- Product and marketability ownership for 30 years
- 70% of selection will be on price
- Preference for biosolids as a recoverable resource
- Standard land application not preferred
- Lime stabilization and compost not preferred
- Preference for new technologies that can demonstrate sustainable market

Questions