Composting of Anaerobic Digestate - Challenges and Opportunities

Mark Gould CDM- Cambridge, MA

Tim O'Neill Engineered Compost Systems- Seattle, WA

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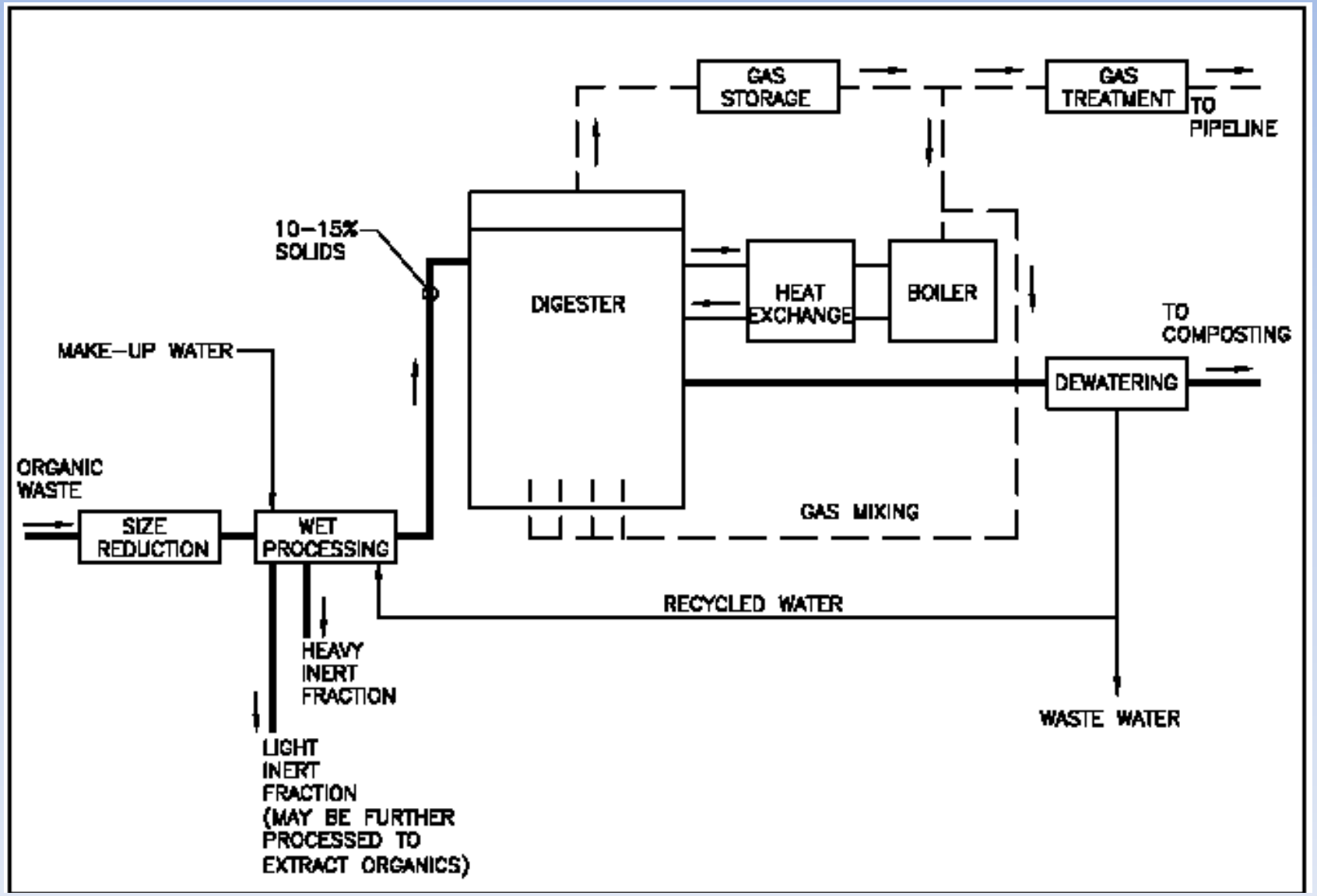
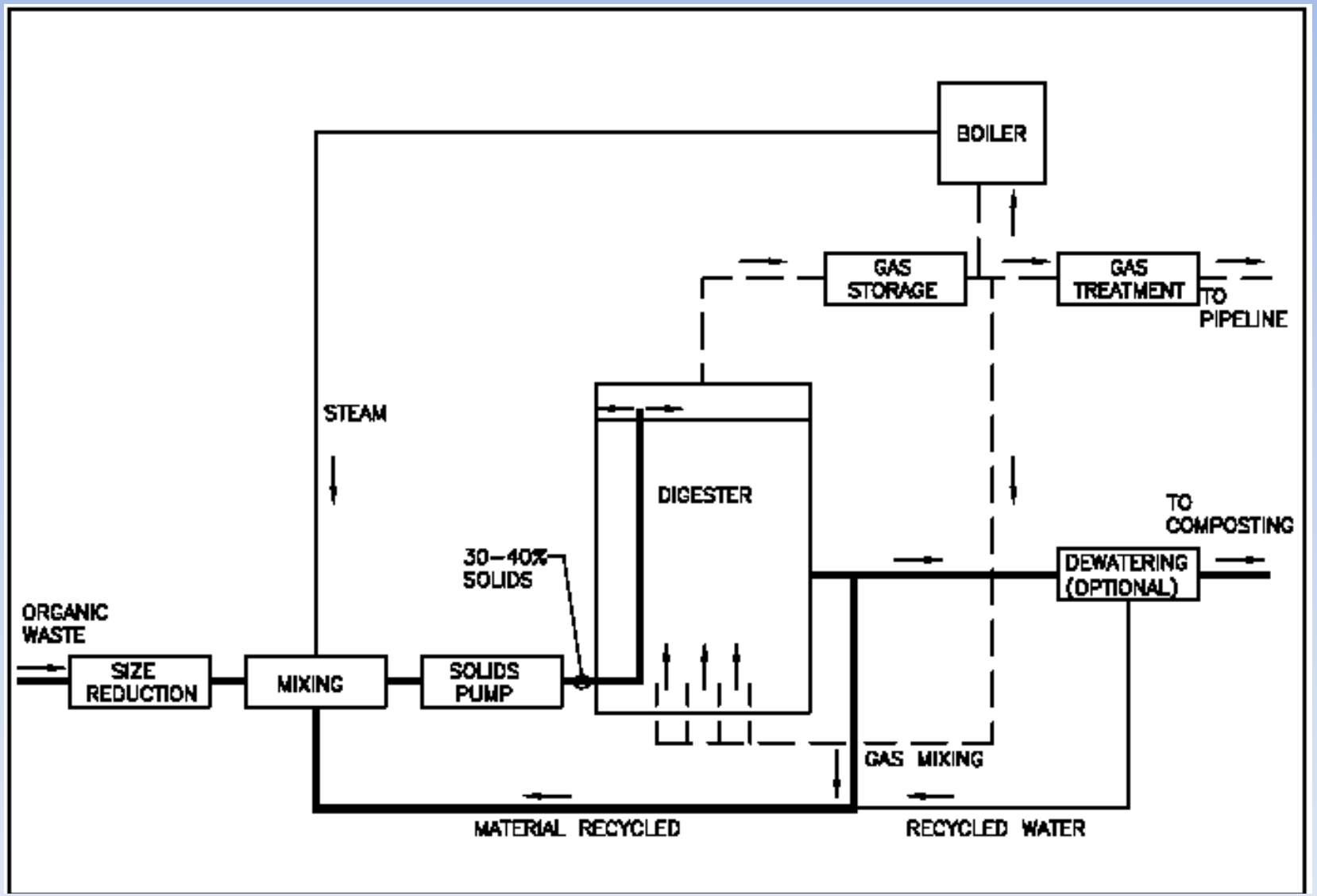
Wet AD Schematic

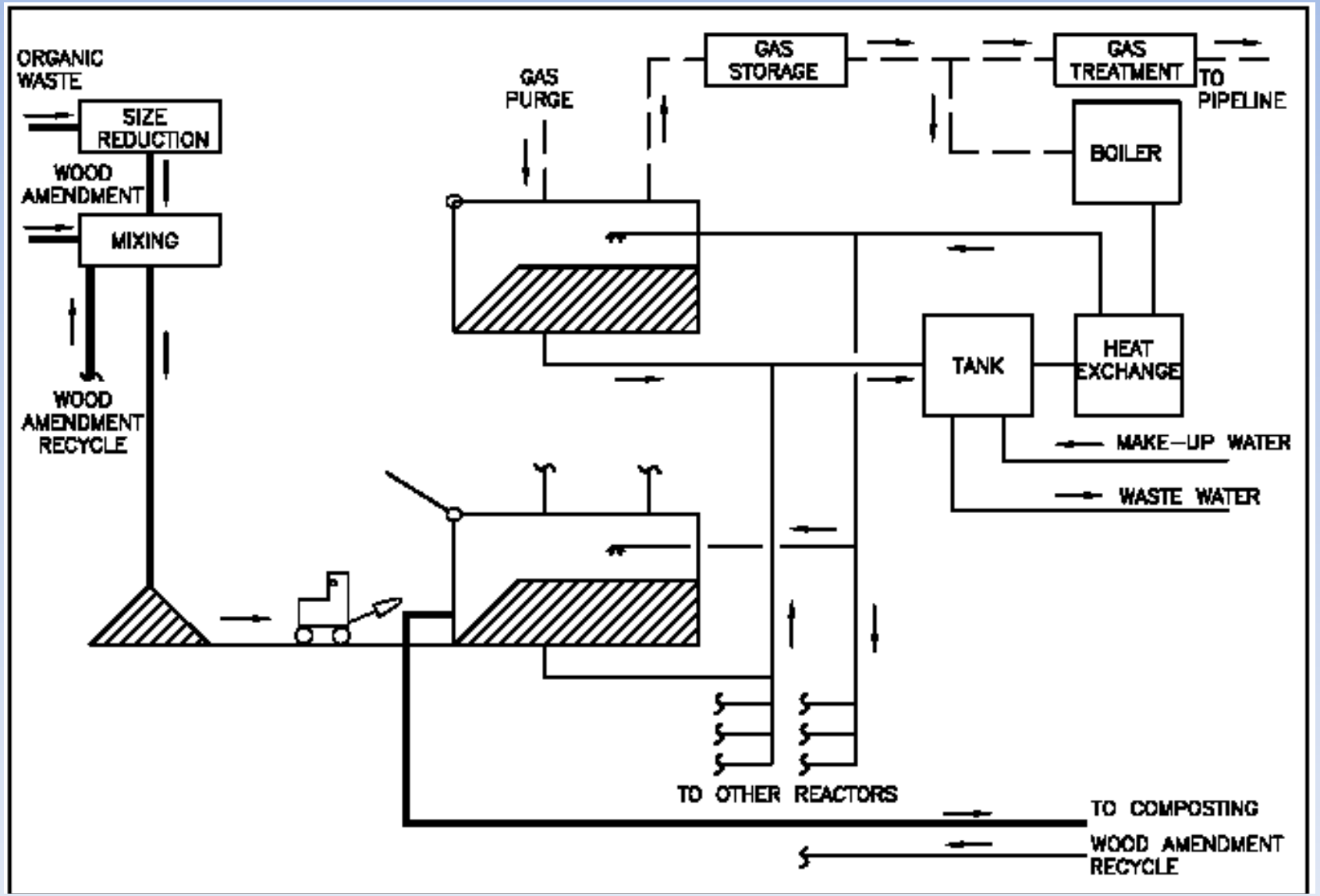



quasar

Continuous Dry AD Schematic



Dry Batch AD Schematic



Dry AD Cell

Feedstock Considerations

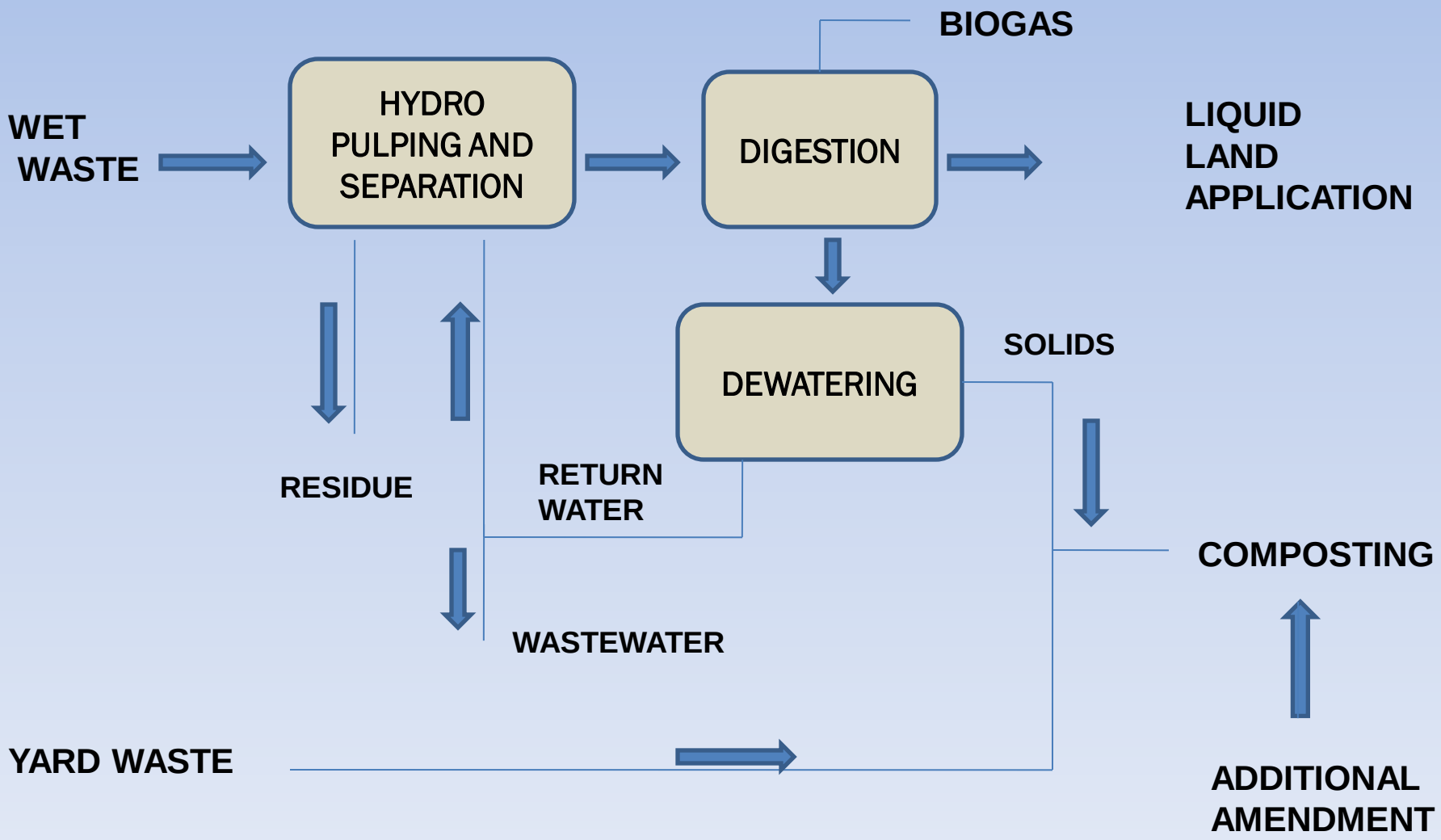
Source of Wet Organic Waste	Challenges	Best-fit Digestion Technology
Residential food and soiled paper	Potential high paper content	Wet Dry Continuous
Dining services	Contaminants	All types
Market Waste	Contaminants	All types
Liquid organic industrial waste	Loads may be highly variable	Wet
Manure	Low energy	Wet
Yard Waste	Too much cellulose Slow biodegradation	Dry batch

Wet Organic Feedstocks

Produce Waste

Liquid Waste

MATERIALS FLOW



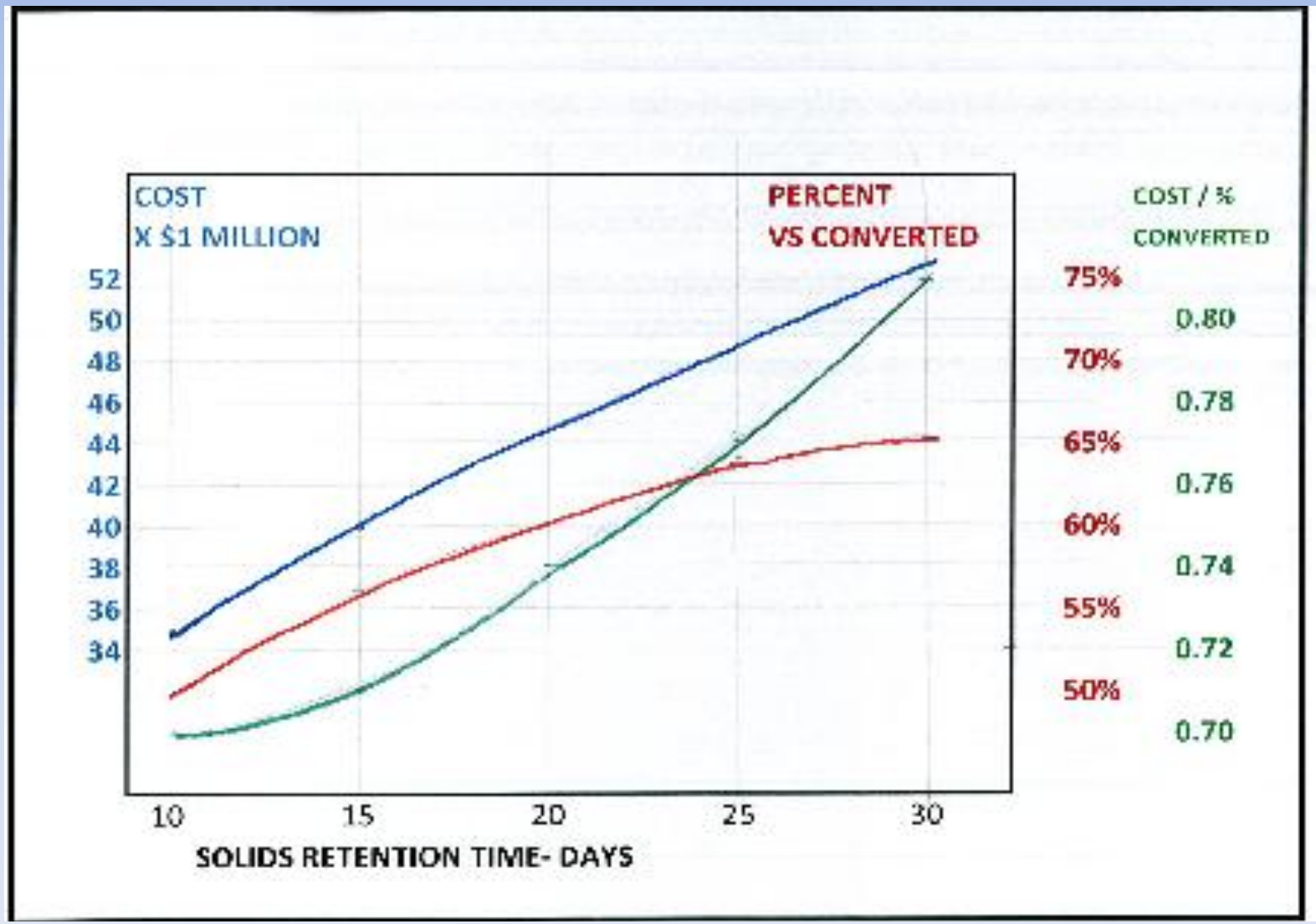
Requirements for Composting

- Sufficiently high bio-available volatile solids
- Dewatering to > 20% solids
- Sufficient amendment to make a good mix

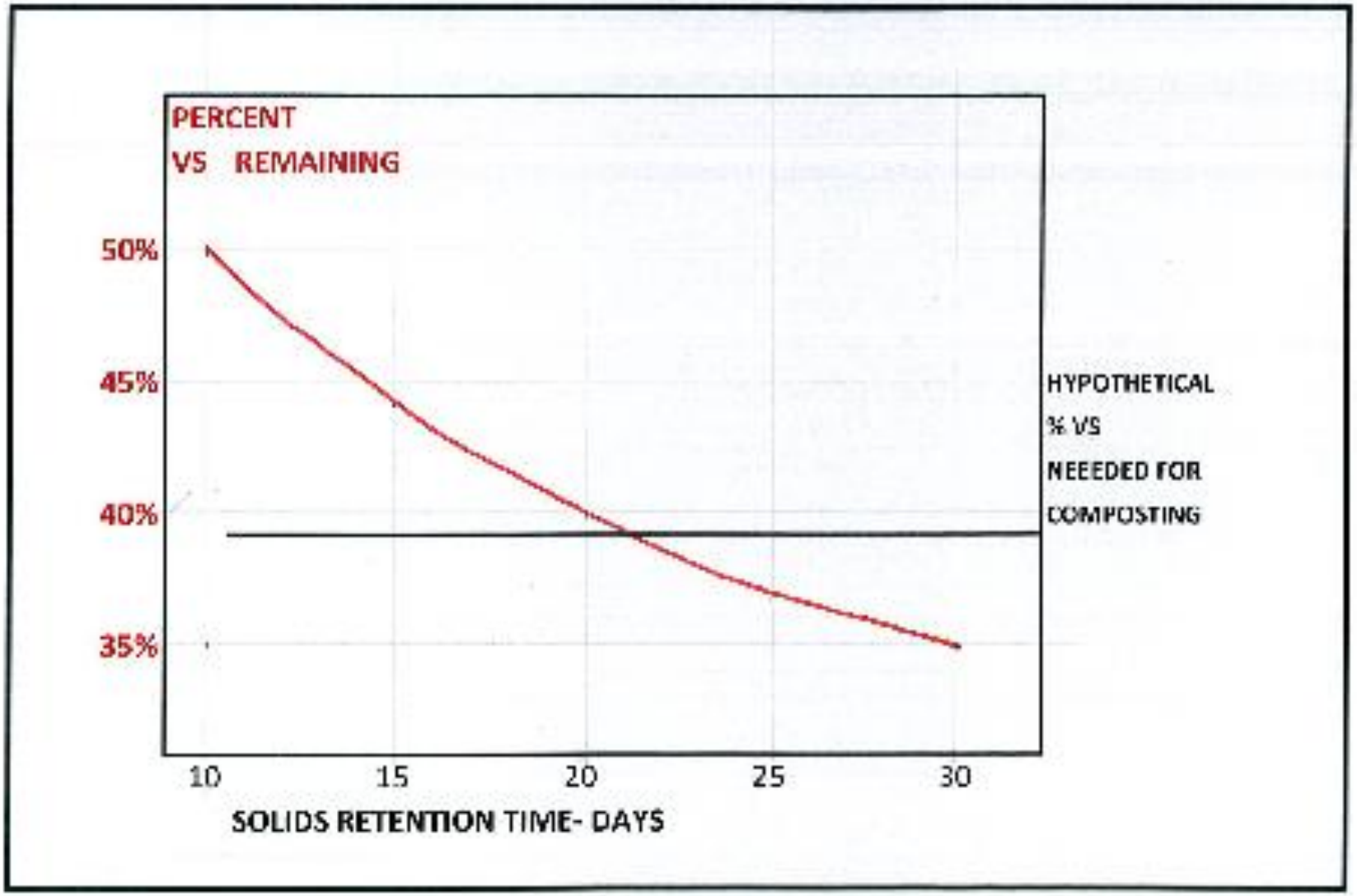
DEWATERING USING VIBRATORY SCREEN AND SCREW PRESS

- Screw presses are simple and low horsepower
- Solids capture is relatively low, returning some solids to digester

Retention vs AD Performance



Break-Even Analysis

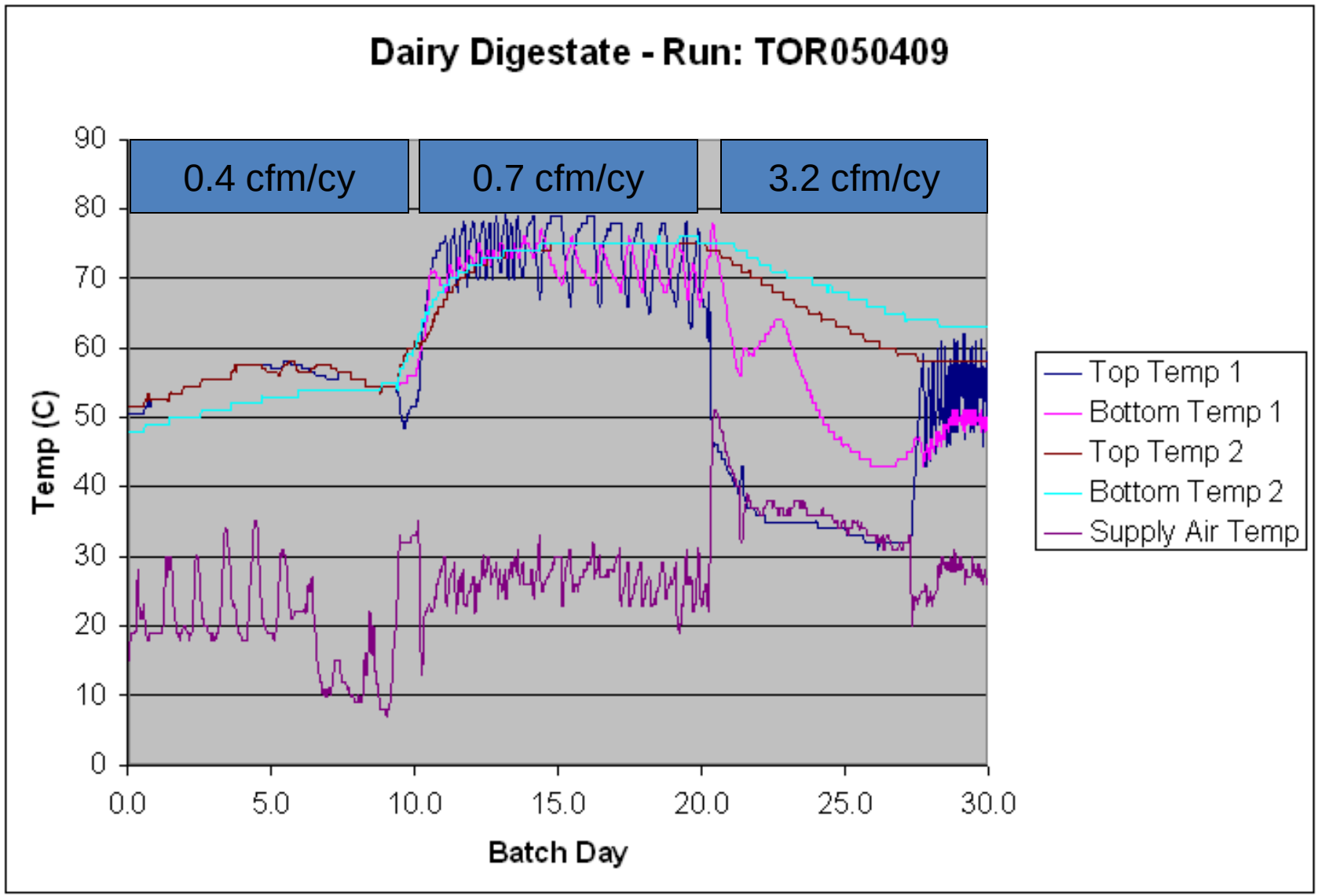


Characteristics of Digestate

- Low Bio-Available Volatile Solids (BVS)
- Low pH
- Low C/N
- High Density
- High Moisture Content
- Minimal Volume Reduction

In-Vessel Digestate Composting Pilot

Pilot In-Vessel Composting of Digestate



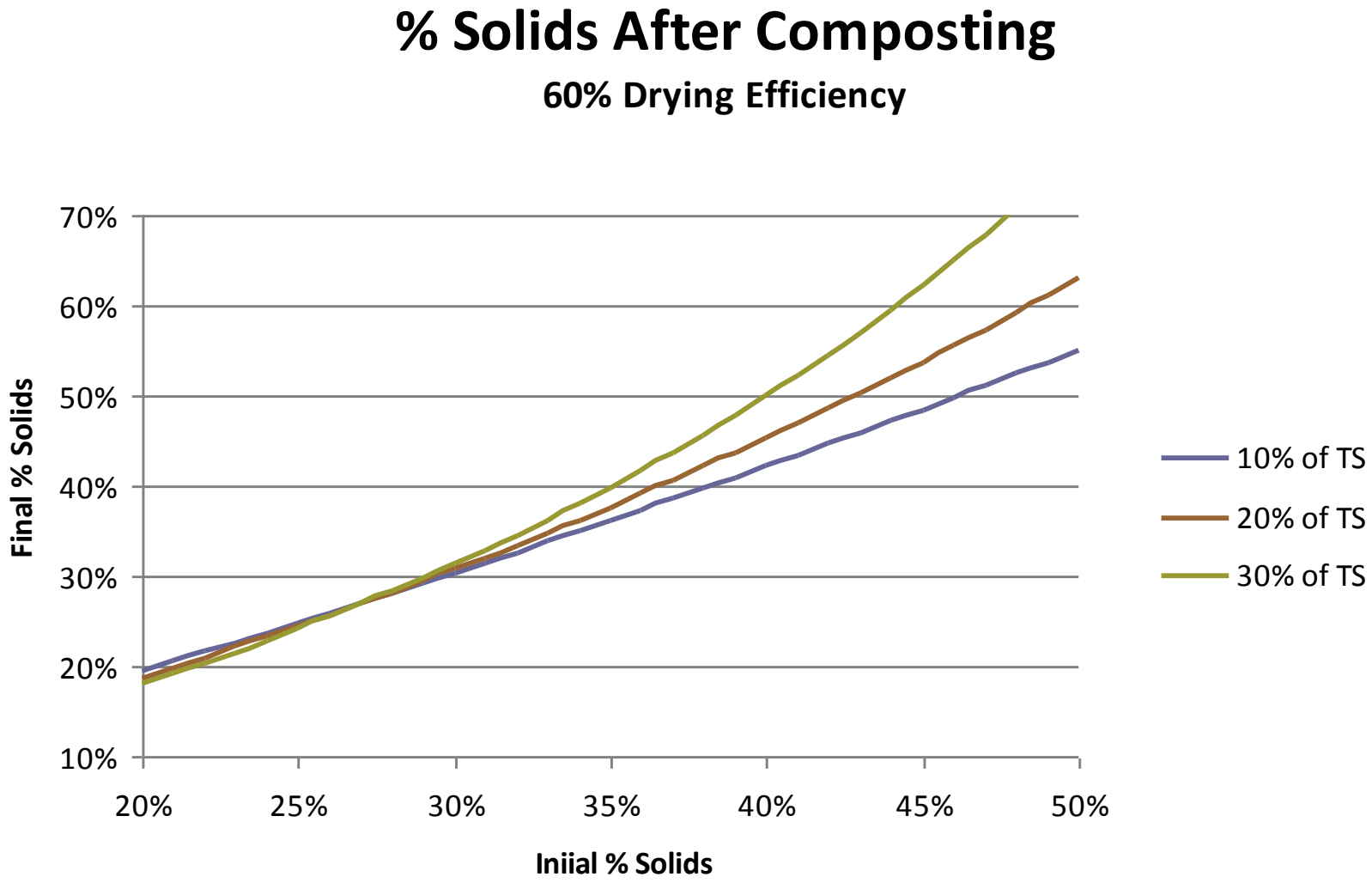
In-Vessel Pilot Scale Drying

Moisture Content	
Day 1	34%
Day 18	36%
Day 30	37%

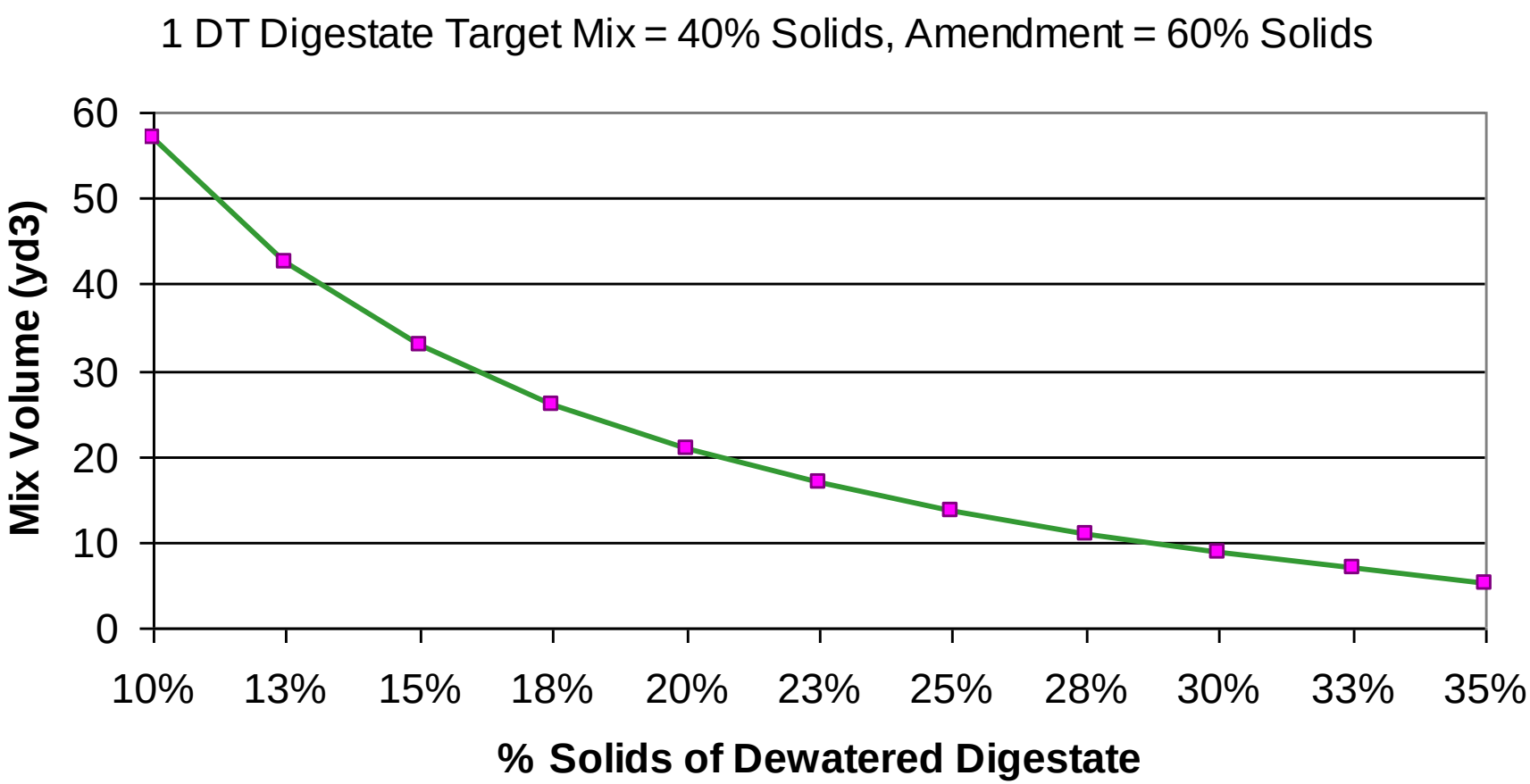
Bench Top Test Results

Compost Stability - Respiration	
	mg CO_2 - C/g OM/day
Day 1	14.8
Day 14	6.2
Day 28	4.5

Drying Model



Impact of Digestate MC on Mix Volume

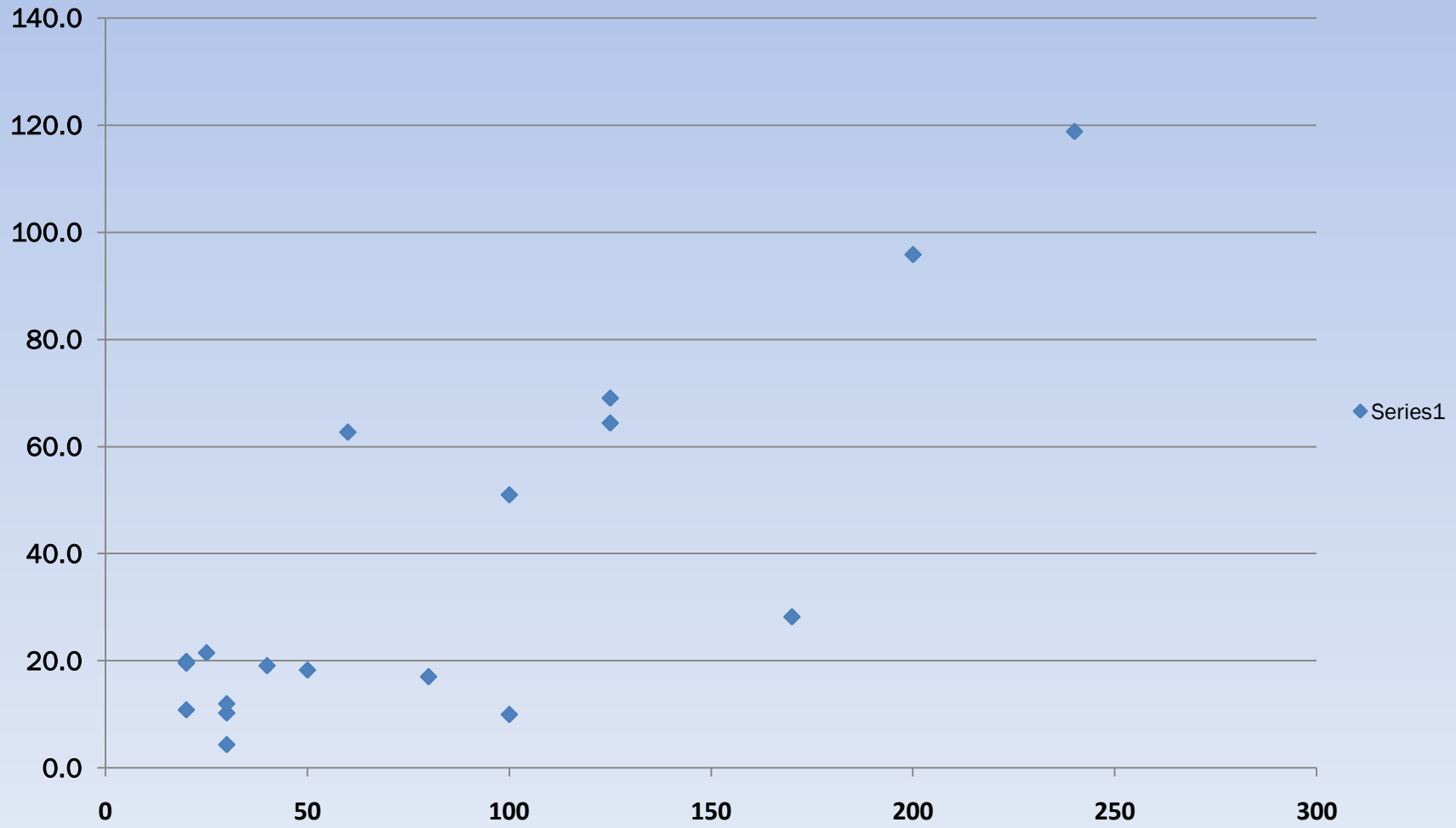


Linear Regression of Capital Costs

x = Capacity x 1000 tonnes/year

y = Capital cost x $ million

Cost = $8.4 million + 0.4 x (1000 TPY)

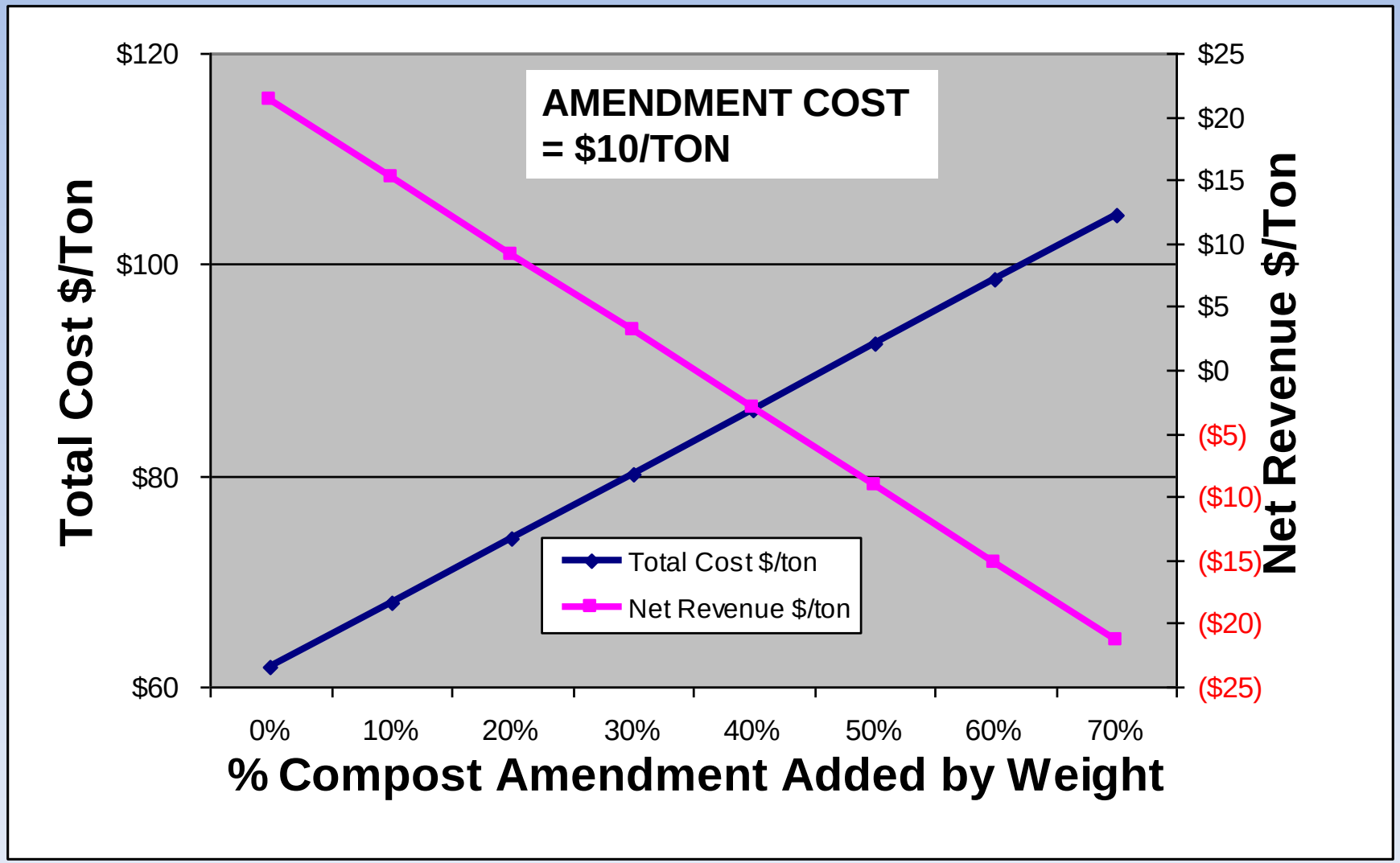


Cost Model

Capital Costs		
Anaerobic Digester	$/TPY	$780
Composting Facility	$/cy	$300
Cost of Money	%	7%
Depreciation Period	yrs	10
O&M Costs		
Cost of Operations - AD	$/ton	$34
Cost of Operations - Composting	$/ton	$15
Amendment Cost	$/ton	$10
Revenue Basis		
Tip Fee	$/ton	$60
Value of Compost	$/ton	$20
Electrical Power Sales	$/ton	$9.3

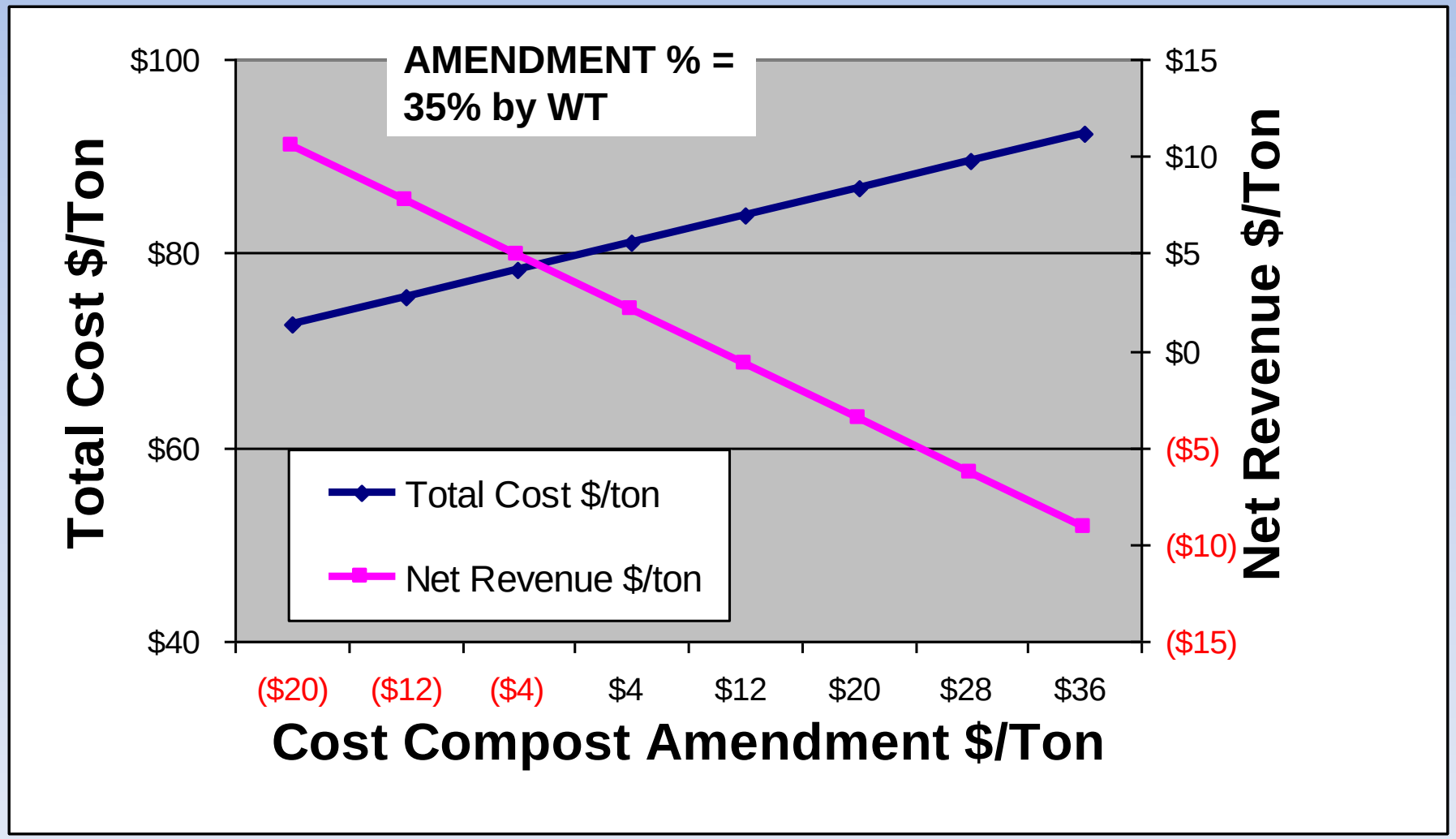
Sensitivity Analysis:

Exp/Rev vs % Amendment Required



Sensitivity Analysis:

Exp & Rev vs Cost of Amendment



Key Considerations

- Understand Compost Market Requirements
  - Contaminant Levels
  - Stability
- Understand Amendment Requirements
  - Quantities
  - Properties
  - Source
  - Cost

Best Combinations of AD & Composting

- Send wet high BVS feedstocks to AD, eliminates a problem for composters
- Stop BVS conversion soon enough
- Use a efficient dewatering method
- Get tip fee for amendments
- Site AD adjacent to large windrow operation