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Recovering Renewable Energy and Compost from Post-Consumer Organic Materials

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Overview

- Feedstocks
- Processing alternatives (e.g., compost, biological, thermo-chemical)
- Issues
- Conclusions

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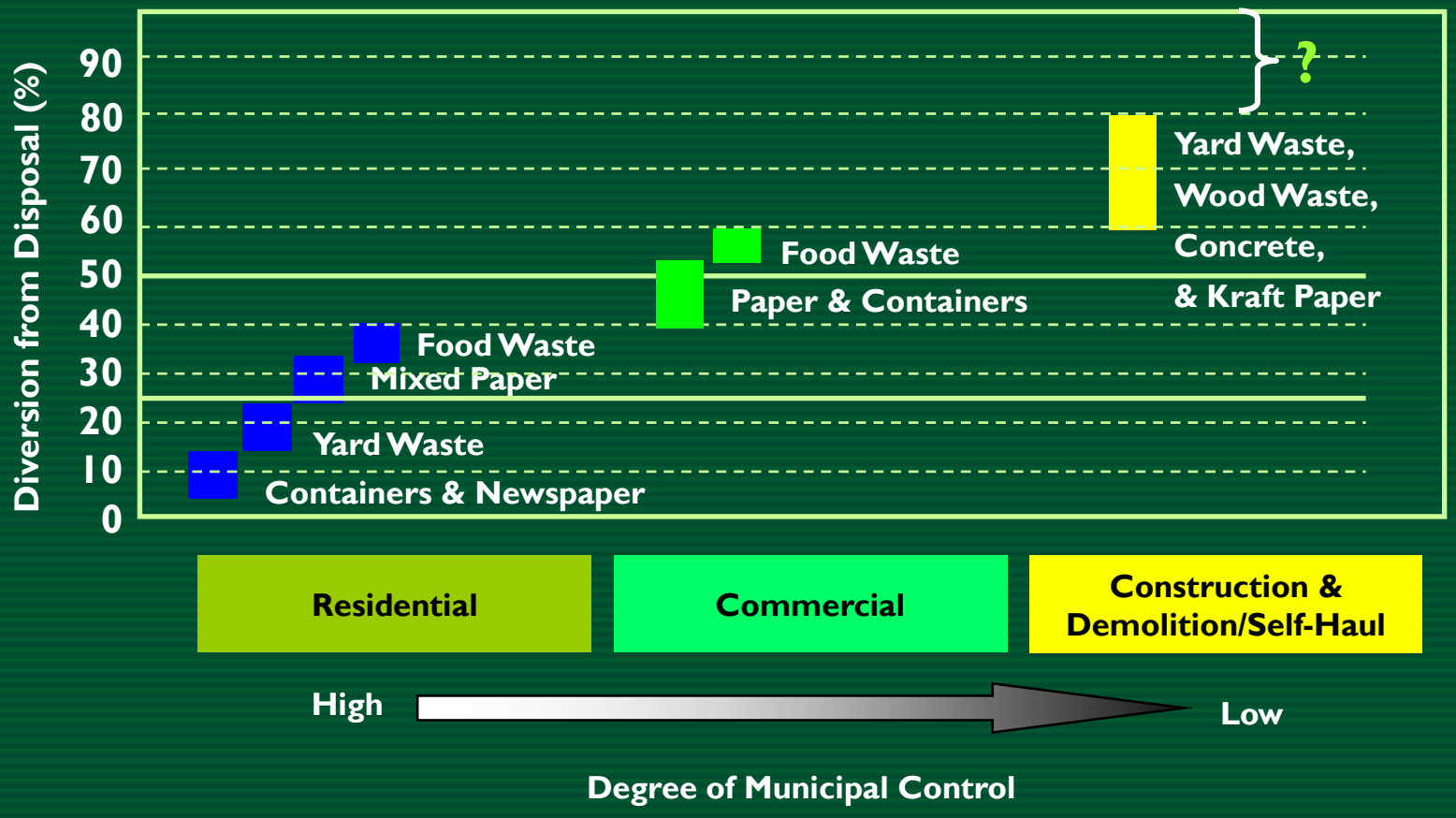
Typical Solid Waste Management Infrastructure Designed to Achieve High Waste Diversion Rates



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Residues from Clean and "Dirty" MRFs Offer Opportunities

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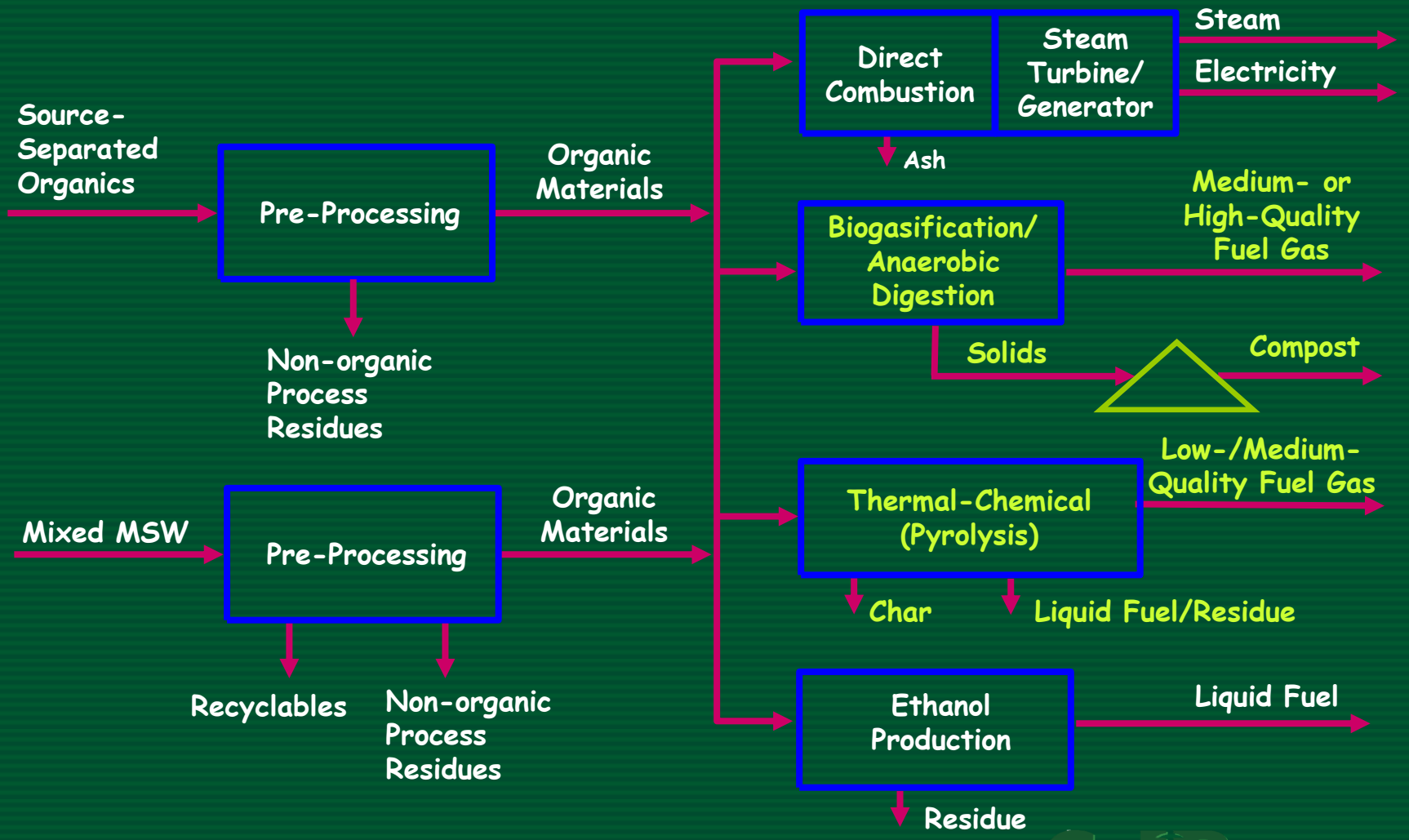
Potential Feedstocks for Energy Recovery and Compost

- Commercial sources:
  - source separated
  - mixed waste
- Residential sources:
  - source separated
  - mixed waste

Examples of Recovering Energy from Solid Wastes



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Markets, Uses and Recovered Product Specifications

- Solids — compost (soil amendment) (NPK, salt content, micronutrients, etc.)
- Gas:
  - biogas (CH_4, H_2S, CO_2, siloxanes, heating value, etc.)
  - pyrolysis gas (syngas) (CO, H, PAH, heating value, etc.)

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Some Key Feedstock Factors

- Combustible or biodegradable organic content
- Moisture content
- Inert content
- Trace contaminants

Food and Yard

Plastics

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General Process Design

- Waste composition
- Concentrate materials with desirable qualities:
  - biogas — biodegradable organics, such as food materials; reject inerts
  - pyrolysis — organics and low moisture content; reject inerts
- Maximize yield and purity of desirable materials from parent mixture

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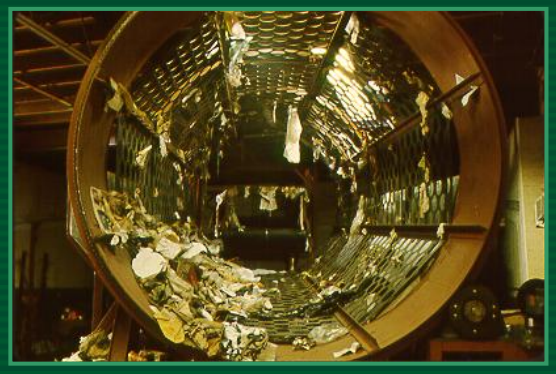
Pre-Processing Stages



- Dry:
  - screening
  - size reduction
  - air/density
- Wet:
  - size reduction (pulping)
  - screening
  - hydraulic/density

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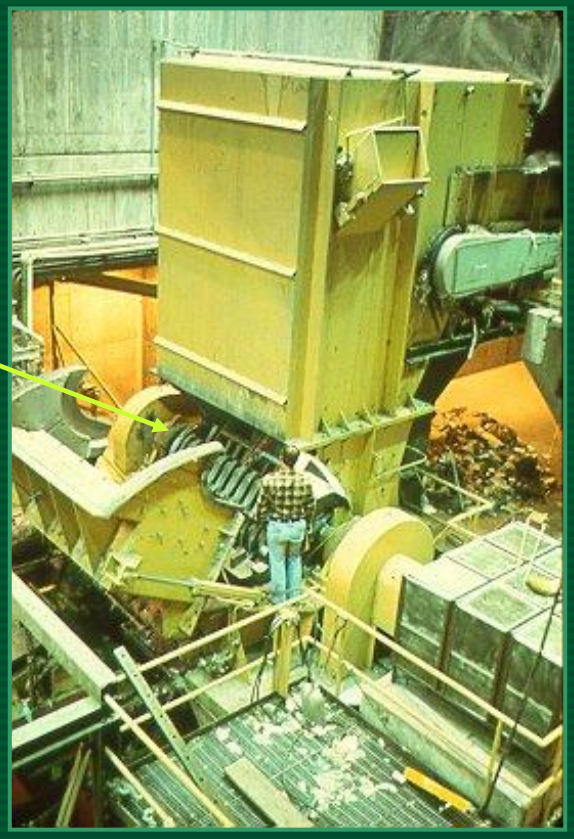
Dry Size Reduction (high-speed hammermill)



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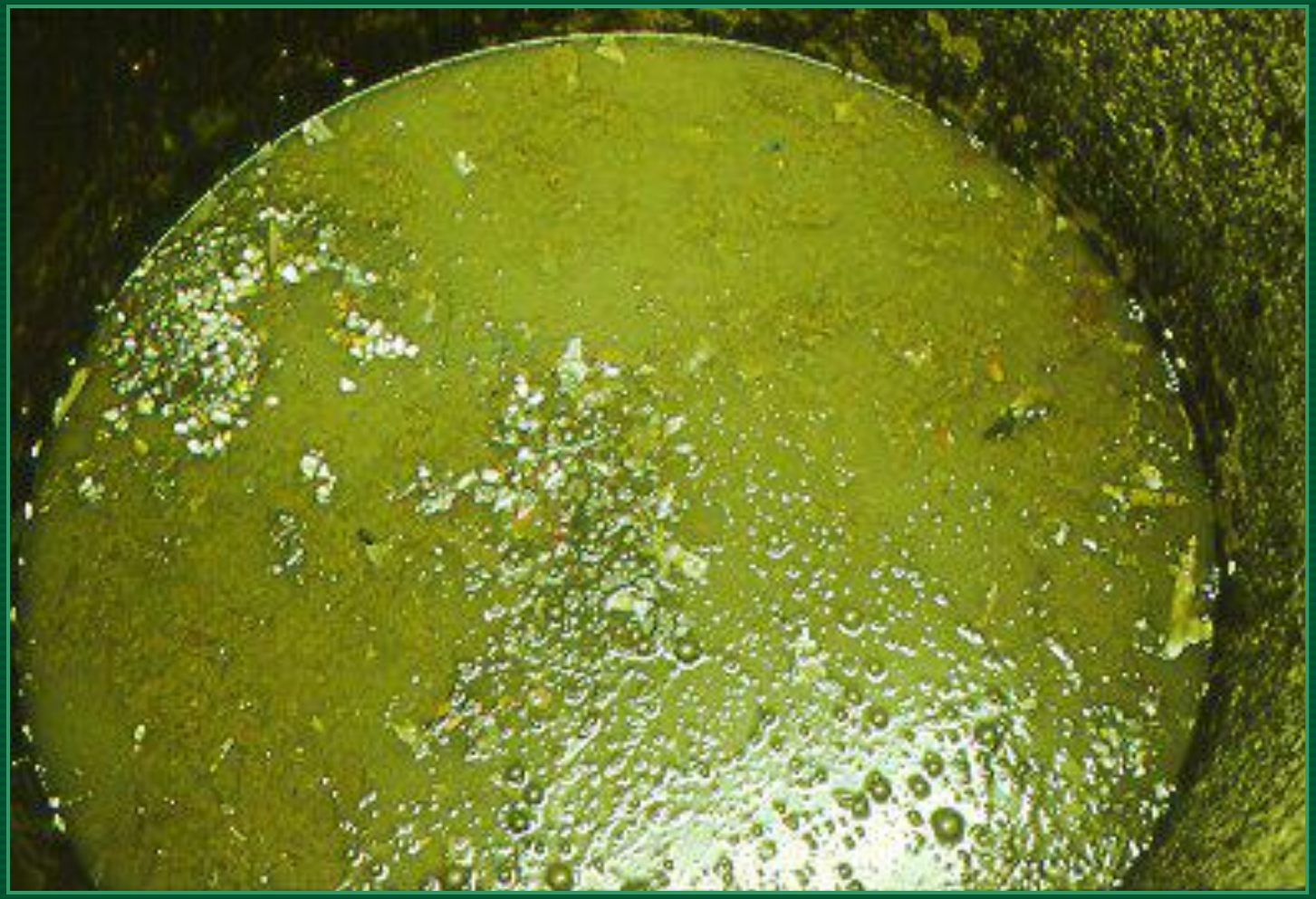
Wet Size Reduction (pulper)



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Principal Methods of Segregation

- Physical (screening):
  - particle size, geometry
- Gravitational (sink/float):
  - particle density
- Aero- or hydro-dynamic (air/liquid classification):
  - particle density, size, and geometry
  - fluid viscosity and velocity

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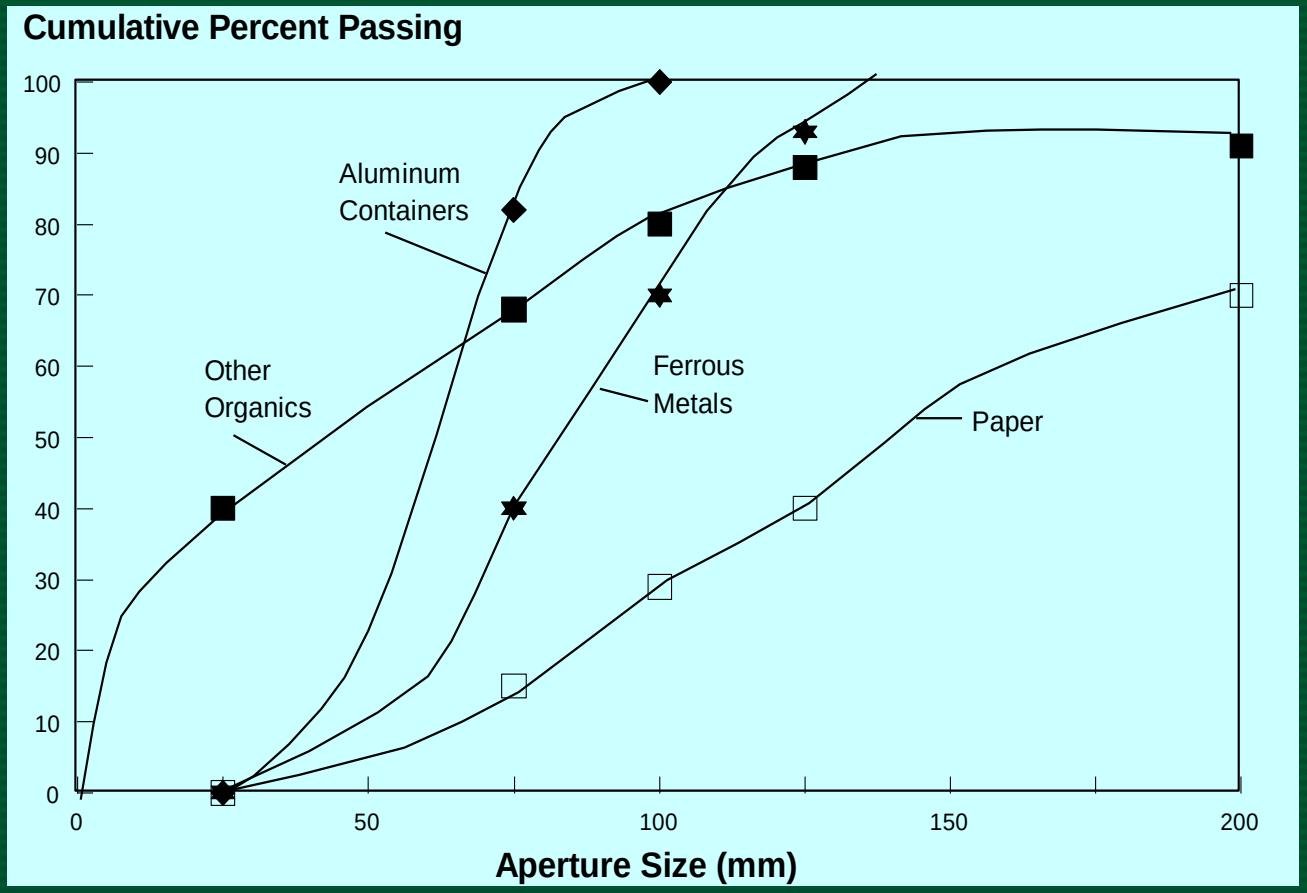
Component Particle Size Distributions



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Screening and Air/Density Separation for Organic Recovery

1) Trommel Screen

2) Air/Density Separator

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Effect of Selective Post-Processing MRF Residues for Organic Upgrading

Size Class (inches)	Percent (dry wt basis)	
	Biodegradable Organics	Inerts
-3	60	40
-2 + 0.5	80	20
-0.5 (fines)	40	60

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Back-end Technologies

Tunnel Anaerobic Digesters

Composting Facility

Plasma Arc Gasification

Vertical Anaerobic Digesters

LNG Fueling Station

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Some Issues

- Thermo-chemical (pyrolysis, etc.):
  - uses of char (requires more processing)
  - uses of pyrolytic oils and tars (requires more processing)
  - gas cleanup required for downstream uses
  - air emissions (from energy conversion system, e.g., engine-generator)
- Anaerobic digestion:
  - process solids (dispose or requires further processing)
  - gas cleanup for downstream uses
  - air emissions (from energy conversion system, e.g., engine-generator)

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Cost and Revenues

- Processing costs are sensitive to:
  - throughput rate
  - composition and contamination
  - "products" that have no viable markets
  - degree of environmental control
- Revenues are sensitive to:
  - yield and purity of products

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Conclusions

- Key planning and design considerations:
  - feedstock characteristics and contamination level
  - markets and product specifications (compost feedstock, fuel)
  - required pre-processing, and processing rate
  - other factors (local regulations; available land; effect of source-separation programs)

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