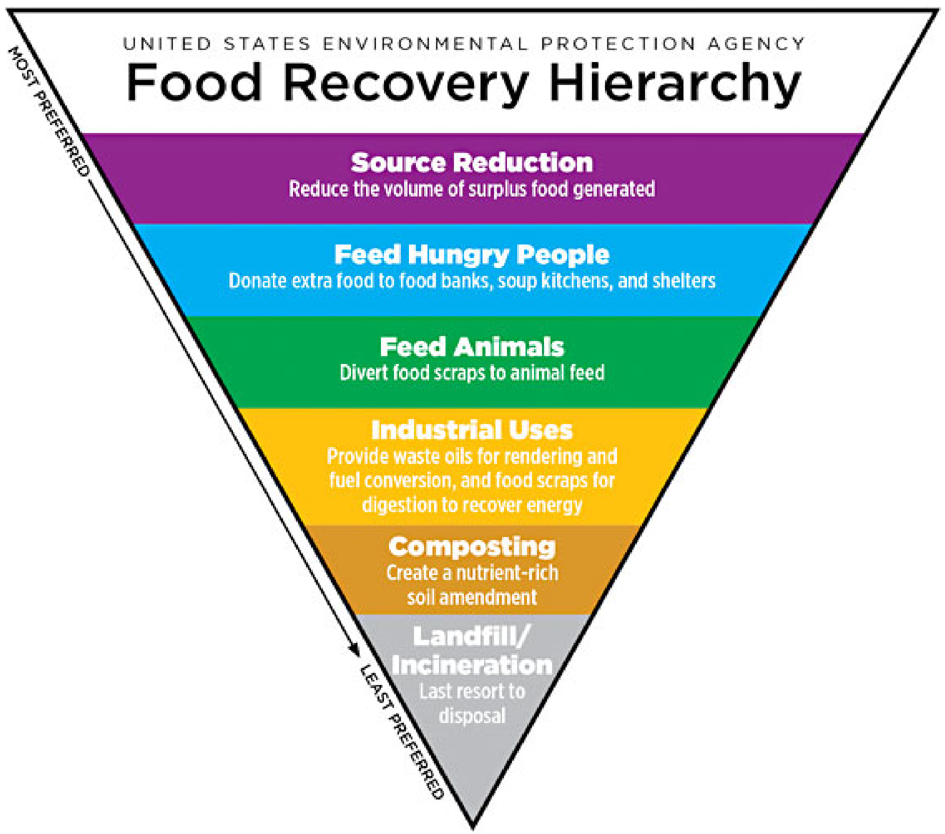
Catch the On-Site, Organics Recycling Showdown

Aerobic Composting vs. Anaerobic Digestion

12th Annual Energy/Facilities Connections Conference
Leavenworth, WA
May 2, 2016

Today's Program

1. On-site organics management examples
   – Washington projects
   – Washington companies
2. On-site management decision steps
   – Information gathering
   – Processing potential
   – Financial analyses
   – Next steps
3. Resources



Sources: Rethink Waste Australia and US EPA

1. ON-SITE ORGANICS MANAGEMENT

- Food processors or wholesalers
- Hospitals, group homes, and other institutions
- Schools and universities
- Corrections facilities
- Military bases
- Hotels, camps, and resorts
- Farms (especially as part of other facilities)

Washington Projects

Monroe Corrections

Photos: Everett Herald

Walla Walla Corrections

Photo: O2 Compost

Cedar Creek Corrections

Photos: DT Environmental

University Projects

- Many universities and colleges participate in green waste collection programs, diverting tons of food scraps and landscaping debris
- On-site composting
  - Washington State University
  - The Evergreen State College
  - Seattle University

Seattle University

Photos: Seattle University

Joint Base Lewis-McChord

Photo: O2 Compost

Joint Base Lewis-McChord

Fremont Brewing

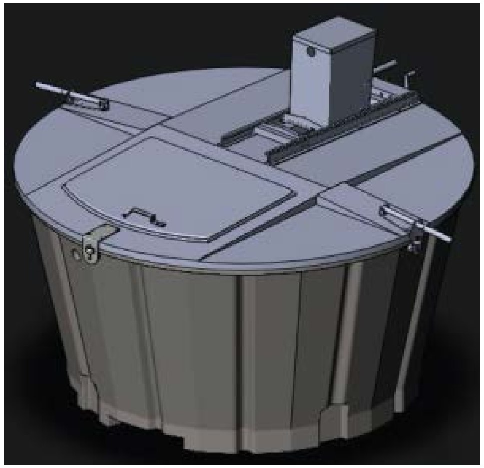
Washington Companies

O2 Compost

Photos: O2 Compost

Green Mountain Technologies

- Earth Cube (50#dy)
- Earth Tub (100#dy)

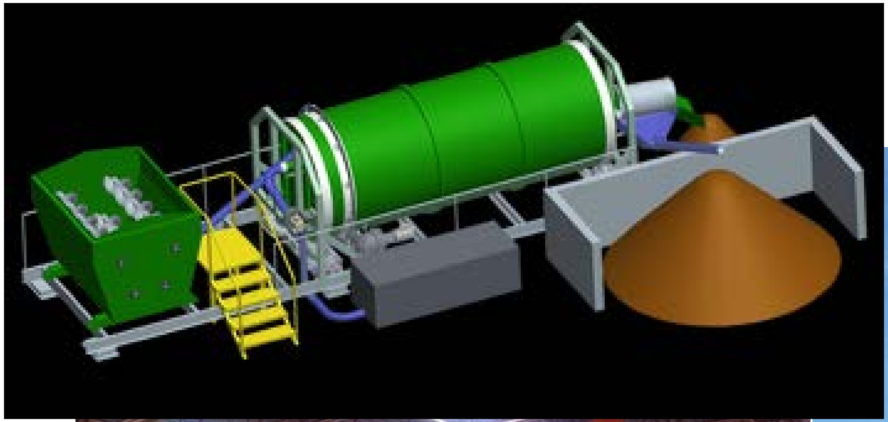


- Earth Flow (in-vessel)
  - Up to 3 tons/dy
- Earth Flow (site-built)
  - Up to 10 tons/dy

Photos: Green Mountain

DT Environmental

EnviroDrum



Anaerobic Digesters

Photos: DariTech

Impact Bioenergy

HORSE = **H**igh-solids **O**rganic-waste **R**ecycling **S**ystem with **E**lectricity

Photos: Impact Bioenergy

135#dy to 2.5 tons/dy

WISERG

Photos: WISERG

2. DECISION STEPS

1. Information gathering
2. Avoided cost threshold
3. Processing potential analyses (composting or anaerobic digestion
4. Economics/financial analyses
5. Next steps - plan

Use a scorecard

Analyses	Options (Compost-AD)			
	Minimal	Low	Medium	High
Avoided Cost Threshold	☐	☐	☐	☐
Materials/Feedstocks	☐	☐	☐	☐
Siting	☐	☐	☐	☐
Resources	☐	☐	☐	☐
Environmental Issues	☐	☐	☐	☐
End Use/Marketing	☐	☐	☐	☐
Summary of Analyses Which are viable? Is any preferred?	☐	☐	☐	☐
Economic-Financial Analyses	☐	☐	☐	☐
Recommendation and Next Steps	☐	☐	☐	☐

Information Gathering

- Materials for composting – Feedstocks for digestion
- Soil product usage
- Space
- Weather, climate, and other environmental factors
- Labor
- Equipment
- Waste handling
- Capital and operating costs

Information Gathering

- Project goals
- End uses
- Potential value added
- Risk aversion
- Operating history

Why Do This?
What are your project goals?

- Avoided costs - Save money on waste management costs
- Offset purchases for mulch, soil, or energy
- Provide education or work opportunities
- Reduce environmental footprint
- Community goodwill

Avoided Cost Threshold

- Disposal or hauling cost savings
- Savings from self haul of waste materials
- Recycling cost savings
- Savings from substitution of compost for purchased products
- Potential value of other benefits of using compost in landscaping

Processing Potential

Materials

Collections

Siting

Resources

Environmental issues

End uses

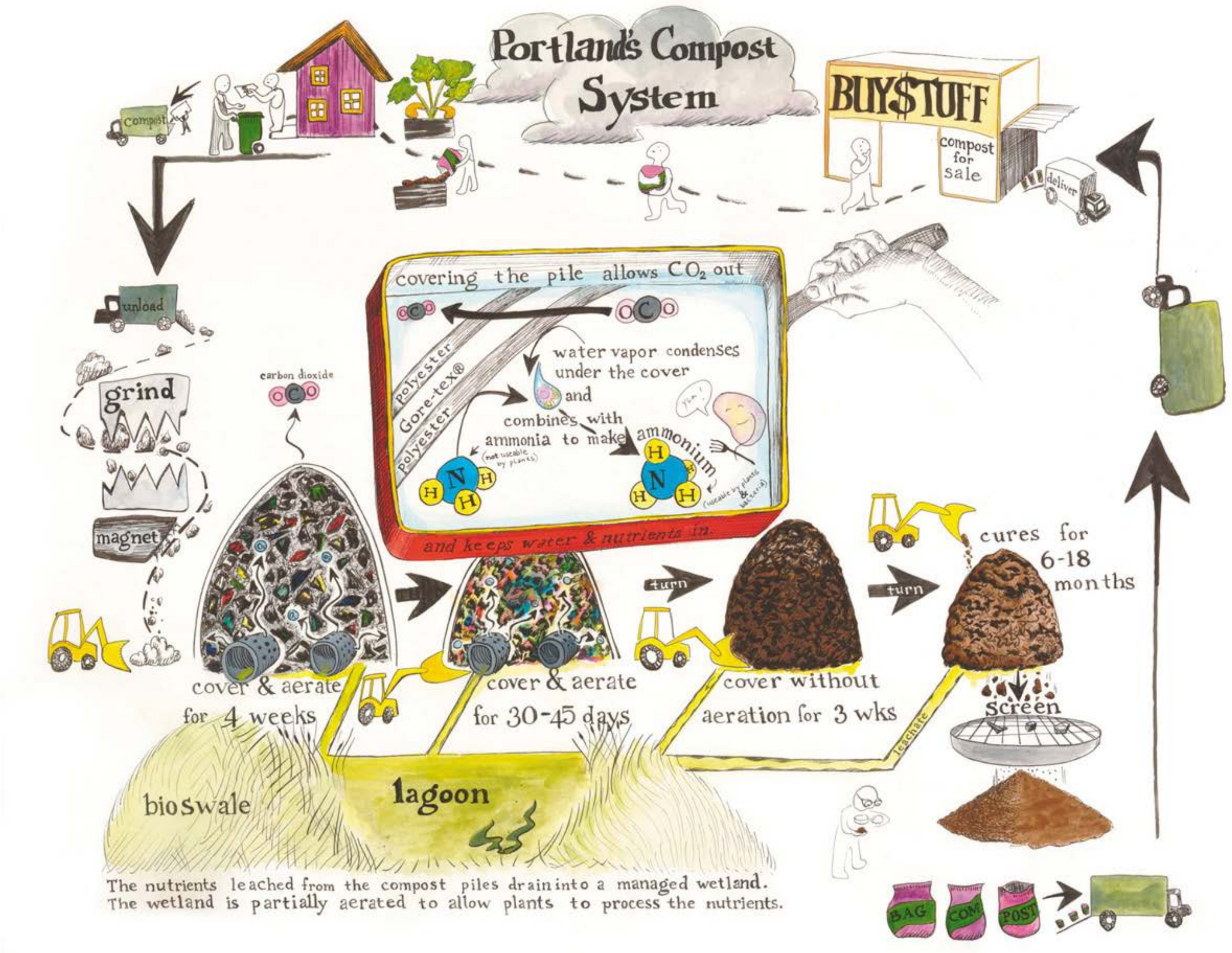
Composting vs Digestion

Composting	Digestion
Aerobic	**Anaerobic**
With Oxygen	Without Oxygen
Produces Carbon Dioxide	Produces Biogas: Carbon Dioxide + Methane Also known as “Swamp Gas”

Composting Basics

- Carbon and nitrogen balance
- Moisture
- Oxygen
- Surface area
- Volume/pile size
- Temperature and time

Composting Flow Chart



Source: permaculturenews.org

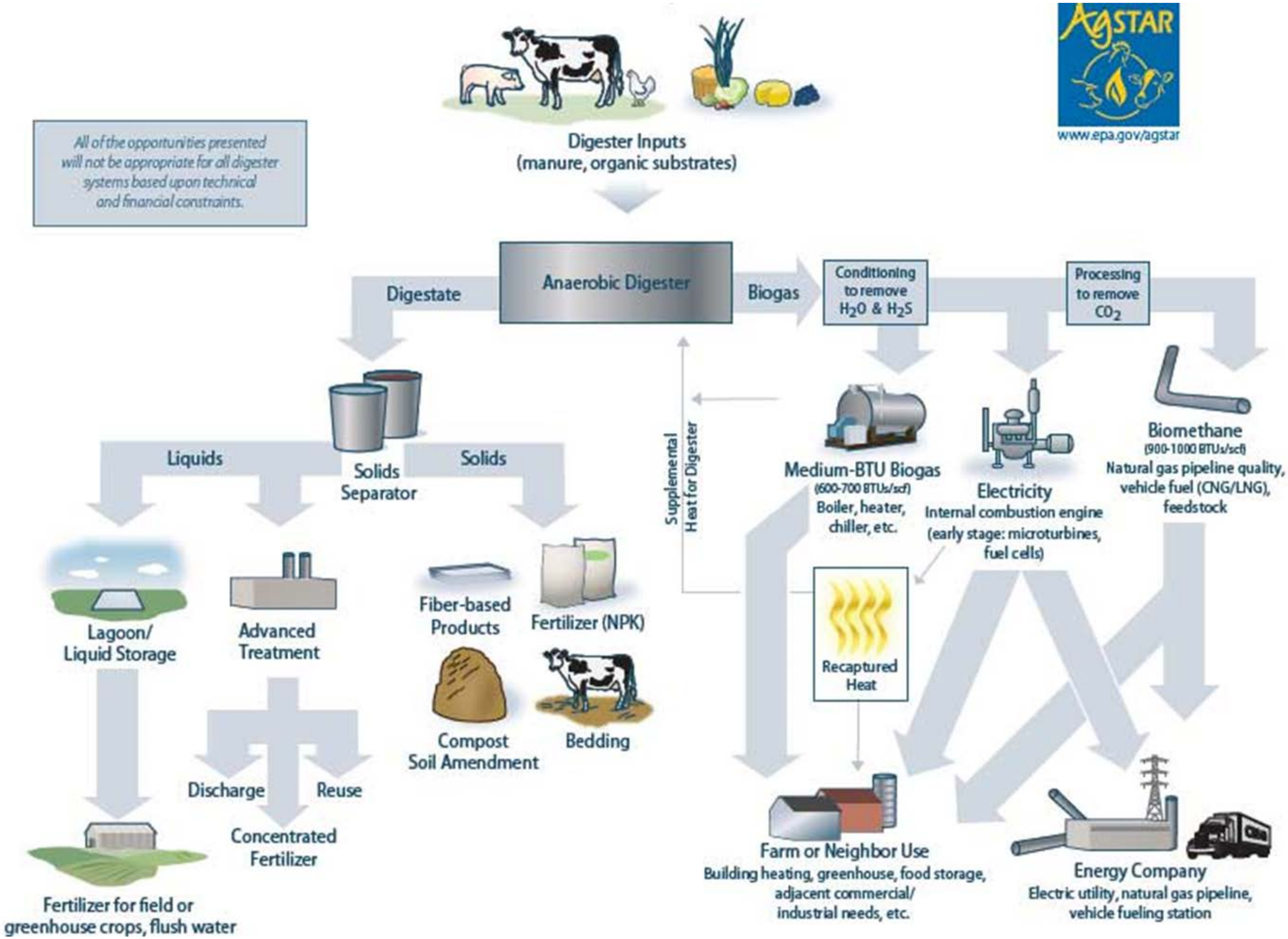
Composting Technology

- Low technology
  - *Passive aeration, turned bins, simple vermicomposting*
- Medium technology
  - *Active aerated static piles or bins, turned piles, rotating drums*
- High technology
  - *In-vessel or bay-type systems with active aeration and biofilters*

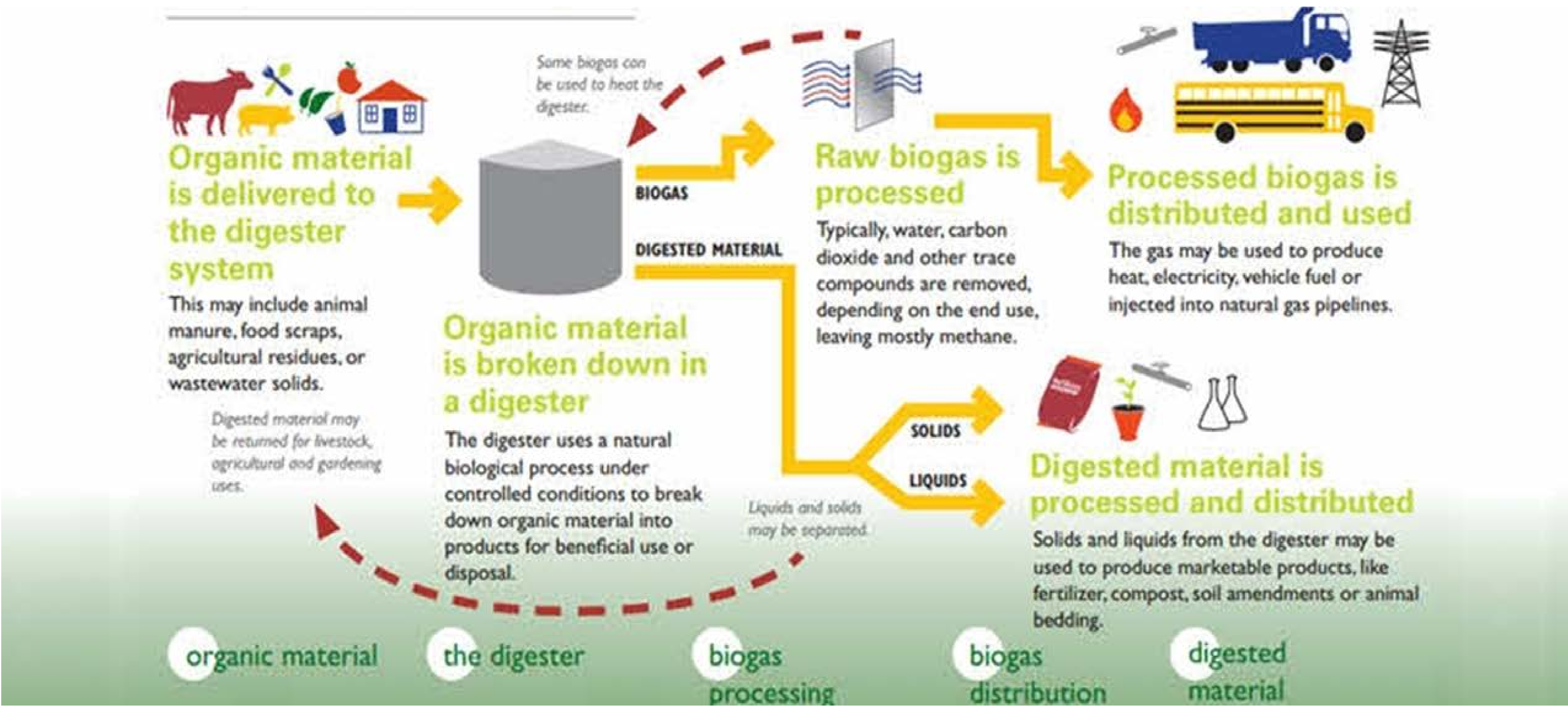
Anaerobic Digestion Basics

- Carbon and nitrogen balance
- Moisture
- Oxygen-NOT
- Surface area
- Volume/digester size
- Temperature and time

Common Digester Flow



Anaerobic Digestion Flow Chart



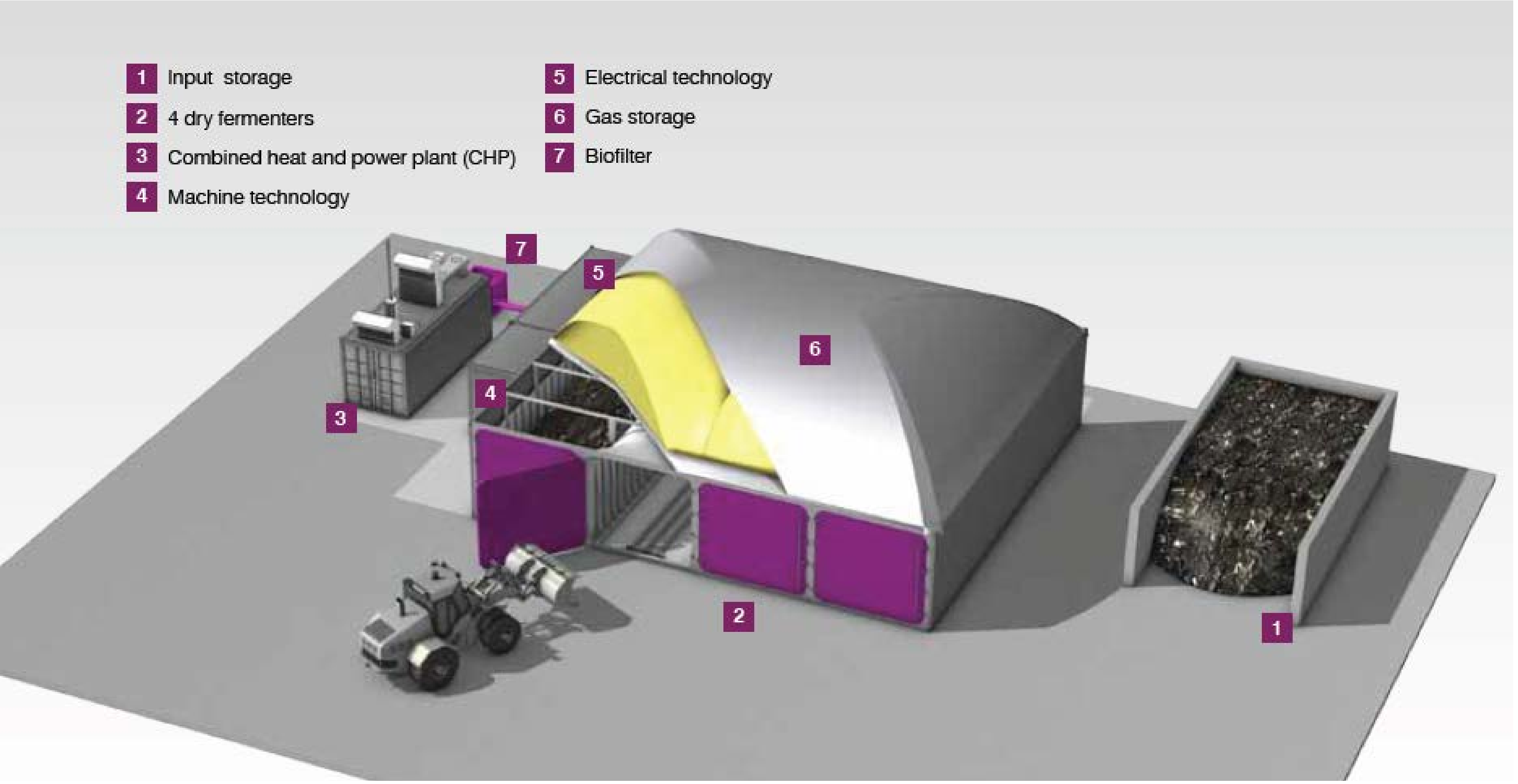
Source: USDA, EPA, ABC

Common Manure Digester Systems

Figure 1. Plug-Flow Digester (left), Complete Mix Digester (center), and Covered Lagoon Digester

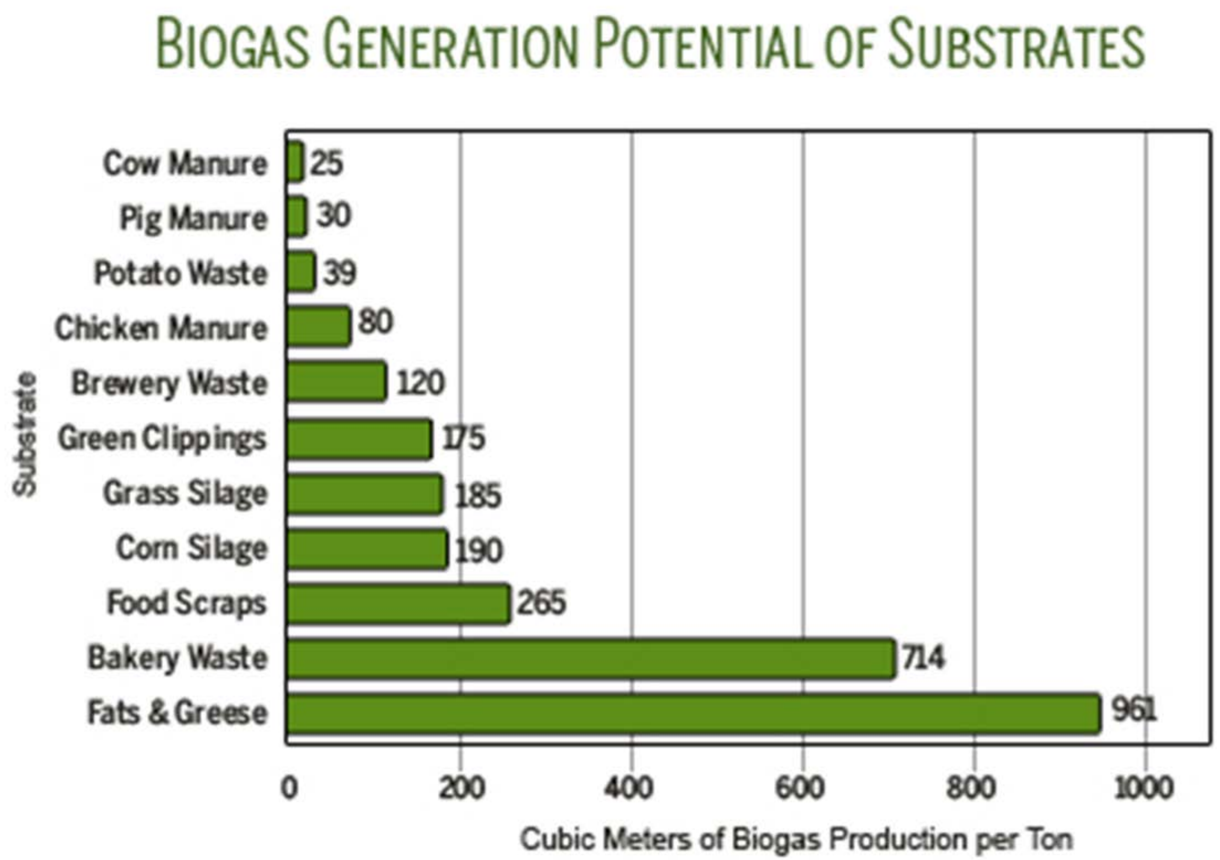
Digester systems more commonly associated with manure-based, lower solids projects.

High-Solids AD



Source: Smart Ferm - Kompferm

Biogas Potential



Source: Data derived from www.biogas-energy.com, © 2007 Biogas Energy, Inc.
Translated from: Basisdaten Biogas Deutschland, Marz 2005,: Fachagentur Nachwachsende Rohstoffs e.V.

Putrescible

“contains organic matter capable of being decomposed by microorganisms and of such a character and proportion as to cause obnoxious odors and to be capable of attracting or providing food for birds or animals.”

"Garbage" means putrescible solid wastes (WAC 173-350-100)

Materials/Feedstocks

- Yard and garden debris
- Woody materials
- Food scraps (pre- and post-consumer)
- Paper fiber materials
- Livestock manures
- Fats, oils, and greases (FOG)
- Wastewater biosolids

- Porosity
- Moisture
- Carbon & nitrogen
- Nutrients
- pH
- Visual/sensory qualities

Collections

- Average volumes vs peak volumes
- Seasonality
- Separation – ability and efficiency
- Materials balance
- Quality – contamination
- Collection cost and labor
- Collection containers, equipment, vehicles

Siting

- Topography, soils, flood zone
- Space: total area available (surface, coverage)
- Access to infrastructure
- Vehicle access
- Neighbors in homes
- Buffer space to environment
- No history of site contamination

Resources/Assets

- Utilities: electrical, water (well), sewer (septic)
- Equipment: loaders, chippers, grinders, shredders, pulpers, conveyors, mixers, manure spreaders, irrigation, etc.
- Human labor vs equipment
- Existing, new or rented equipment
- General vs multipurpose vs specialized
- Management/monitoring (low vs high tech)

Environmental Issues

- State Environmental Policy Act (SEPA)
- Water quality
- Air quality
- Solid waste handling
- Product quality – public health and safety

DEPARTMENT OF ECOLOGY
State of Washington

Start with your local health department or planning department

Environmental Issues

- Planning or zoning approval
- Fire Department, building/construction, road permits
- Local stormwater permits
- Water use permits, especially for wells
- Hydraulics for projects with water channels or culverts
- Surface mine regulations for removal of excavated materials
- Sensitive areas regulations
- Wetlands regulations
- Shoreline protection regulations

Permitting Summary

- Start with the County Planning Dept.
  - Land-disturbing, construction
  - Shoreline permit
  - Flood hazard zone permit
- ORCAA – air quality permit for genset
- Ecology – solid waste exemption
- WSDA – nutrient management planning

End Uses and Project Benefits

- Energy: heat, electricity, fuel substitutes
- Soil products: mulches and composts
- Nursery/container mixes
- Filter media
- Environmental offsets/credits

Financial Analyses

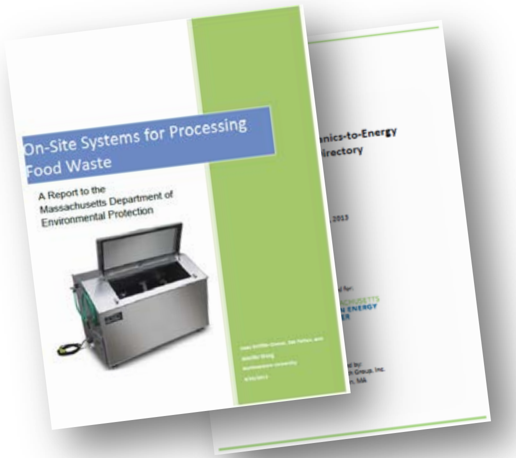
- Capital expenses (CAPEX)
- Operation & maintenance expenses (OPEX)
- Revenues, cash flow, and earnings
- Simple paybacks
- Net present value
- Return on investment

Tips for Next Steps

- Develop a recommendation
- Use the completed analyses and recommendations as a plan
- Develop a team to support the on-site management plan (at all levels of the organization)
- Consider if a pilot project makes sense before full-scale development
- Institutionalize the project

3. RESOURCES

Recent Comparative Studies



- On-Site Systems for Processing Food Waste, **Mass. Dept. Env. Protection**
- Small-Scale Organics-to-Energy Vendor Directory, **Mass. Clean Energy Center**
- On-Site Organics Management Options Review, **Metro Vancouver**

Figure 1. Type of organic material and on-site management options

Key: ✓ Option works for feedstock; ✗ Option does not work for feedstock; ⚠ Option potentially works, with caveat(s)

Option	Food scraps	Bones and carcasses	Paper and cardboard	Compostable plastic	Yard and garden debris
Storage	✓	✓	✓	✓	✓
Dewatering	✓	⚠ 1	⚠ 2	⚠ 3	✗
Dehydration	✓	✓	✓	✓	✗
Small aerobic in-vessel	✓	✓	⚠ 2	✓	⚠ 4
Medium aerobic in-vessel	✓	⚠ 5	⚠ 2	⚠ 5	✓
Large aerobic in-vessel	✓	✓	⚠ 2	✓	✓
Medium anaerobic in-vessel	✓	✓	✗	✗	✗
Large anaerobic in-vessel	✓	✓	✓	✗	✗

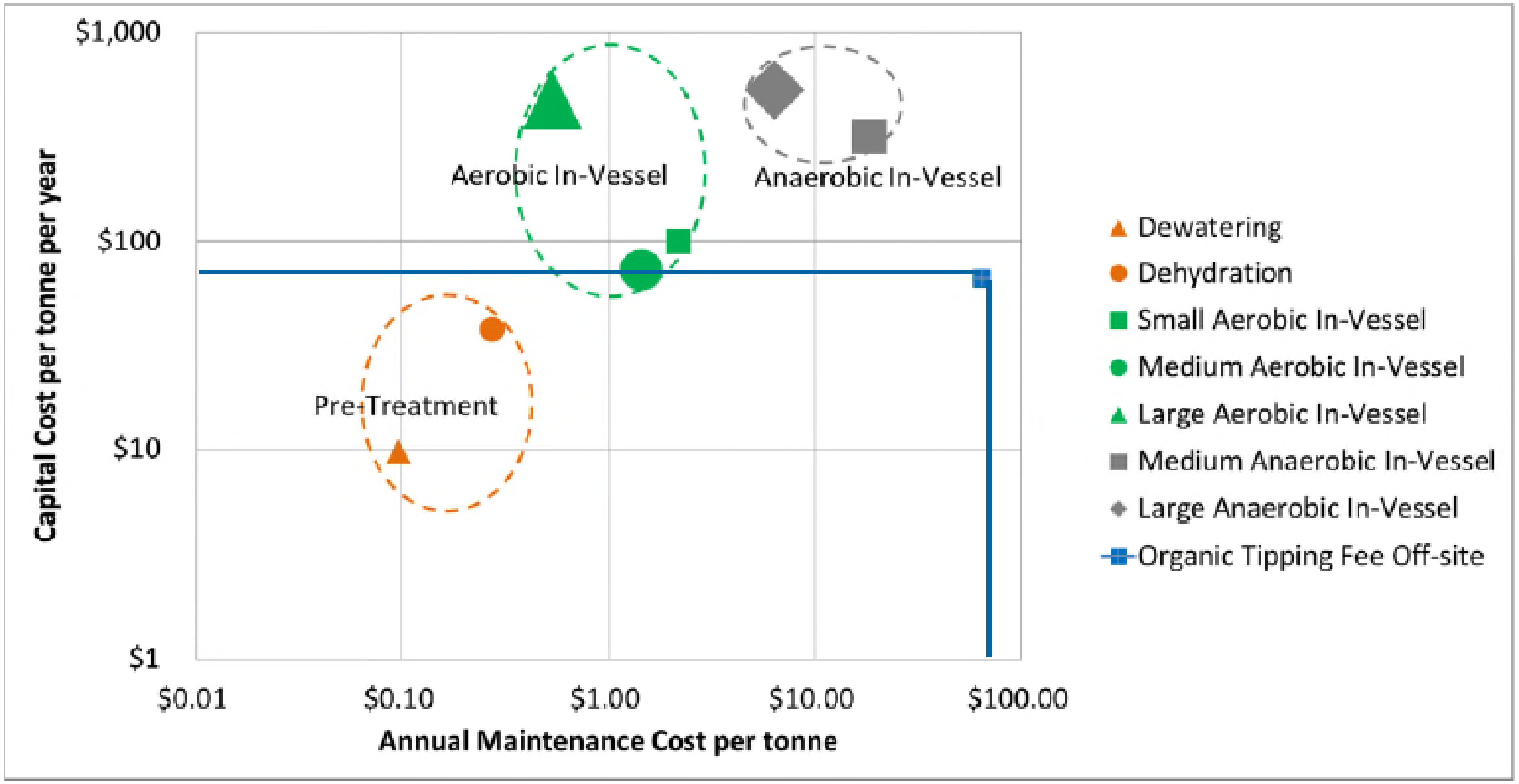
1. May jam mechanical components of system. 2. Maximum 10% of feedstock. 3. Maximum 5% of feedstock must be shredded. 4. Maximum 20% of feedstock. 5. Acceptable, but may not degrade completely.

Comparing Composting & AD

Option	Weekly Capacity	Capital Cost	Annual Maintenance Cost	Footprint	Materials Accepted	Time commitment	Corporate Sustainability Benefit	Odour control	Output Material	Maintenance	Capital	Process Time	Installation Requirements	Capacity	Electricity Requirements
Conventional Storage	Depends on hauling	Up to $1,000	Minimal	◕	●	●	○	○	○	●	●	●	●	◑	●
Specialized Storage	Depends on hauling	$4,000-6,000	Minimal	◕	●	●	○	◔	○	●	●	●	●	◑	●
Dewatering	Up to 400,000 kg/week	$25,000	$250	●	◑	◕	◔	◔	◔	◕	◑	●	◑	●	◔
Dehydration	Up to 14,000 kg/week	$27,000-50,000	$200	●	◕	◕	◑	◑	◑	◕	◑	◕	◑	◕	○
Small Aerobic In-Vessel	150 -3,500 kg/week	$18,000	$400	◕	◑	◑	◕	◑	◕	◑	◕	◑	◕	◔	◑
Medium Aerobic In-Vessel	700 -8,000 kg/week	$30,000+	$600	◑	◑	◑	◕	●	●	◑	◑	◔	◑	◑	◑
Large Aerobic In-Vessel	2,000-18,000 kg/week	$450,000	$500	◔	◕	○	◕	◕	◕	◑	◔	○	◔	●	◑
Medium Anaerobic In-Vessel	5000 - 20,000 kg/week	$240,000+	$14,000	◑	○	◔	●	◑	◕	○	◔	○	◔	◕	●
Large Anaerobic In-Vessel	20,000 kg/week	$825,000+	$10,000	○	◔	○	●	◕	◕	○	○	○	○	●	●

Icon	○	◔	◑	◕	●
Score	Mediocre	Fair	Good	Better	Best

Comparing Costs



Support Organizations

- Washington Organic Recycling Council (WORC)
- American Biogas Council (ABC)
- EPA AgSTAR
- Dept of Ecology, Organic Materials Management
- BioCycle magazine

Facility Operator Training

- Washington Organic Recycling Council (WORC)
- Monday, October 17 to Friday, October 21, 2016

Photo: Dept of Ecology

WSU Puyallup Research and Extension Center

2606 W Pioneer Ave, Puyallup WA, 98371

info@compostwashington.org

Videos

- DT Environmental - Cedar Creek Corrections
- Green Mountain Technology - Bainbridge High School (2010)
- Impact Bioenergy - introduction
- O2 Compost – Aerated Composting Webinar
- WISERG – introduction for grocery stores