

Food Waste to Animal Feed

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Why Food Waste to Animal Feed?

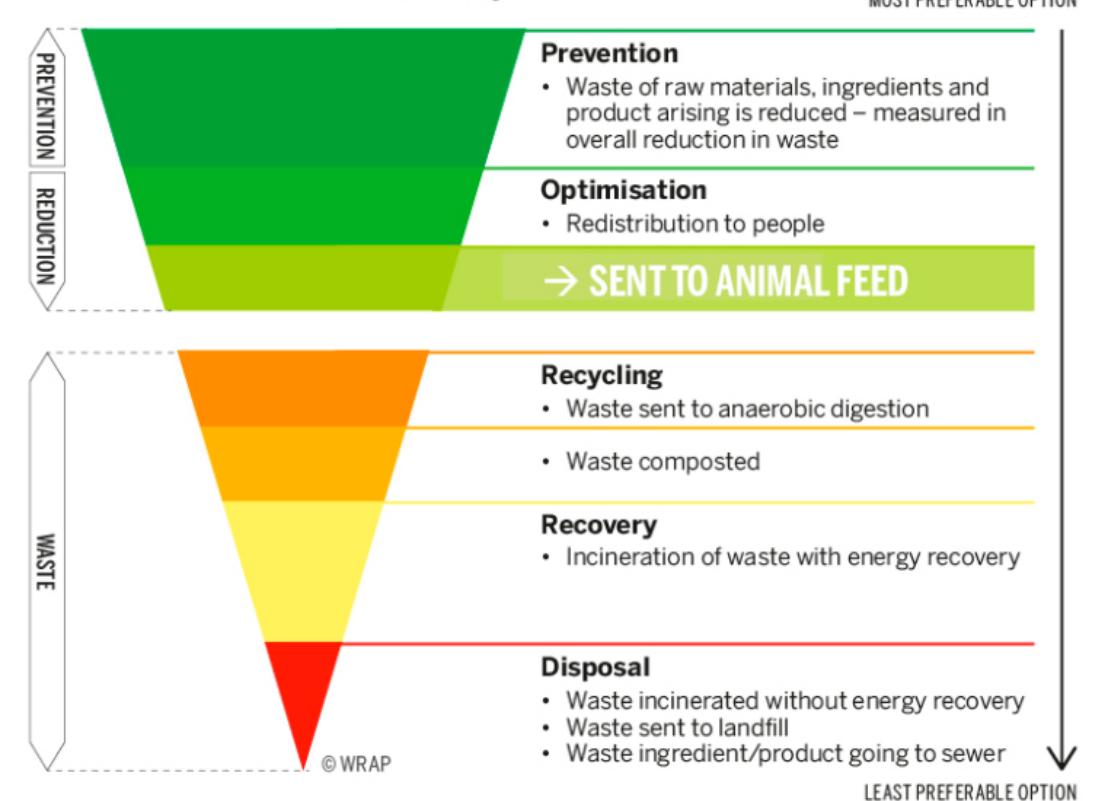
Strong Benefits Support Significant Market Growth

Key Considerations

- **Strong environmental benefits:**
 - Turning food waste into animal feed is a preventative measure and **one of the top three options on the food waste hierarchy**
 - **Prevents food waste from ending in landfills** - over 97% of food waste currently ends in landfills, creating the second largest human source of methane emissions
- **Compelling cost savings:** Given the high value of livestock feed, food waste to animal feed operations have lower tipping fees, saving money for municipalities, residents and businesses.
- **A proven solution:** Waste to feed operation is successful in Massachusetts and is mainstream in other countries including Japan, South Korea and New Zealand.

Food and Drink Material Hierarchy⁽¹⁾

Food and drink material hierarchy



(1) <https://www.fffpa.eu/reducing-food-waste/>

Environmental Benefits

Significantly Reduces Carbon Emissions and Land Requirements for Farmers

Highlights

- Using food waste as animal feed saves nearly three times more emissions than sending it to Anaerobic Digestion⁽¹⁾
- Most arable land is utilized for corn and soybean production to feed animals which can be diverted to focus on crops for human consumption, as the waste to feed market grows⁽²⁾
- Forty percent of food produced in the U.S. is wasted and is the largest component of municipal landfills
- Rotten food accounts for 34% of all methane emissions

Demand for Food Will Increase by 2 Billion People by 2050



(1) <https://feedbackglobal.org/wp-content/uploads/2020/09/Feedback-2020-Bad-Energy-report.pdf>

(2) United Nations Environment Programme (2009), The Environmental Food Crisis – The Environment’s Role in Averting Future Food Crises, A UNEP Rapid Response Assessment, ed. C. Nellemann et al., February 2009, p. 19

Cost Savings

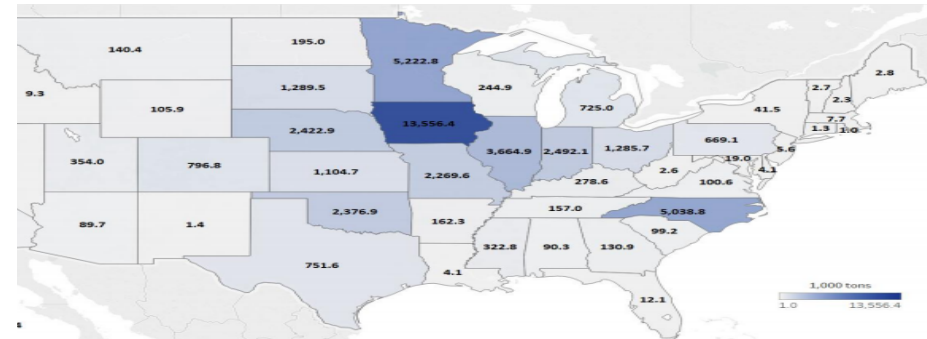
Market For Animal Feed Is Large, With Demand For 46M Tons For Pigs and 56M tons for Broilers Alone

Economic Benefits Created By Feed Market

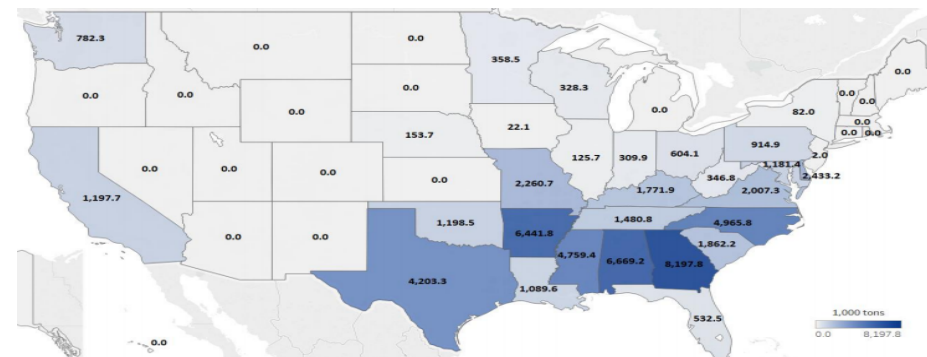
- Large and stable feed market creates an attractive economic proposition for feed producers (priced relative to corn and soybeans)
- Price for finished pellets (\$100+ a ton) translates to lower tipping fees (\$20-\$40 per ton) compared to anaerobic digesters and composters (\$40-\$80 per ton)
- As growing demographics drive demand for food globally, putting pressure on corn and soybean prices, demand for alternative sources of feed are expected to grow
- Waste to feed operations have strong end markets in pig and poultry livestock. Hogs consume ~46M and broilers 56M tons per year of animal feed⁽¹⁾

Hogs 2016 Food Consumed by State

(in 000s tons)



Broilers 2016 Food Consumed by State



(1) 2016 U.S. Animal Food Consumption Report: <https://www.afia.org/pub/?id=49AB0CF7-F3ED-766D-F8F0-82EEB09179C8>

Japan and South Korea's Experience with Food Waste

Japan and South Korea are Advanced in their Waste to Feed Capabilities

Food Waste into Animal Feed is Integral Part of Japan and South Korea's Recycling Operations

- Japan's food industry recycles more than 70% of food waste and about 50% turns into feed⁽¹⁾
- Recycled feed in Japan tends to be about fifty percent cheaper than standard animal feed
- South Korea's capital city Seoul now operates one of the most rigorous food waste recycling programs in the world with impressive results. Today, 95% of food waste is recycled – into compost, animal feed, and gas to power⁽²⁾

Food Waste Operations



(1) <https://asia.nikkei.com/Business/Japan-s-edible-waste-becomes-sought-after-pig-feed>

(2) <https://www.intelligentliving.co/south-korea-zero-food-waste#:~:text=South%20Korea's%20capital%20city%20Seoul,less%20than%202%25%20in%201995.>

New Zealand

EcoStock, a Private Waste to Feed Company in New Zealand, Processes ~10% of New Zealand's Food Waste⁽¹⁾

- EcoStock sources food waste from major food manufacturers such as Goodman Fielder, Pepsi-co, Nespresso, Griffins and Nestle as well as supermarkets⁽²⁾
- Ecostock's revenue exceeds \$40M⁽³⁾

Food Waste Operations



(1) <https://www.youtube.com/watch?v=CSse5hX4hI4>

(2) <https://www.ecostock.co.nz/FOOD+RECYCLING.html>

(3) <https://www.nzherald.co.nz/business/ecostock-turning-food-waste-into-millions>

History of Feed in the United States

Renewed Interest and Strong Regulatory Oversight Expected to Accelerate Adoption of Waste to Feed Operations in Coming Years

- Diverting food waste to feed animals has been commonplace for centuries
 - Previously waste was sent directly to farms unprocessed with little regulatory oversight
 - The practice declined in the 1980s when state and federal laws were introduced following disease outbreaks
 - Recently, there has been renewed interest in the practice of feeding safe, properly treated food waste to animals as federal government and states have put in place a strong regulatory framework to ensure quality
 - Although regulations vary by state, a summary of key regulations are shown below:
 - **SWINE HEALTH PROTECTION ACT (SHPA)**- requires that food scraps containing animal meat or animal by-products must be heat-treated in a manner that is sufficient to kill disease-causing bacteria (212° F or 100° C at sea level) for at least 30 minutes
 - **THE FDA'S BOVINE SPONGIFORM ENCEPHALOPATHY (BSE)/RUMINANT FEED BAN RULE** – Creates processing, inspection, labeling, and record-tracking of products containing mammalian protein.
 - **THE FOOD SAFETY MODERNIZATION ACT PREVENTIVE CONTROLS FOR ANIMAL FOOD** - Requires animal food processing facilities to implement necessary food safety controls
 - **REGULATIONS REGARDING LABELING AND ADULTERATION** – Any food, including animal feed, cannot be adulterated or misbranded
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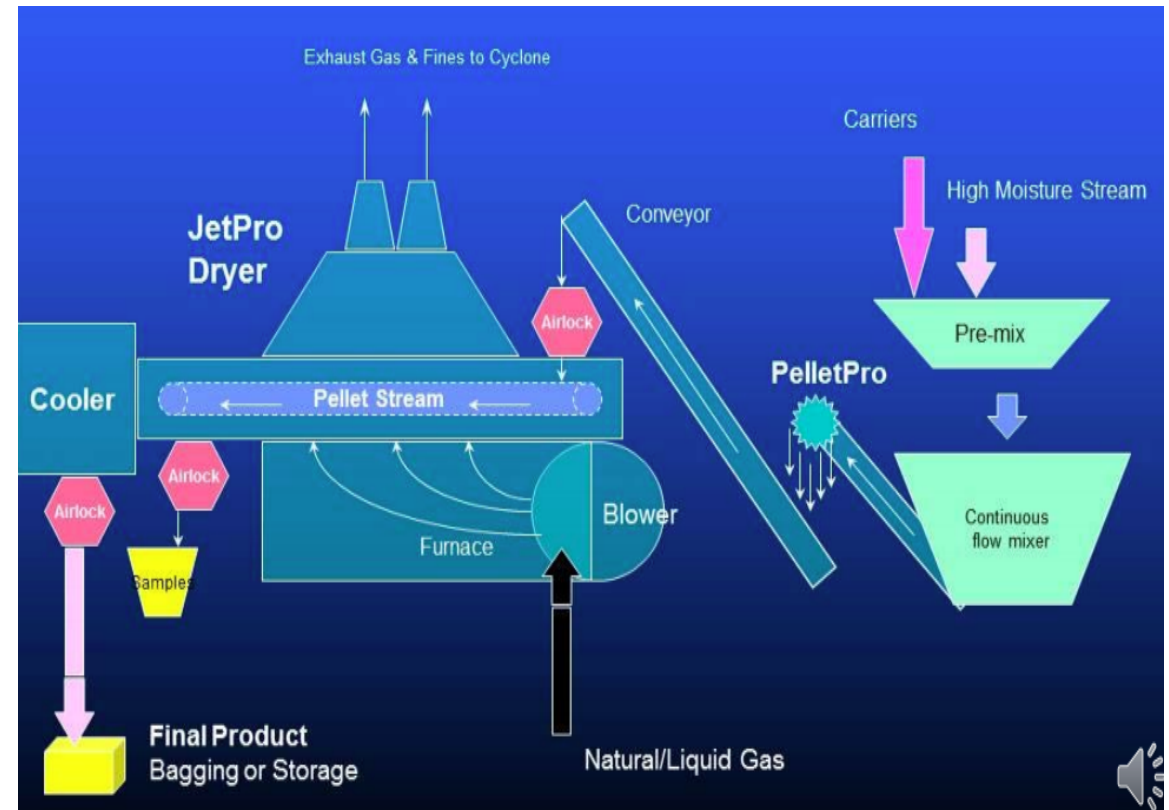
North Grafton Animal Feed Plant

Food Waste Operation in North Grafton, Massachusetts Highlights Efficacy

State of North Grafton Operation




- In 2015 the Massachusetts Department of Environmental Protection issued a recycling, composting, and conversion permit to process 375 tons of Fresh Unwanted Food Waste per day and up to 136,875 tons per year
- The operation successfully processes on average 70 tons per day selling its finished feed pellets to brokers who distribute to farms in the Northeast for prices in excess of \$100 a ton
- Process (see graphic). The plant receives food waste, and manually sorts and discards unwanted materials such as plastic and metals. It grinds, mixes and pelletizes the feed and heats and dries the product to remove moisture and pathogens

Illustrative Operations Overview



Challenges For the Animal Feed Industry




Three Operational Challenges Impact Profitability of Animal Feed Plants using Organic Waste

<u>Operation</u>	<u>Challenge</u>
1 Sourcing 	<ul style="list-style-type: none">Without centralized sourcing or efficient sourcing partners for food waste, an animal feed plant could face economic challenges
2 Sorting 	<ul style="list-style-type: none">Food waste often arrives at plants in contaminated form as the food waste is not separated from other forms of waste (common across waste treatment businesses)
3 Drying 	<ul style="list-style-type: none">Since food waste has ~70% moisture, efficient drying is needed to maintain high throughput rates

Note that the North Grafton operation loses \$15 per ton on sourcing, has high plant costs due to manual sorting of contaminated waste, and has been unable to scale due to obsolete drying technology.

Solutions for Animal Feed Operations

Identified Process Improvements to Create Scalable Operations

Operation	Solution/Risk Mitigant
1 <u>Sourcing</u> 	<ul style="list-style-type: none">• Coordinate with municipalities/towns to receive waste directly from haulers or pick up in a centralized location• With better sourcing, an animal feed plant would require a tipping fee of only \$20-\$40, lower than tipping fees for trash or anerobic digestion
2 <u>Sorting</u> 	<ul style="list-style-type: none">• The Tiger Depackager was presented at the CCSMM Organics Working Group meeting by Chris Field from WeCare Denali on October 20th as a viable solution to separate unwanted materials• Municipalities/ towns (ex: Greenwich) are beginning to institute programs to encourage separation of waste
3 <u>Drying</u> 	<ul style="list-style-type: none">• New drying technology can process higher moisture waste streams increasing scalability

It is estimated that implementing these strategies at North Grafton could increase production five-fold, enabling the firm to reach the 375ton/day capacity limit set by the permit

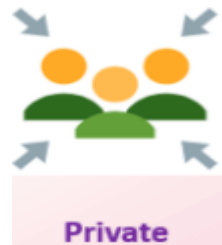
Recommendations for CCSMM (1/2)

The San Francisco model: Four Key Components...

Recommendation	Detail
Create a highly convenient service	<ul style="list-style-type: none">• Door-to-door collections of three waste streams - organic waste, recyclables and trash• Choice of bin size (from 32 gallons up to 96 gallons) and frequency of pick-up• Residents receive pail to separate food waste
Financial incentives to recycle food waste	<ul style="list-style-type: none">• Collection services priced based on size and frequency of collections• Fees for trash collection are about 10 times higher than for food waste
Partnerships	<ul style="list-style-type: none">• Form partnerships with collection services and haulers to ensure an efficient supply of food waste
Legislation	<ul style="list-style-type: none">• Laws passed to keep food waste out of landfills. California, Massachusetts, Rhode Island, Vermont and Connecticut have all passed such laws• Enforcement of laws coupled with alternative solutions needed to support positive outcomes

Recommendations for CCSMM (2/2)

Recommendation	Detail
Pilot program	<ul style="list-style-type: none">• Partner with private waste to feed operation to set up a plant in Connecticut• Firm should have the financial backing to buy the necessary drying and separating equipment (estimated \$6M needed), intimate knowledge of organic waste and feed markets, as well as technical competence• Estimated 30 tons per day (assuming ~\$30 tipping fee) to breakeven and ~60 tons in order meet private industry ROI requirements
Support permitting	<ul style="list-style-type: none">• Streamline permitting process to encourage businesses to select Connecticut for their operations (companies including Smart Feed are evaluating opportunities in Massachusetts given support from the Department of Environmental Protection).
Specifications for plant	<ul style="list-style-type: none">• The operation should be in an area zoned for industrial use• Roughly 3-4 acres of land and a 25,000 square foot building are needed for production• Land near transfer station will likely maximize distribution efficiencies



Conclusions

Organic Waste to Animal Feed Offers Clear and Compelling Value for Connecticut

Benefits

- Turning food waste to animal feed is one of the top three measures in the food hierarchy recommended by the EPA; environmental benefits are greater than anaerobic digestion, composting and incineration
- Saves money compared to existing solutions, resulting in lower tipping fees and financial burden on municipalities, residents
- Organic waste to animal feed is a proven solution in other countries and US municipalities
- Policy changes and a strong regulatory framework are powerful tailwinds that will support the growth of the waste to feed market

Considerations

- Can't currently take yard waste and therefore more sensitive to inputs compared to anaerobic digestion
 - Stigma from experience in the 20th century has slowed adoption
 - Not as ubiquitous as anaerobic digestion; fewer current businesses that have waste to feed capabilities
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Thank You
