



# Integrated Food Production Systems



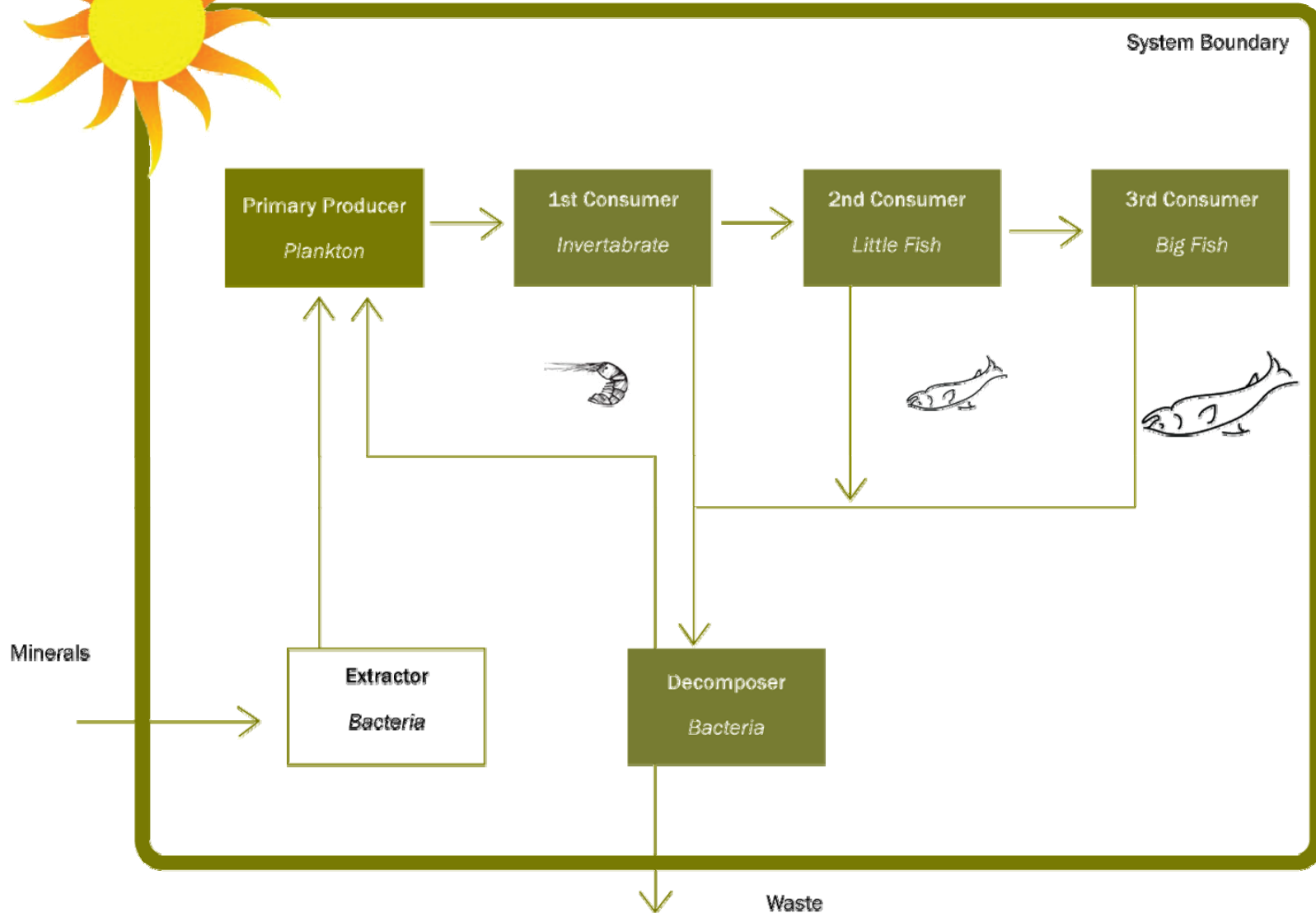


Integration of food production and food processing to reduce added inputs, reduce environmental impacts, improve the economics, and operate sustainably

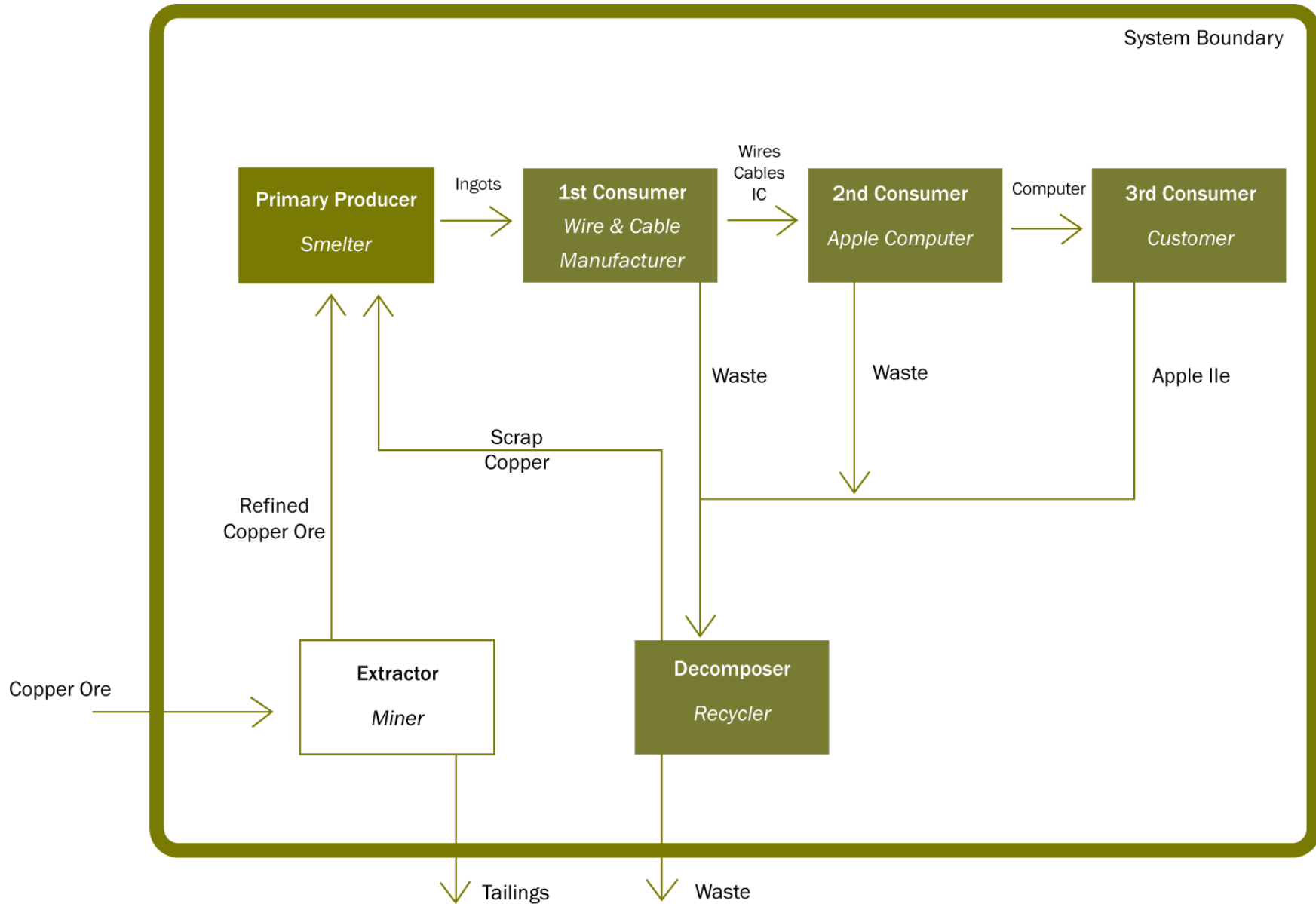


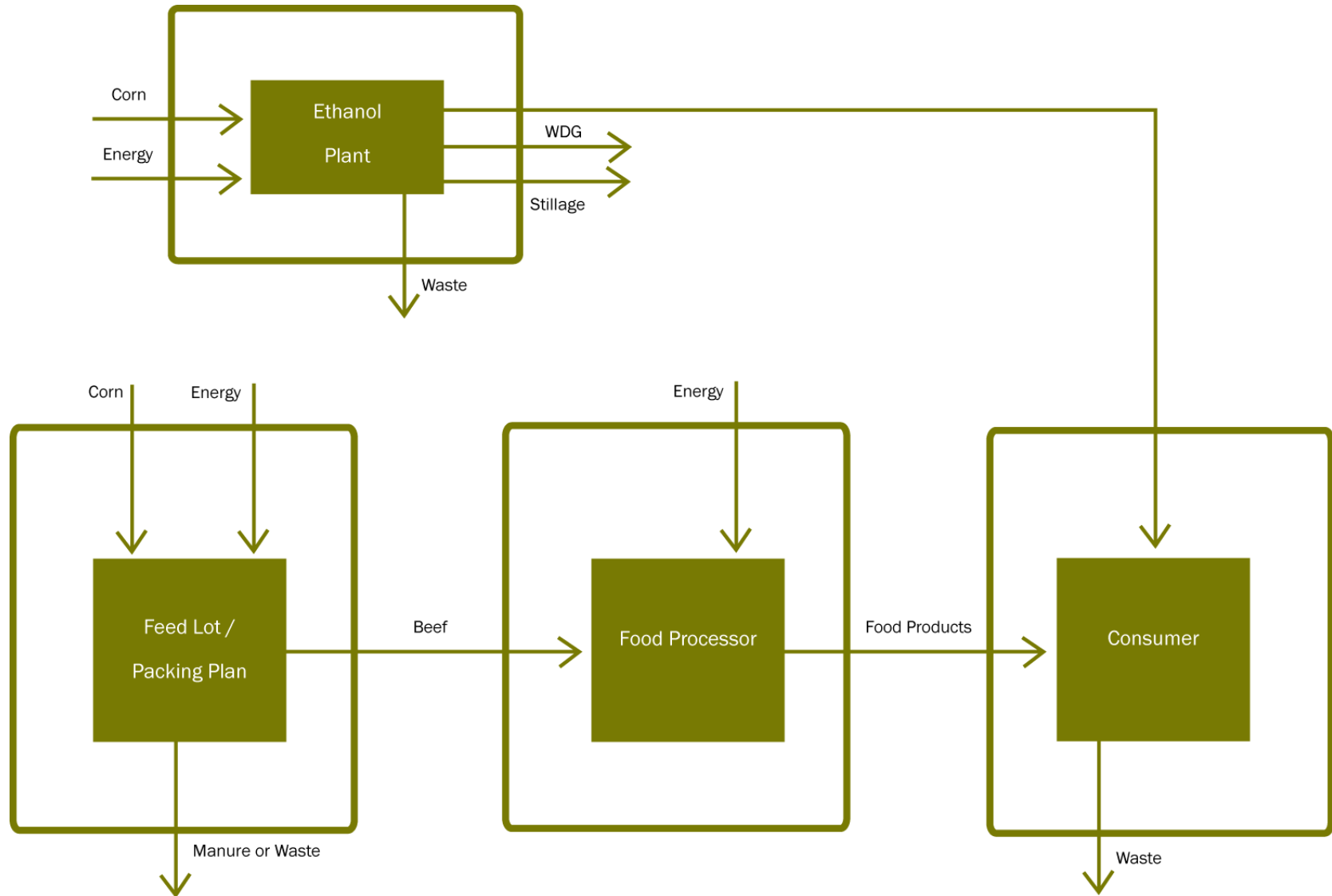
- Offset fossil fuel use by utilization of renewable energy captured from the livestock waste stream
- Reduces grain use
- Improve the economics of each operation vs. stand-alone
- Reduce water and air pollution, reduce odor
- Use livestock waste stream as sustainable fertilizer
- Benefit from Greenhouse gases or nutrient credit markets
- Reduce transportation fuel and emissions.

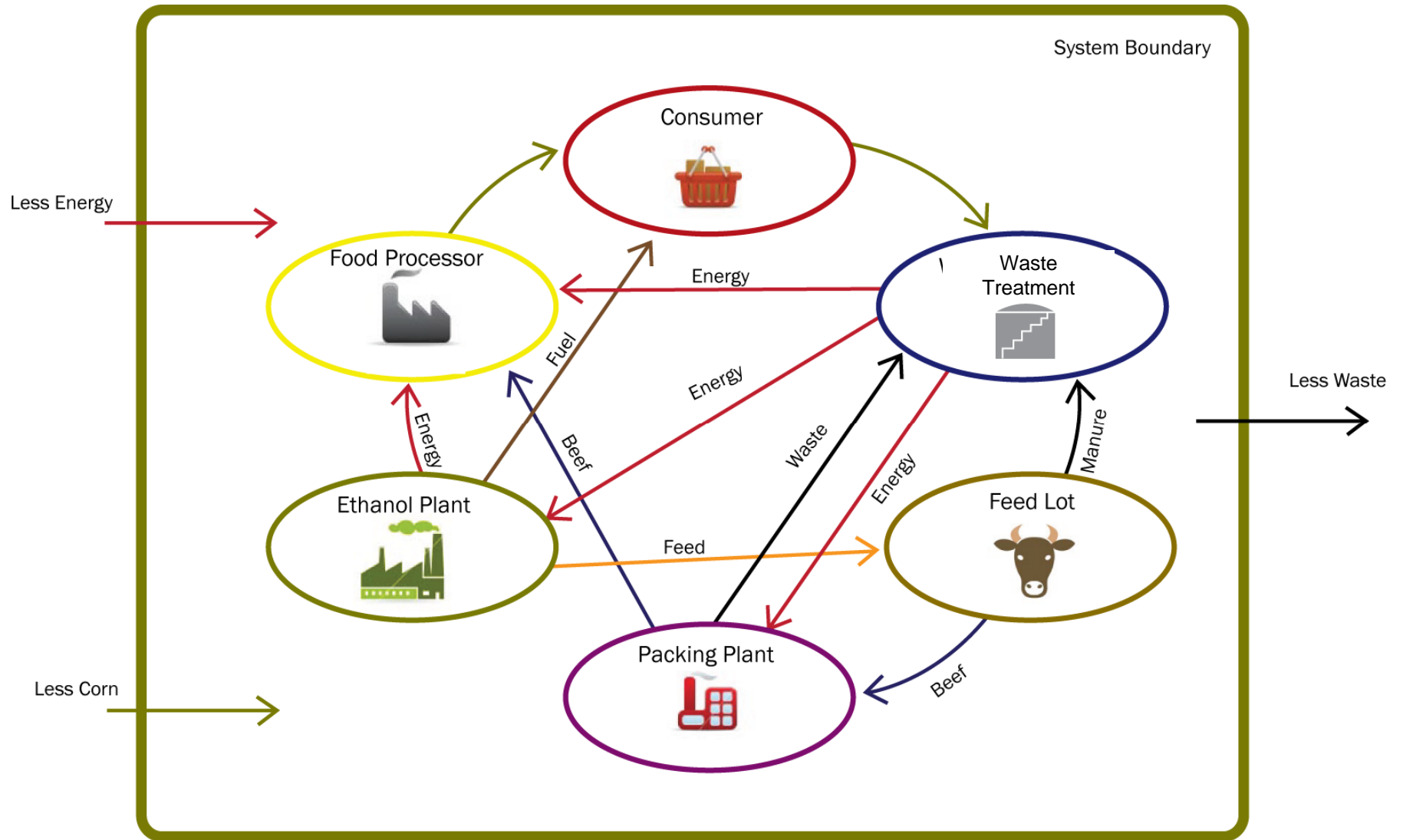


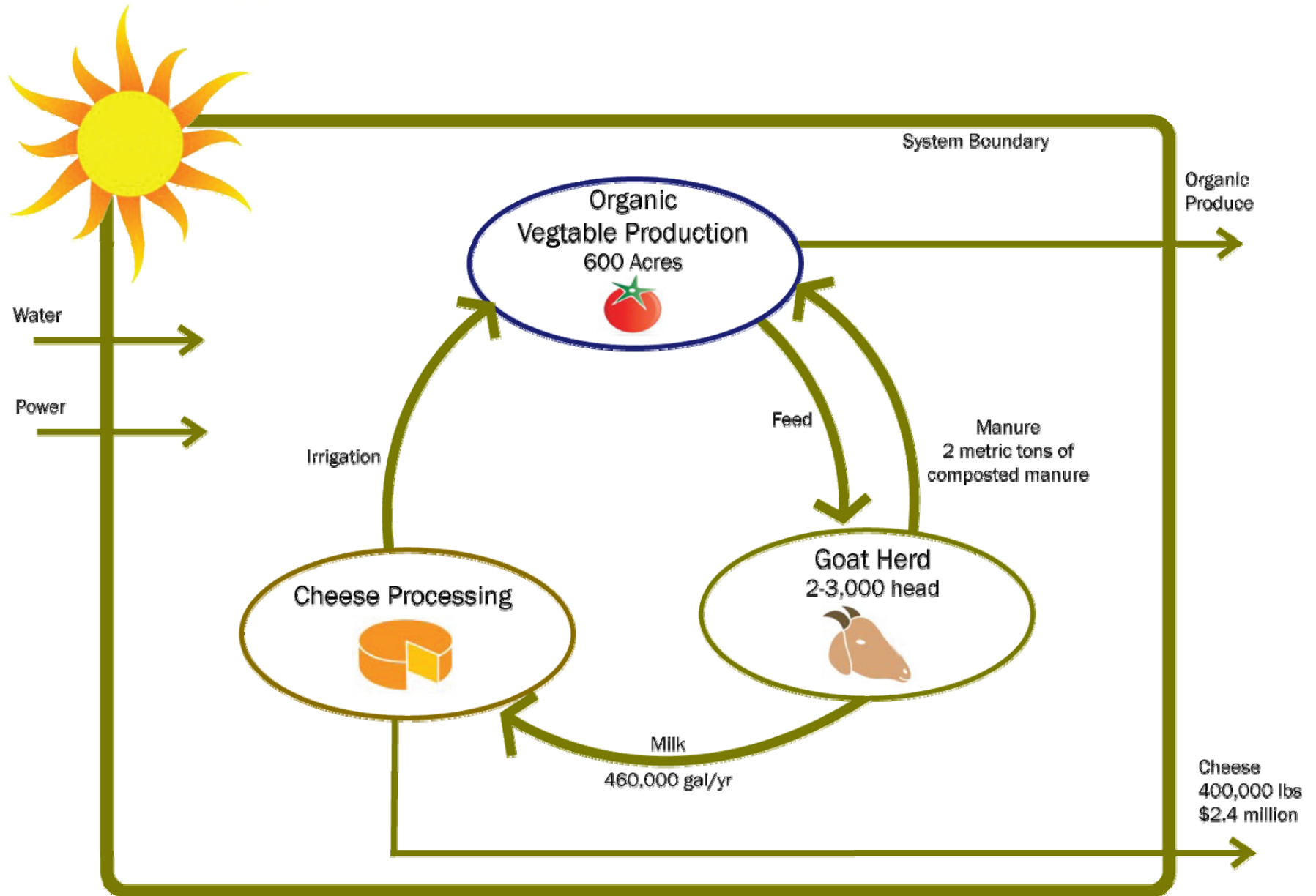


(Graedel/Allenby model)



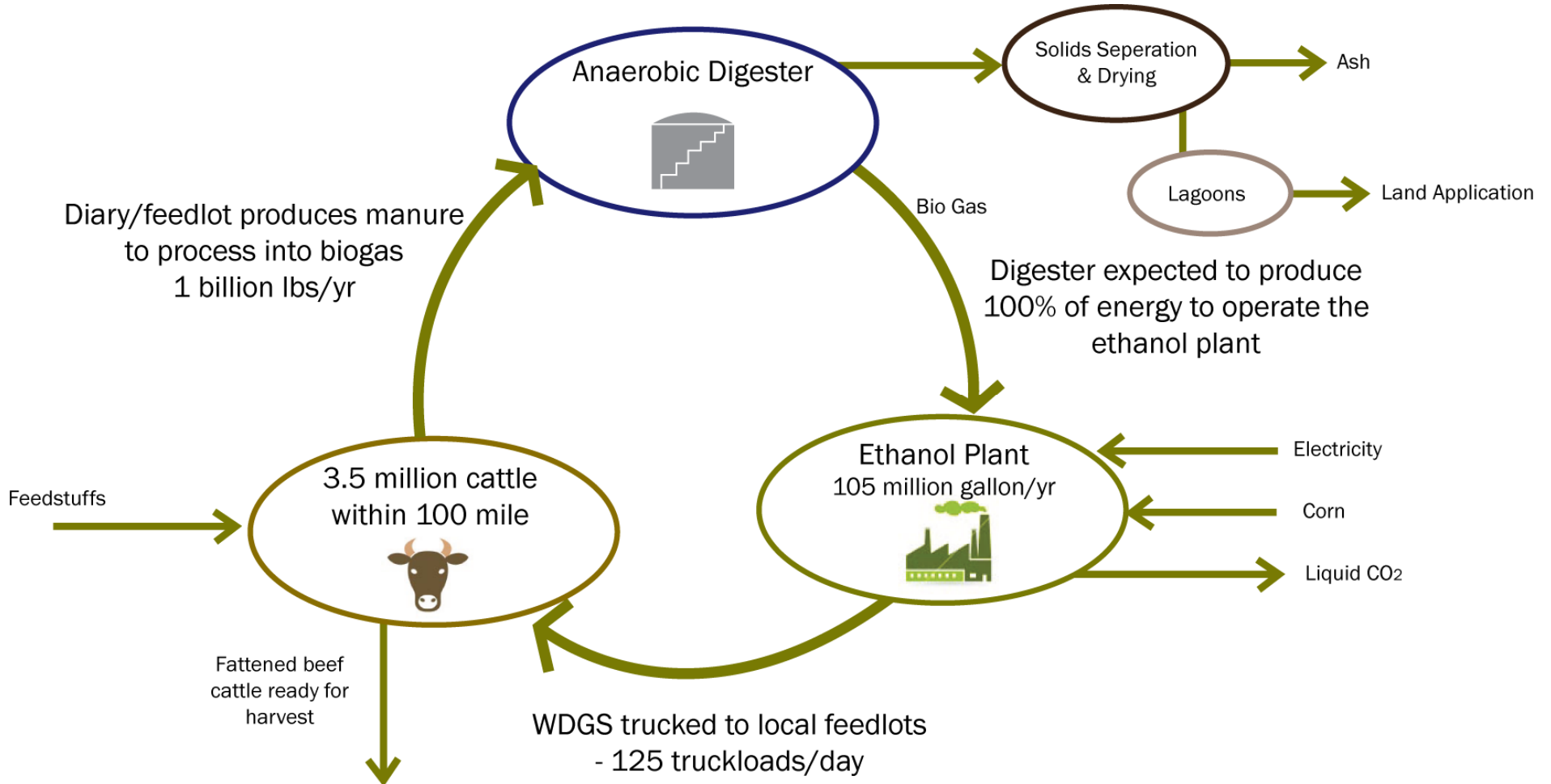






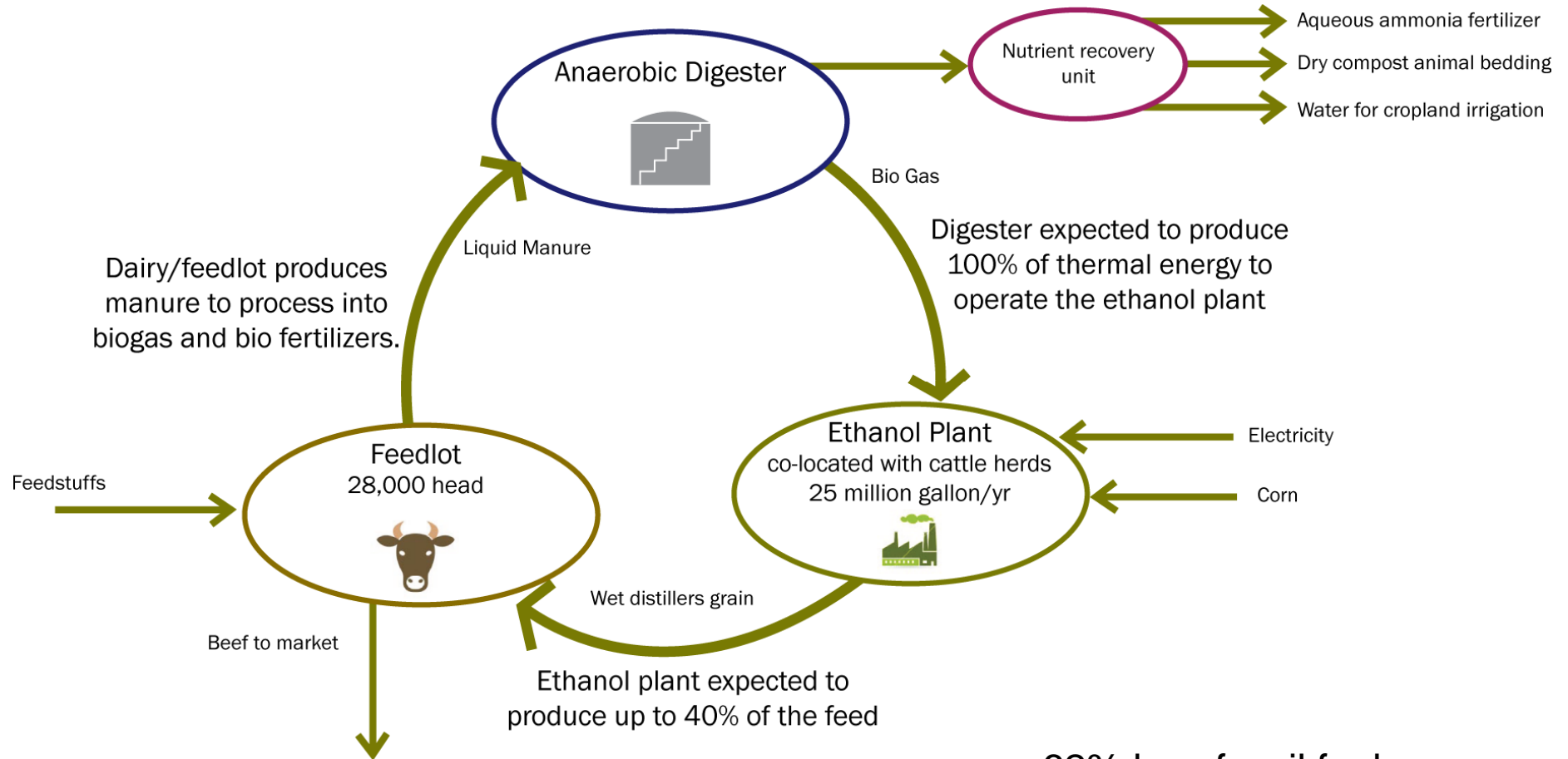
# Panda, Hereford, Texas

## \$200 Million+, Fall 2008

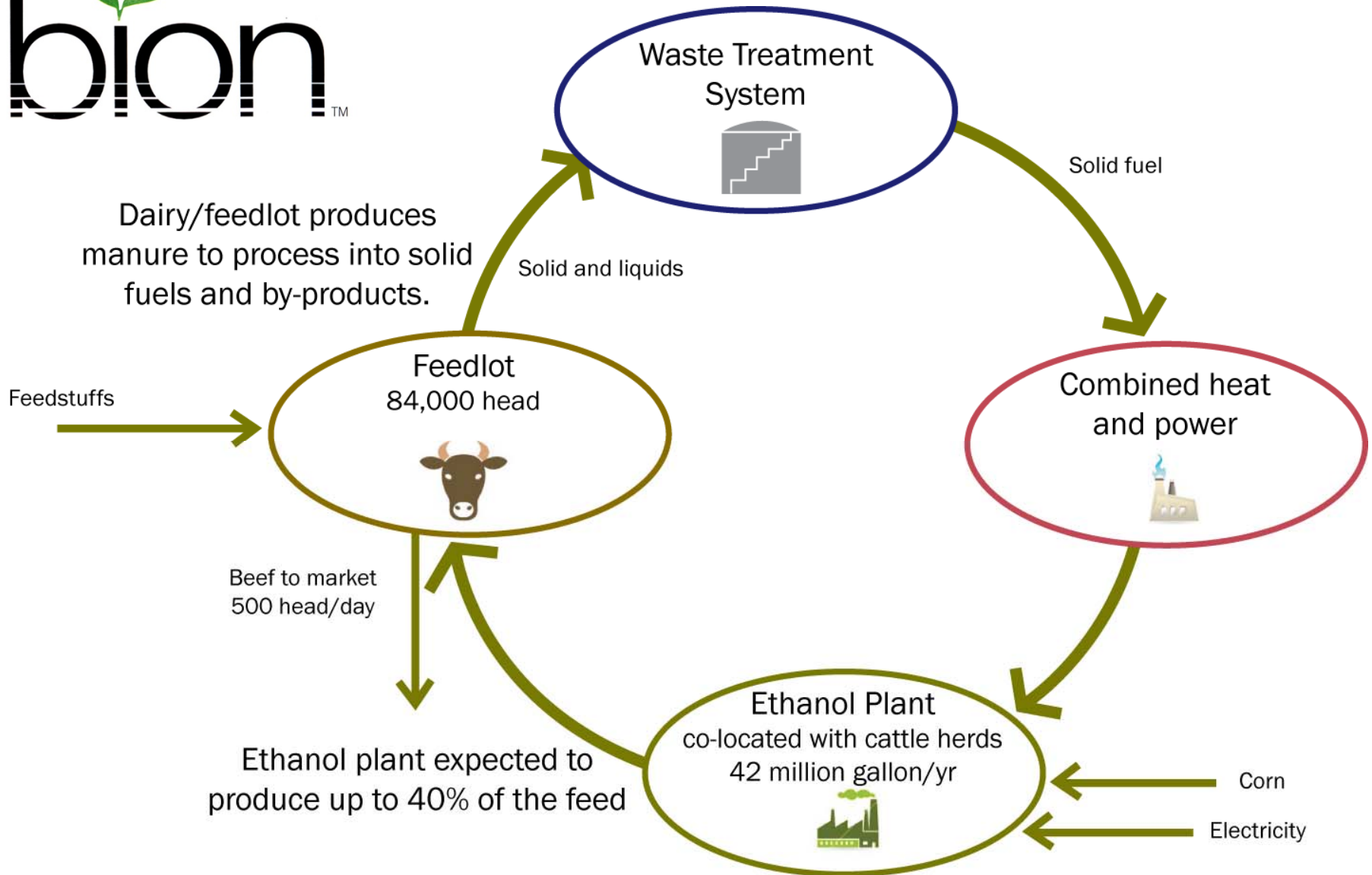


# E-3 Bio Fuels Mead, Nebraska

## \$80 Million



- 62% less fossil fuel vs. gas
- 70% less GHG emissions



## Integrated Food Production System The Bion Technology Platform



- A proprietary process control platform that directly addresses both air and water impacts from confined animal feeding operations, while using renewable energy to offset fossil fuel use:
  - Reduces inputs by reusing waste and byproduct streams
  - Reduces environmental impacts (air/odor, water/nutrients)
  - Proprietary, proven and patented
  - Benefits from Nutrient and Carbon credit markets
  - Facilitates the siting of these types of operations
  - Improves the economics of all the integrated operations, benefits from scale

# The Bion Technology Platform

## Cellulose-Based Renewable Energy Generation

- Bion’s technology platform efficiently produces a cellulose based renewable solid fuel suitable for offsetting the use of natural gas in ethanol production via combustion.
- Anaerobic digestion captures only about one-quarter of the renewable energy content of cattle manure based upon partial destruction of volatile solids present, while the Bion’s technology captures approximately three-quarters of the available energy content.

<b>Potential Renewable Energy from Dairy Manure</b>		
<b>Renewable Energy Potential</b>	<b>Per Milk Cow per Day</b> (Btu per cow per day)	
	Anaerobic Digestion <sup>5</sup>	Bion’s Cellulose-Based Solid Fuel
Gross Energy Potential	42,200 <sup>2</sup>	100,000 <sup>1</sup>
Energy Required to Produce	16,600 <sup>4</sup>	27,100 <sup>3</sup>
<b>Net Renewable Energy</b>	<b>25,600</b>	<b>73,000</b>

1 Based upon laboratory analysis of combustion value for manure coarse solids

2 Based upon production of 44 cu ft of methane per cow per day

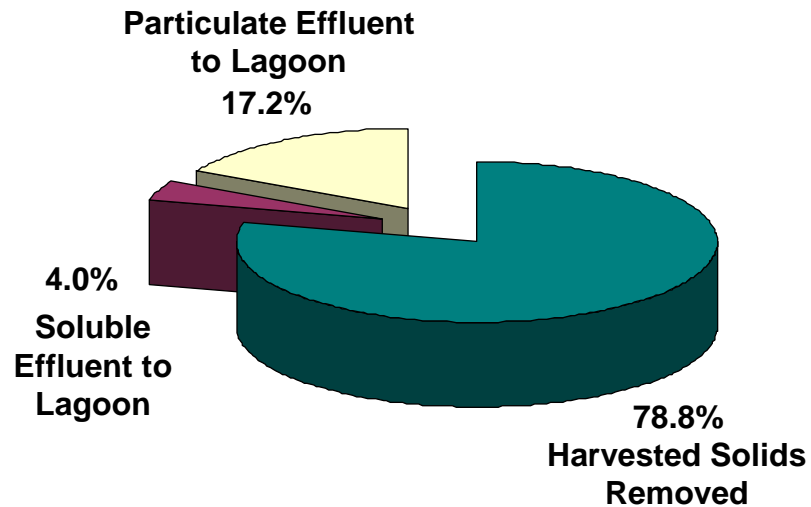
3 Assumes drying of manure solids to 90% TS

4 Assumes AD preheat required for ambient temperatures in Indiana

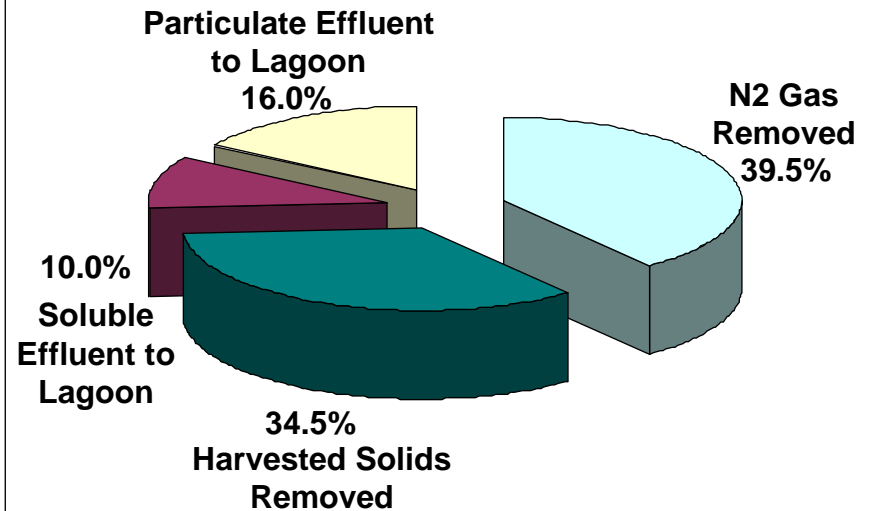
5 Assumes no substrate for supplemental methane production.

- On-farm P Levels Reduced by **79%**
- On-farm N Levels Reduced by **74%**

### Phosphorus Fate



### Nitrogen Fate

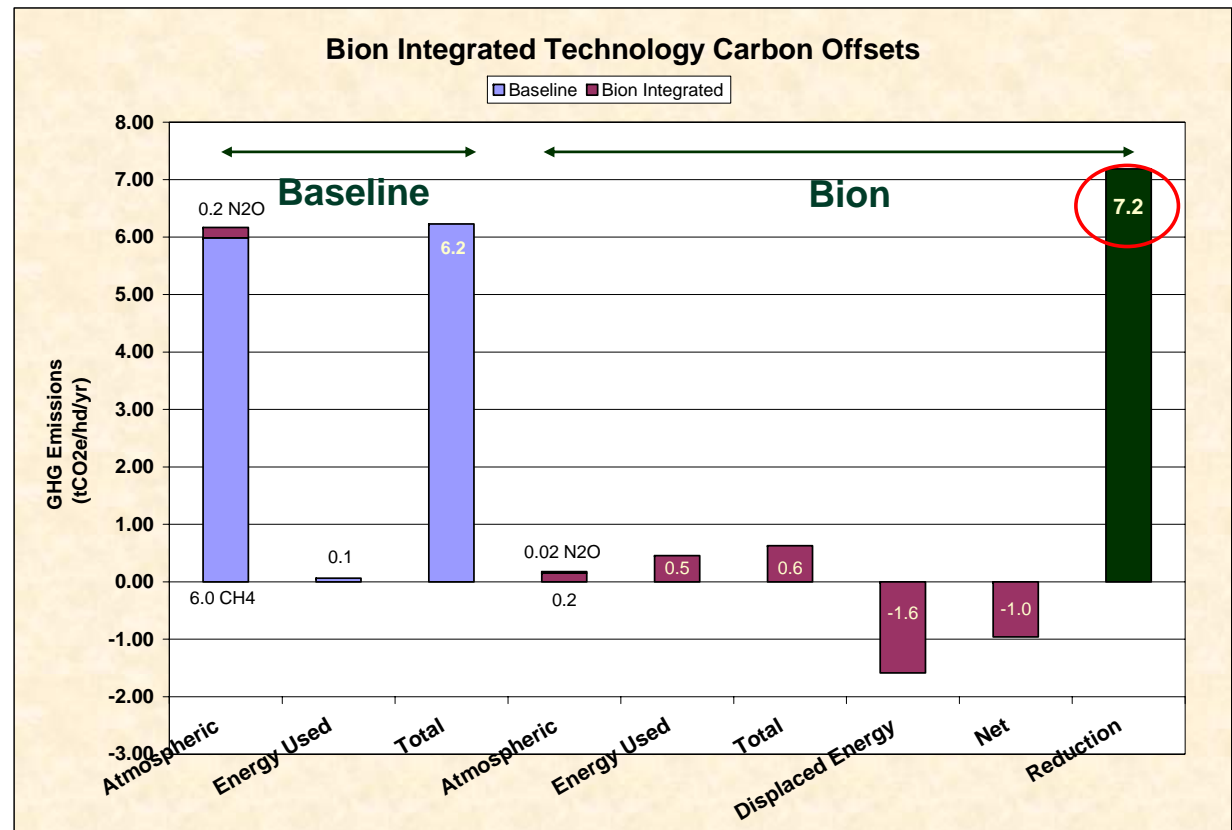


# Bion —Benefitting from new GHG & Nutrient Credit markets

- Bion commissioned Econergy International to conduct an independent evaluation of greenhouse gas (GHG) emission reduction potential for an integrated agricultural development using its technology platform.

- Results using conservative input assumptions show that Bion will generate 7 tons of GHG credits per cow at a market value of \$3 - \$5 / ton.

- Actual data will be used following a year of operation -- Bion expects GHG credits per cow at 10 to 14 per year.





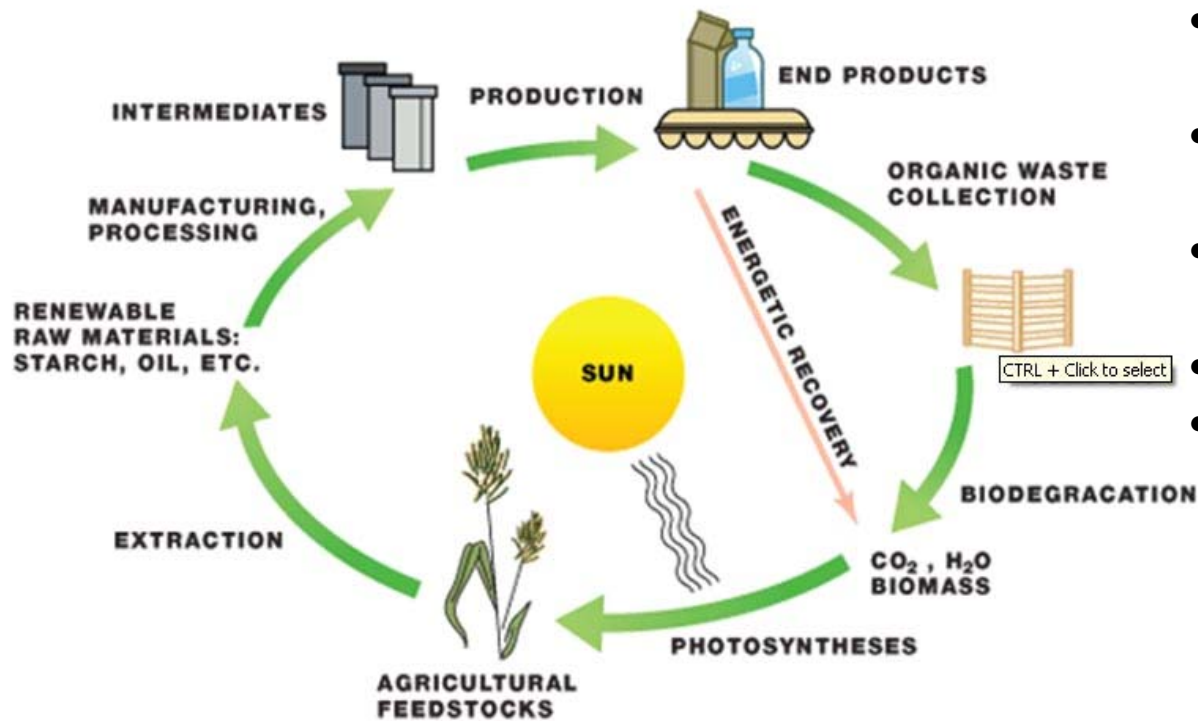
- Continued sharp increases in ethanol and co-product production
- Increasing competition from offshore ethanol production with or without current tariffs
- Softening in ethanol market values from current levels
- Increasing cost for corn
- Support for / advent of cellulosic ethanol
- Highly variable and potentially increasing costs for energy
- Saturating markets for distiller grains leading to significant market devaluation



- Nutrient recovery minimizes environmental impact—not addressed by anaerobic digesters
- New construction reduces objection to existing CAFOs—comprehensive environmental approach addresses odor, traffic, and improves operating economics.
- Since energy (solid fuel vs. biogas) is in a readily transportable form, it facilitates integrated project design.
- Higher recovery of renewable energy vs. biogas reactors
- Science-based approach—Considerable technical and financial expertise on the BION team
- [www.biontech.com](http://www.biontech.com)



Eni



- 25 year program, 42,000 acres
- The post-petroleum future
- Residential, commercial and industrial complexes
- Reduced-input crop cultivation
- Non-corn Ethanol
- Organic, sustainable living

“a sustainable community centered around old-world values and 21st Century science and technology that guarantees the preservation and protection of the land and its natural habitats”



- Livestock wastes are "one of the top two or three most significant contributors to the most serious environmental problems at every scale."—UN
- These new approaches solve an interlocking set of current problems, but require a comprehensive reorganization of how food and fuel are produced.
- Integrated systems analysis of complex problems—the sweet spot for Chemical Engineers—is at the core of the solution.

*"In Nature, there is no waste"*