

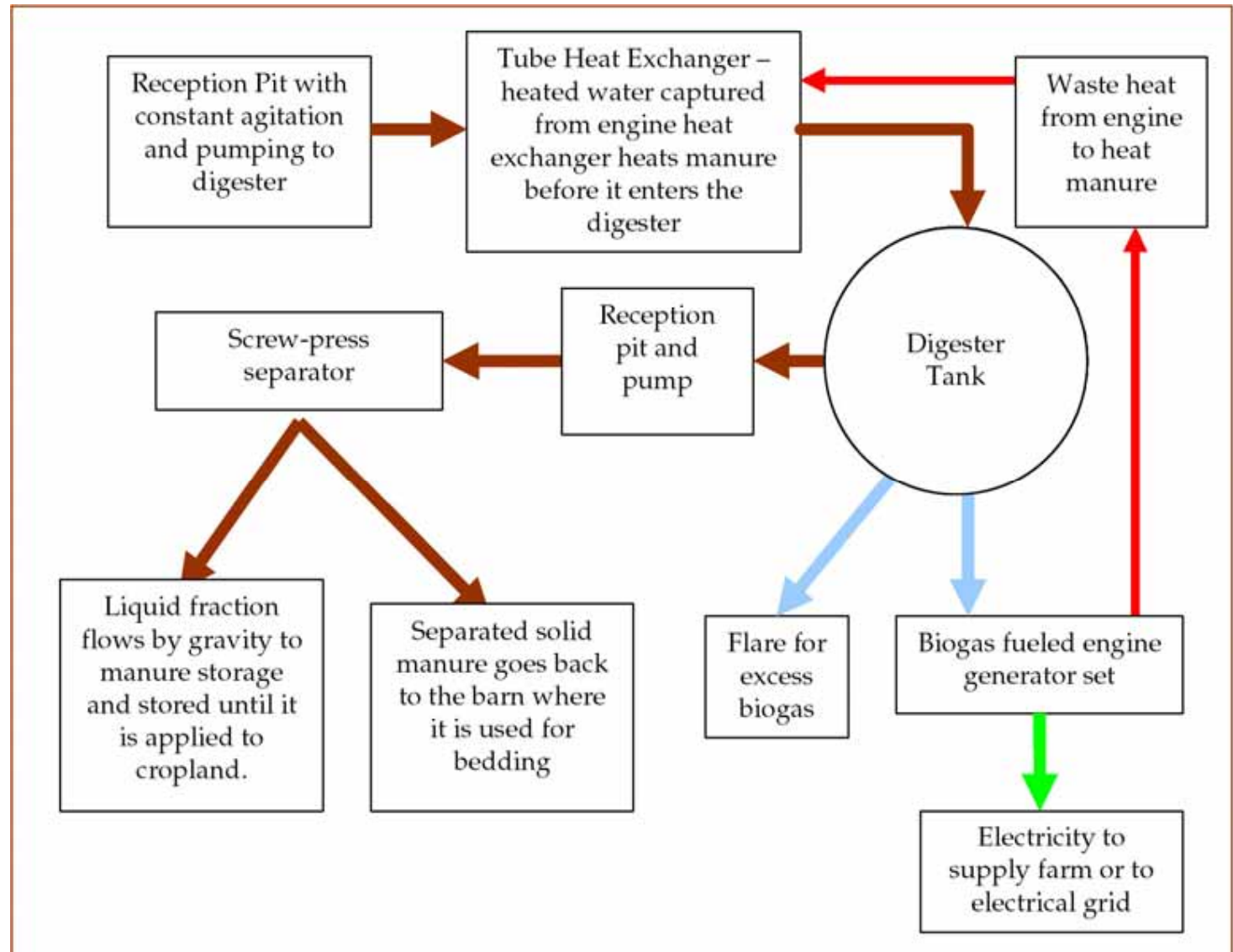
# Exploring the Economic Opportunities of Anaerobic Digestion and Biomass Gasification

Anaerobic  
Digesters:  
Opportunity  
for Farms,  
Businesses,  
and Local  
Government



## The Process

### Anaerobic Digesters: Opportunity for Farms, Businesses, and Local Government



## Multiple Technologies

Anaerobic  
Digesters:  
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- Covered Lagoon
- Plug-Flow
- Fixed Film
- Complete Mix
- T-PAD: Temperature-Phased Anaerobic Digester

## Multiple Benefits

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- Waste and pathogen reduction
  - And odor?
- Clean, Renewable, Local, Dispatchable Power
- Reduced waste management costs
- Regulatory Assurance

## The Plug-Flow Digester at Haubenschild Farms

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- 6 month construction time: spring-summer 1999
- Timed with farm expansion: Spring 2000 expanded to 425 cows. Fall 2000-Summer 2002 expanded to 750 cows
- Installed infrastructure for future plans



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## Vertical Tank Digester at the Jerr-Lindy Dairy

Grants totaling  
\$329,900 from local,  
state, and federal  
agencies

Farm covered  
\$130,100

Total Construction  
Cost: \$460,000

Annual Operational  
Cost: \$12,640



## ROI

### Anaerobic Digesters: Opportunity for Farms, Businesses, and Local Government



- Reduced or Avoided Costs and New Incomes
  - Reduced waste handling: \$2,400/year
  - Animal bedding: \$12,000/year
  - Net-metered electricity: \$10,000/year
  - Minnesota Renewable Energy Production Incentive: \$1,800/year
  
  - Carbon Credits: \$550/year
  - Total: \$26,750/year
  - ROI: 11 years

## On-Farm Digester Opportunities

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- Dairy
- Swine
- Poultry
- Food waste
- Markets
  - Electricity
  - Carbon Credits
  - Tax Credits
  - Soil Amendments
  - Tipping Fees

## Business Opportunities

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- Planning
  - Feasibility studies
  - Regulatory analysis
  - Environmental impact assessments
  - Project financing
  - PPA's
  - Contracting and leasing agreements
  - Workforce training

## Manufacturing

### Anaerobic Digesters: Opportunity for Farms, Businesses, and Local Government

- Digester components
  - Tanks
  - Heat exchangers
  - Screw presses
  - Engines
  - Monitoring equipment
  - Software
    - Operations
    - Data Management



## Installation

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- Construction
  - Concrete
  - Building
  - Plumbing
  - Electrical



## Operation and Maintenance

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Digesters:  
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- **Digester Optimization**
  - Ph balance
  - Temperature
  - Overall gas productivity
- **Engine and Generator**
  - Scheduled Overhauls
  - Emergency Repair Service

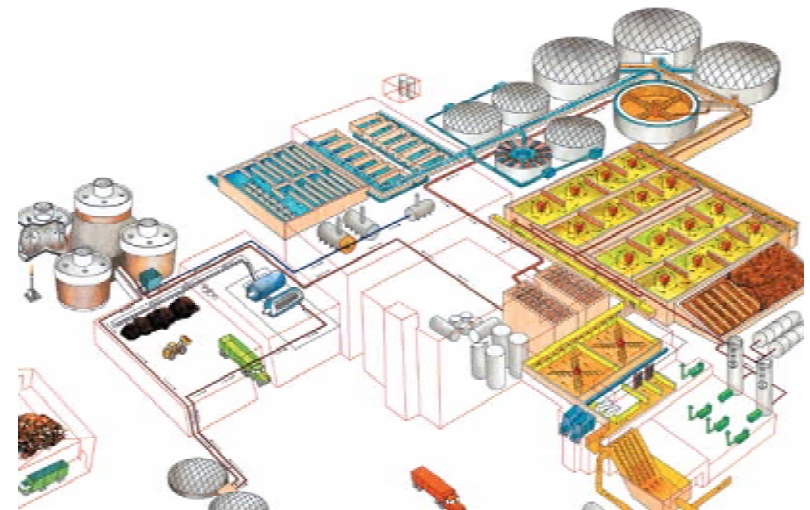
## Local and County Government Opportunities

### Anaerobic Digesters: Opportunity for Farms, Businesses, and Local Government

- Wastewater pre-treatment
- Clean Power Industrial Parks
  - Madelia Model
  - Maine Renewable Energy Consortium
- District Energy
  - City of St. Paul
  - Charlottetown, PEI
    - 33MW heating, 1.2MW electricity



Source: <http://cdeamap.navlar.com/cases/pei.pdf>



# Biomass Gasification

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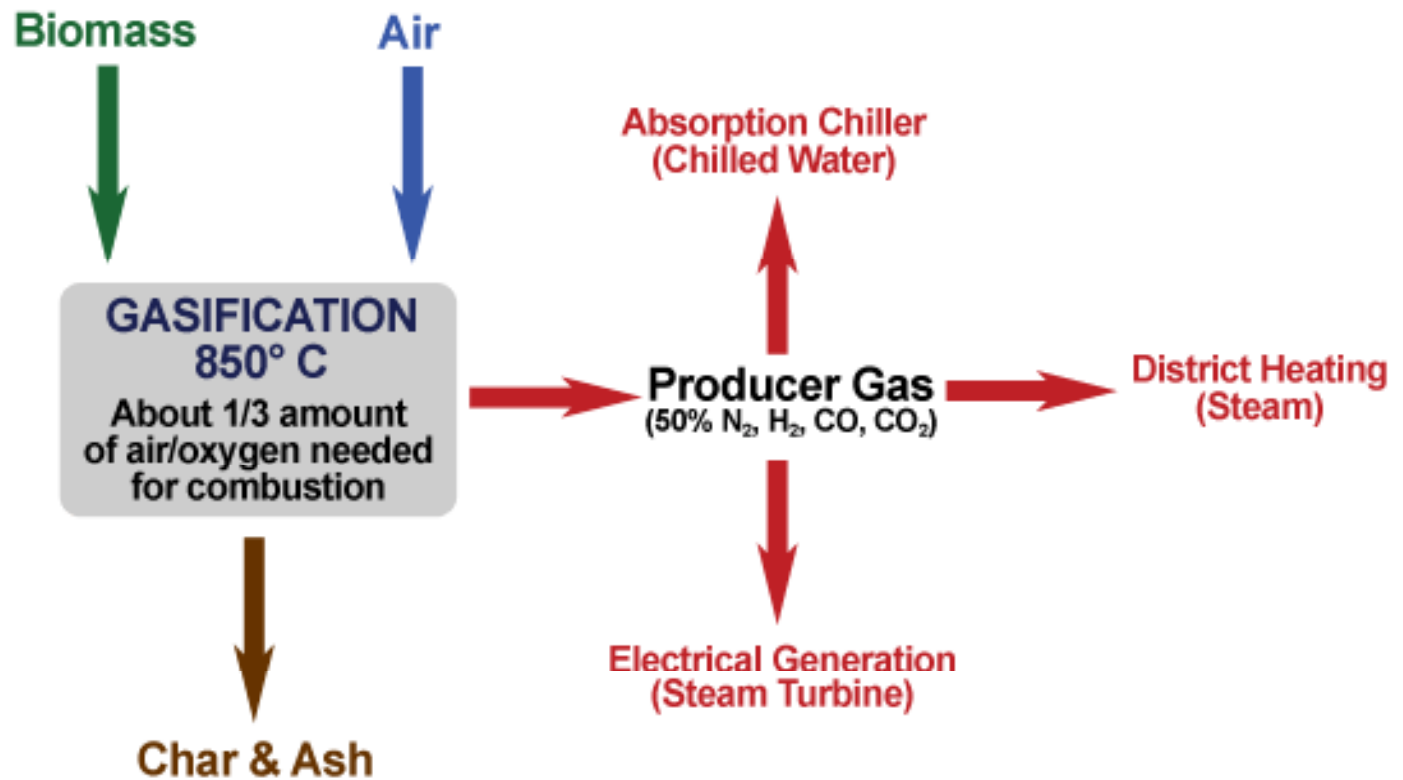


Image Source: UM-Morris:  
<http://renewables.morris.umn.edu/biomass/technology>

## Business Opportunities in Biomass

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- Biomass production and management (wood, grasses, food-crop bi-products)
- Pre-processing, densification and transportation



**Source: Biomass Utilization &  
Restoration Network for the Upper  
Peninsula**

## Additional Resources

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### Information about technologies:

- Union of Concerned Scientists
- National Renewable Energy Laboratory
- Forest Products Industry Technology Roadmap
- AURI

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## Information on Funding

- MDA Sustainable Agriculture Demonstration Grant Program
- Minnesota Office of Energy Security provides funding opportunity listings
- EPA AgStar program and USDA REAP: [www.epa.gov/agstar/](http://www.epa.gov/agstar/)
  - Lisa Noty, USDA State Energy Coordinator
    - [Lisa.noty@mn.usda.gov](mailto:Lisa.noty@mn.usda.gov)
    - 507-373-7960 ext. 120

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