MANURE TO ENERGY AND CHESAPEAKE BAY RESTORATION

Philadelphia Society for Promoting Agriculture
Manure to Energy Briefing
December 5, 2015

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Chesapeake Bay Commission

Discussion

1. The Chesapeake Bay Commission: Policy for the Bay
2. Water Quality Impairment; Manure Contribution
3. Manure to Energy: The Promise and The Practice
4. CBC Policy Support for Manure to Energy

Chesapeake Bay Commission

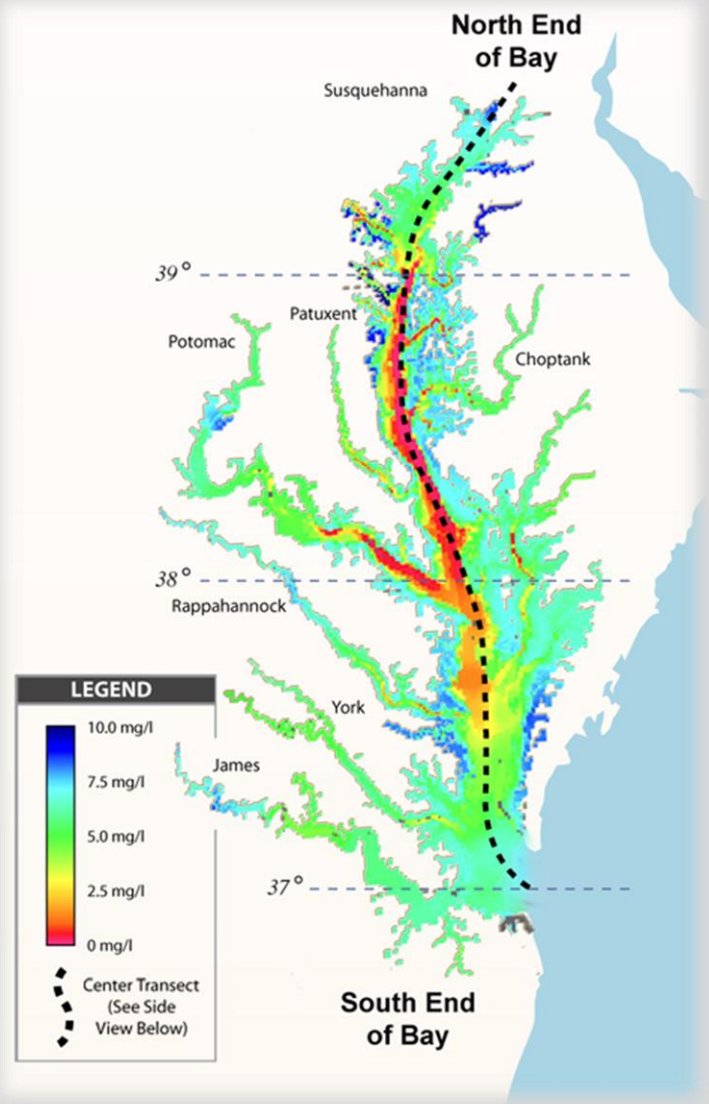
- Tri-State Legislative Commission
  - PA, MD, VA
- Established by state law
- Legislative arm of Chesapeake Bay Program
- 7 Members Each (21 total)
  - 2 Senate
  - 3 House
  - 1 Cabinet-level
  - 1 Citizen at Large

The Chesapeake Bay is *Impaired*

- Its waters do not meet *water quality standards* based on *designated uses.*

- *N, P and Sediment*

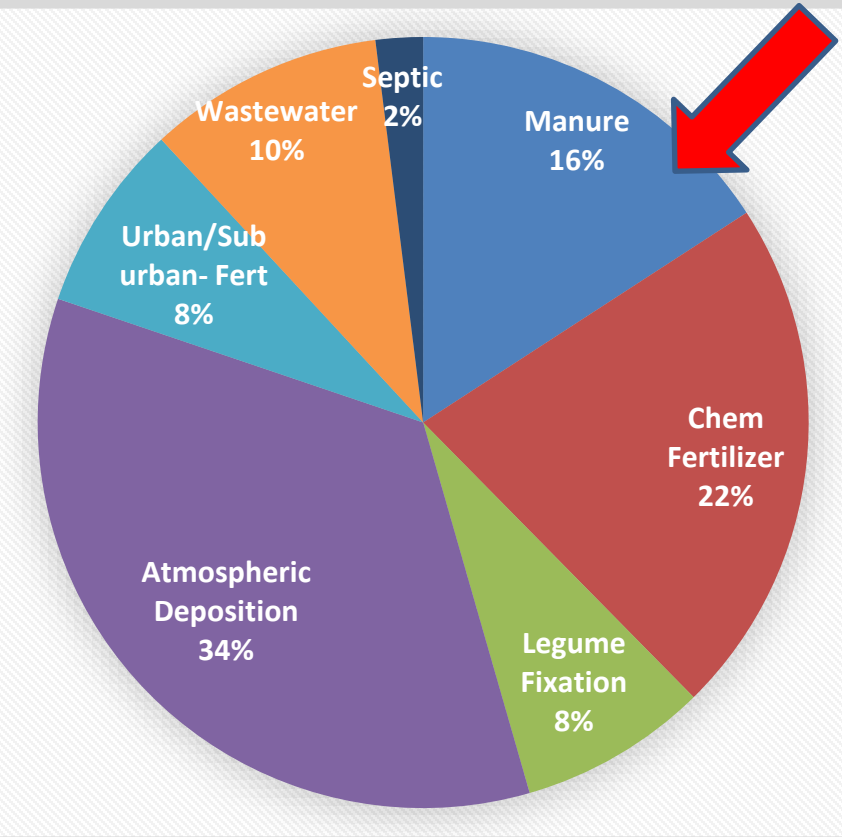
- Under the federal Clean Water Act, a **TMDL** was developed.



Excess nutrients and sediment cause water quality problems in the Bay and are the focus of Bay restoration.

Bay Pollution: Sources of Nitrogen

PENNSYLVANIA



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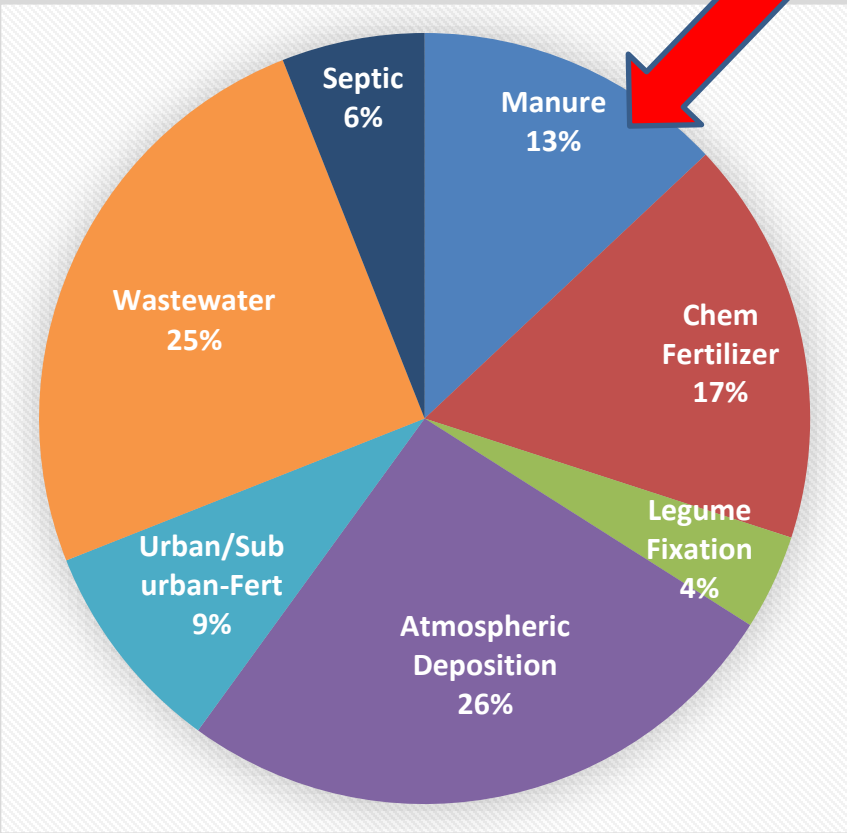

Bay Pollution: Sources of Phosphorus

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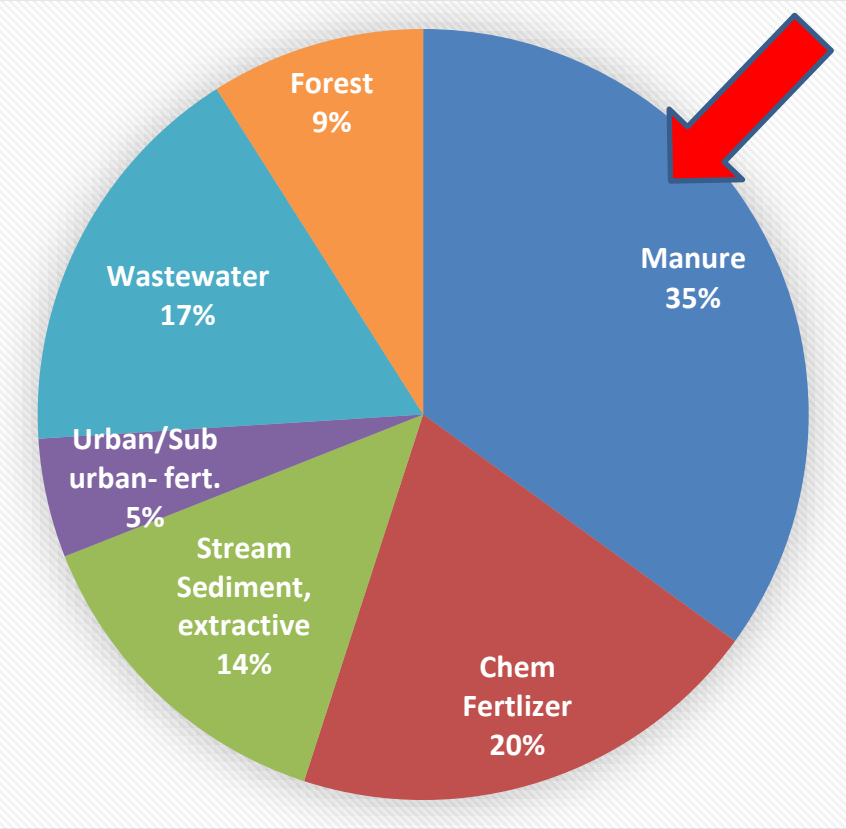

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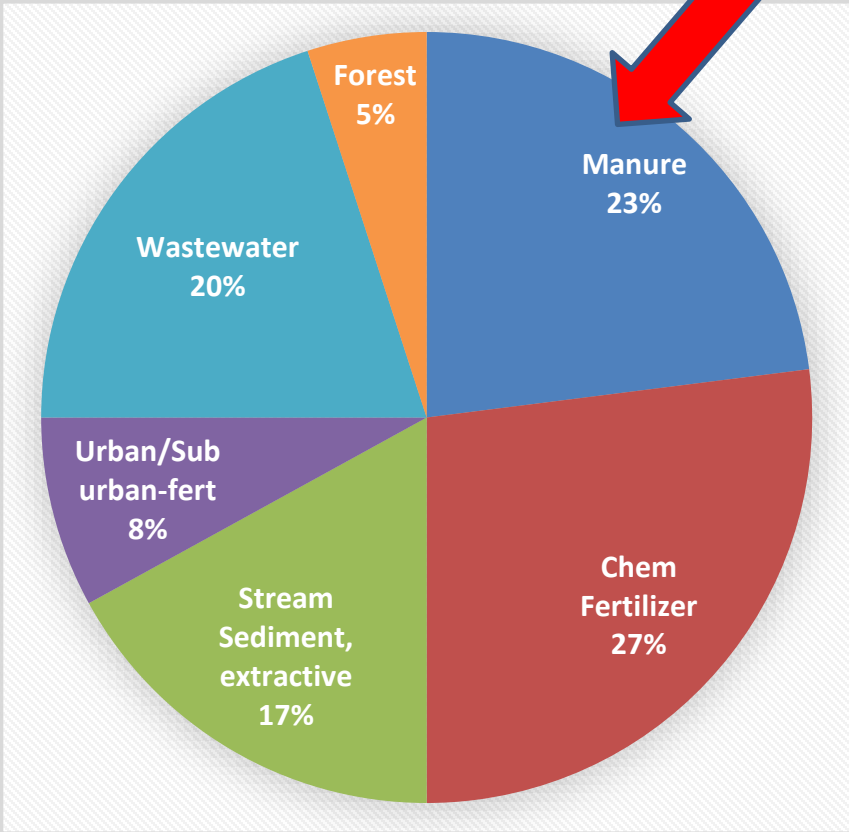
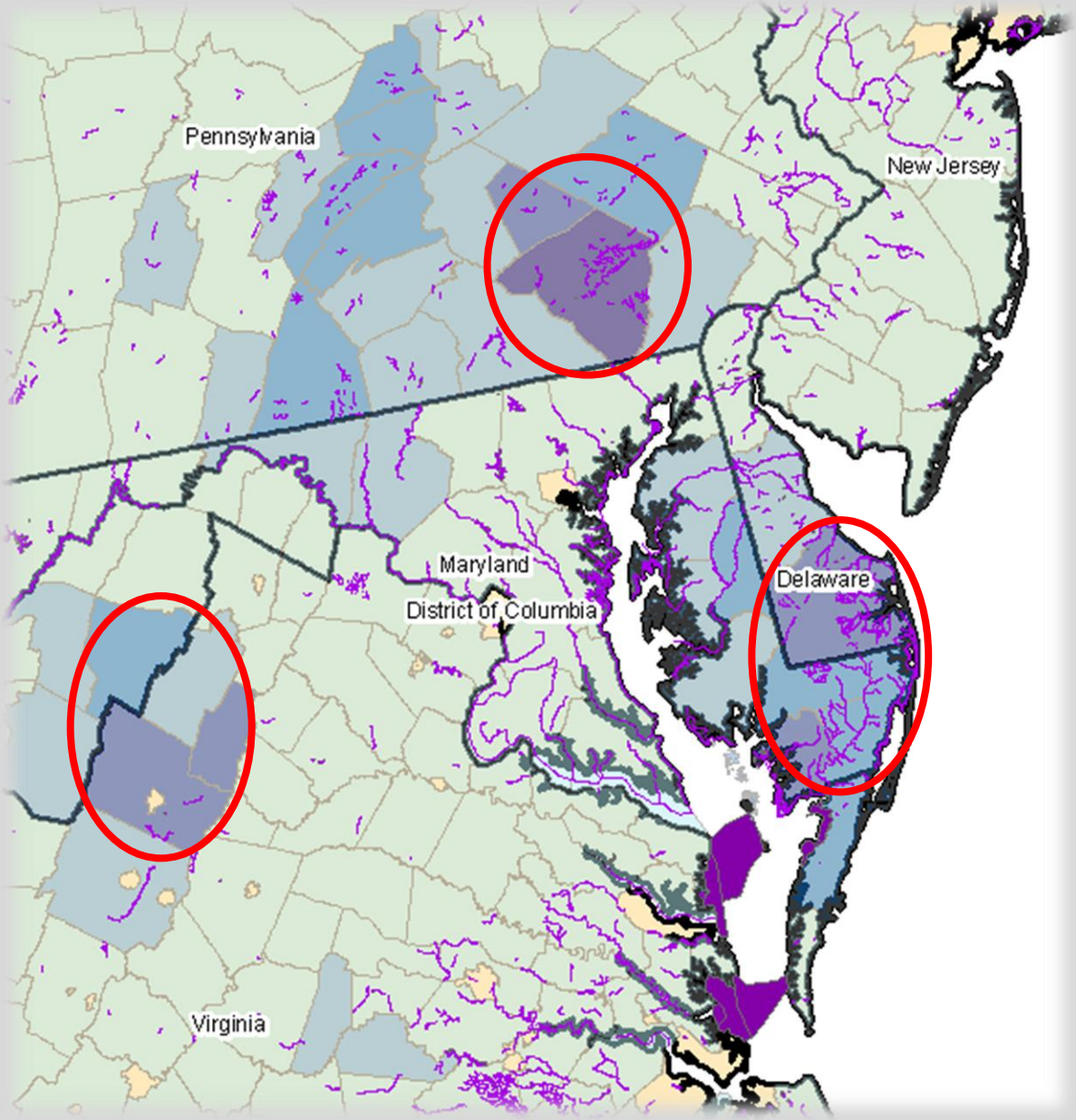



Pennsylvania
New Jersey
Maryland
District of Columbia
Delaware
Virginia

Maryland Policies Limiting Land Application of Manure

- **2012- Nutrient Management Regulations-** winter ban on manure application 2016
- **2015- Maryland Phosphorus Management Tool**: more accurately measures risk of phosphorus & accounts for P saturated soils.
  - Phosphorus Reductions- 24,000-48,000 lbs. *(41% of Ag goal for 2025)*

CHALLENGE - 228,000 tons/year excess litter

Strategies to Use Excess Litter

- **Increase Manure Transport**
  - **Dairy**
  - Litter
- **Increase Alternate Uses**
  - Pelletizing
  - Composting
- **Manure to Energy**

Manure to Energy Technologies

- **Anaerobic Digestion**- no O2- bacteria convert organic carbon in manure to methane which is used to generate heat or electricity.
  - Sludge byproduct contains N and P.

- **Combustion**- ample O2- burn at 2,000 degrees
  - Concentrated byproduct- phosphorus rich ash
  - Some NOx (nitrogen) emissions

- **Pyrolysis-** no O2- 700-1200 degrees
  - Decomposition of organic matter under high temp
  - Bio-oil, biochar, syngas

- **Gasification**- little O2- burn at 1,000-1,800 degrees
  - Concentrated byproduct- phosphorus rich ash
  - Converts nitrogen to N2, no env. Impact

Manure to Energy in Pennsylvania

Anaerobic Digestion

30 Dairy Digesters and 5 Swine Digesters as of 2013;

- •adoption driven by need for odor management
- •Several hooked to electric grid
- •generally does not decrease the N and P

Funding support:; currently from PA Alternative Clean Energy Program, USDA REAP 7 EQIP, (previously from PennVest)

Dairy Power Stakeholders Group

- Partnered with industry and Chesapeake Bay Commission to evaluate the pre and post digestion nutrient content of the manure.
- Results used by Bay Program Expert Panel that is determining how to credit manure technologies.

* PUC proposed regs limiting generator capacity have stalled new digesters

ENERGY WORKS, Gettysburg PA

Gasifier- 240 tons Egg Layer Manure/day from Hillandale farm

Electricity Output- 3,240 kw

Mineral Recovery- 35 tons per day

Revenue Streams:

- Electricity – net metering through host farm
- Mineral ingredient for organic fertilizer and organic animal feed (pending approvals)
- Nutrient credit trading

Manure to Energy in Maryland

Animal Waste Technology Fund (AWTF)

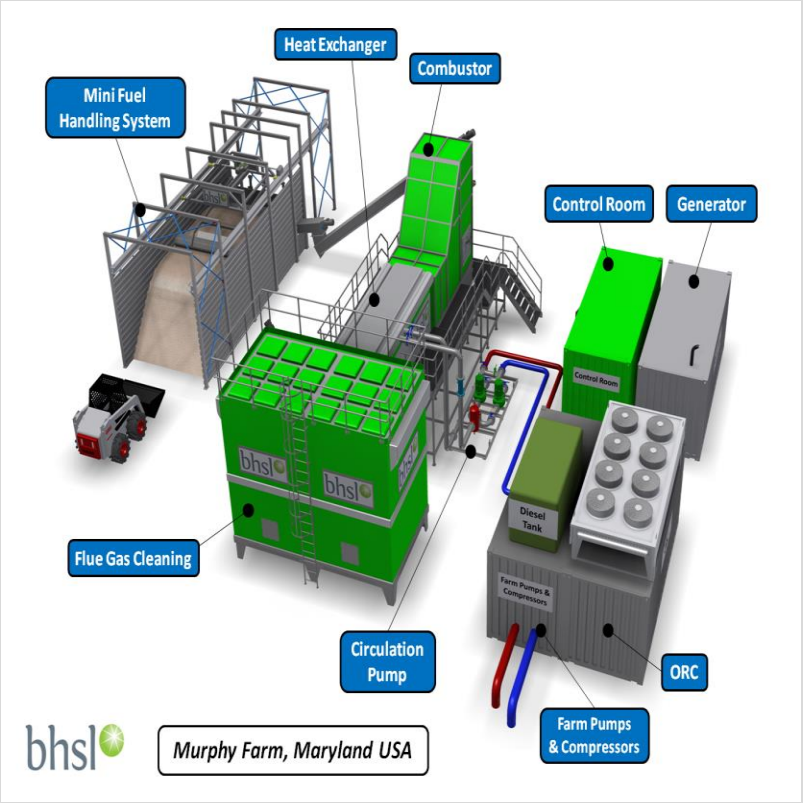
- 2.5 million/year since 2013 for proven technology

Funding Awarded for:

- Combustion
- Digestion with Nutrient Recovery
- Fast Pyrolysis
- In-vessel composting

Biomass Heating Solutions (BHSL)
$970,000 (AWTF)

- **Technology:** Combustion process
  - Reduces volume of litter by 90%
- **Feed stock**: Poultry litter from 10 existing & 4 new houses (3,650 tons/year)
- **Products:**
  - Hot water used to heat 2 new poultry houses
  - Electricity that will be sold to grid
  - High phosphorus ash (w/potash) to be marketed for fertilizer

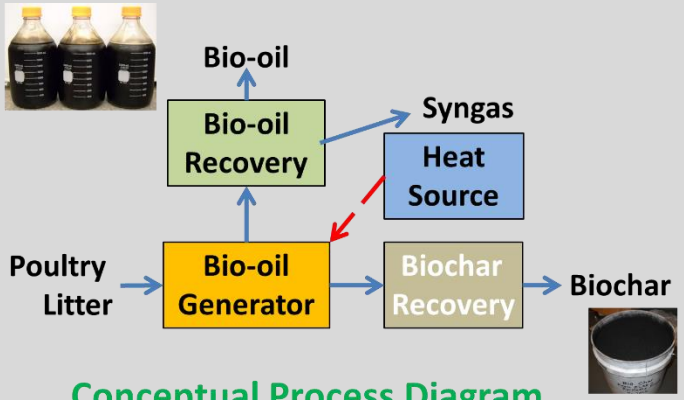


Planet Found Energy Development
$ 676,144 (AWTF)

- **Technology:** Anaerobic Digester linked with Nutrient Capture System
  - digester produces methane for heat & electricity
  - particulate fraction treated w/struvite to extract phosphorus
  - nitrification/denitrification system removes ammonia
- **Feedstock**: 1,500 tons/year poultry litter
- **Products:**
  - Methane used to heat and run system and to make electricity for farm use
  - Nutrient by-products will be marketed/used for fertilizer products
  - Dried solids considered slow release fertilizer product w/improved N:P ratio (4:1 or 5:1 compared to litter 1.1: .8)

Renewable Oil International
$1,175,943 (AWTF)

- **Technology**: Fast Pyrolysis
  - Reduces volume of litter by 50%
- **Feedstock:** 800-1,000 tons litter/year
- **Products:**
  - bio-oil marketed as asphalt extender
  - biochar marketed to enhance compost
  - syngas used as heat source for the process



Conceptual Process Diagram
Renewable Oil International
Thermal Treatment Process

* Demonstration is farm scale; commercialization would be at community or regional scale

Farm Manure to Energy Initiative

Purpose:

- Demonstrate innovative technology for converting manure to energy
- Document technical, environmental, economic performance
- Strengthen agriculture by creating revenue streams for litter/manure

Funders:

- USDA Conservation Innovation Grant- $848,000
- National Fish and Wildlife Foundation- $650,000
- Chesapeake Bay Funders Network- $625,000

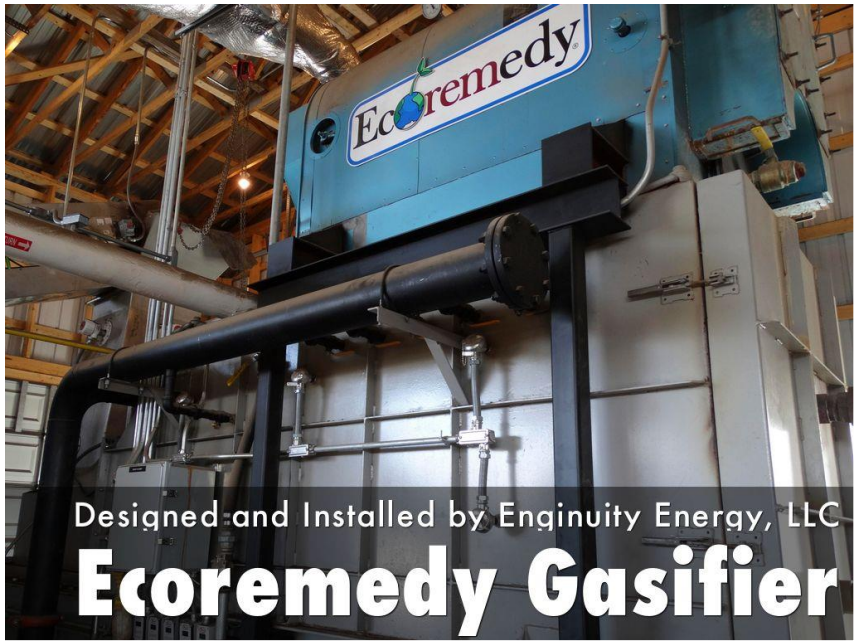
Partners:

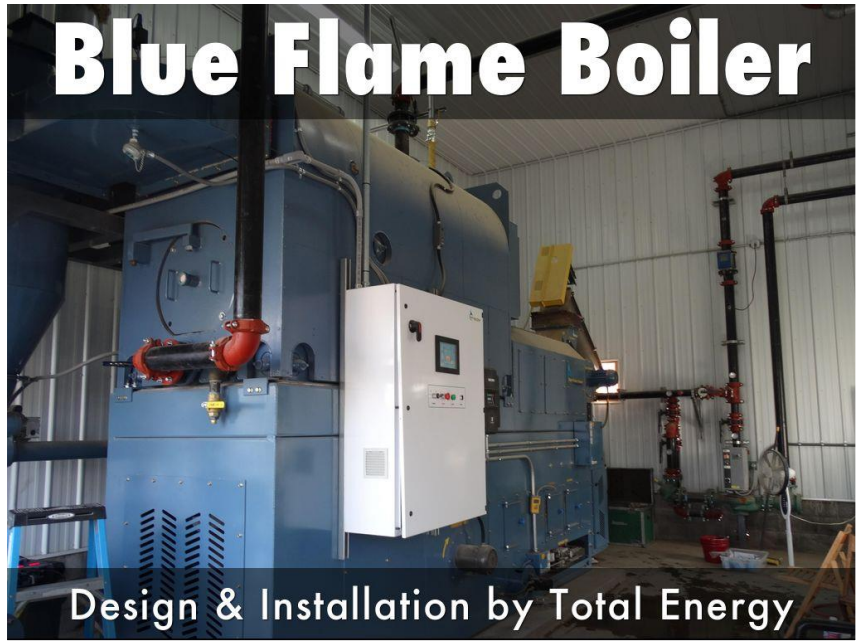
Farm Pilot Project, Inc., UMD Center for Environmental Science, UMD Finance Center, Virginia Cooperative Extension, Lancaster Co. Conservation Dst., Sustainable Chesapeake

Farm Manure to Energy Initiative

Flintrock Farm, Lititz, PA
hot water heat to 4 poultry houses

Windview Farm, Port Treverton, PA
used to heat two turkey houses





Farm M2E Lessons Learned

- Technology at all scales is in early phase of commercial deployment- still needs subsidies.
- Vendors are expanding their expertise in poultry house heating, connecting to the grid, controlling emissions
- Growers interested in heat and electric
- Potential increase in bird performance with thermal heat.
- Ash and biochar have potential as fertilizer or animal feed
  - U.S. Phosphorus production expected to decline in next 25 years

Manure- to- Energy Policy

Finding the "Win – Win - Win"

Technologies can produce energy from manure that provide the farmer with income *and* reduce air and water pollution.

Policies should support all three goals.

Environmental Protection

Energy Independence

Agricultural Sustainability

Maryland Funding and Policy

- **Funding:**
  - ✓ **Animal Waste Technology Fund- 2.5 million in Md. Budget since 2013**
  - ✓ **RFP in Jan. 2016 for M2E - $44 million from Exelon/Constellation merger**
  - ✓ **Renewable Energy Credits for thermal energy created by M2E satisfies the Renewable Portfolio Standard. (2012)**
- **Emissions:**
  - ✓ **Md. Dept. of Environment updated emissions regulations for small boilers.**
- **Env. Regs Driving Manure to Energy Solutions:**
  - ✓ **Nutrient Management Regulations bans winter application**
  - ✓ **Phosphorus Management Tool replaces P- Site Index. (2015)**

CBC Support for Manure to Energy in Watershed

- **CBC 2011 Summit and Report: "Manure to Energy, Sustainable Solutions for the Chesapeake Bay Region."**

- **Farm Manure-to-Energy Pilot Initiative.**
- **Technical Expert Group meetings at Brubaker farm in PA to explore methods for nutrient reduction from anaerobic digester.**
- **CBC requests Chesapeake Bay Program to review nutrient reductions from M2E and assign BMP reduction efficiencies.**
- **PA HB 1349 proposes cap on customer-generators but exempts digesters used to comply with Chesapeake TMDL**
  - **CBC Position- digesters and thermochemical M2E systems should both be exempt**

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Questions?