Manure To Energy

Sustainable Solutions for the Chesapeake Bay Region

CHESAPEAKE BAY COMMISSION
CHESAPEAKE BAY FOUNDATION
MARYLAND TECHNOLOGY DEVELOPMENT CORPORATION
FARM PILOT PROJECT COORDINATION, INC.

JANUARY 2012

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This report presents the policy options from the 2011 Manure-to-Energy Summit for the Chesapeake Bay region. The summit emphasized the triple benefits that manure-to-energy projects can offer — producing renewable energy, sustaining profitable farms, and improving water quality — while directing attention to policy changes that can create more of these projects in the Bay region.

The Manure-to-Energy Summit was hosted on September 8, 2011, by the Chesapeake Bay Commission, Chesapeake Bay Foundation, Maryland Technology Development Corporation, and Farm Pilot Project Coordination, Inc. The summit was made possible through generous sponsorship from the Keith Campbell Foundation for the Environment, U.S. Department of Agriculture, and U.S. Environmental Protection Agency's Chesapeake Bay Program.

The policy options contained in this report do not reflect the positions of any one partner or sponsor, but rather present a suite of possible actions identified by technology vendors, farmers, non-governmental organizations, academics, and government officials. These ideas were raised during the research phase of this project and further clarified by the 143 experts attending the summit.

Scenes from the Summit

ABOVE: The summit convened experts in agriculture, business, research, and policymaking to discuss strategies to encourage manure-based energy projects. **BELOW:** Maryland Secretary of Agriculture Buddy Hance and environmental consultant Roy Hoagland discuss the confluence of agricultural and water quality benefits derived from manure-based energy.

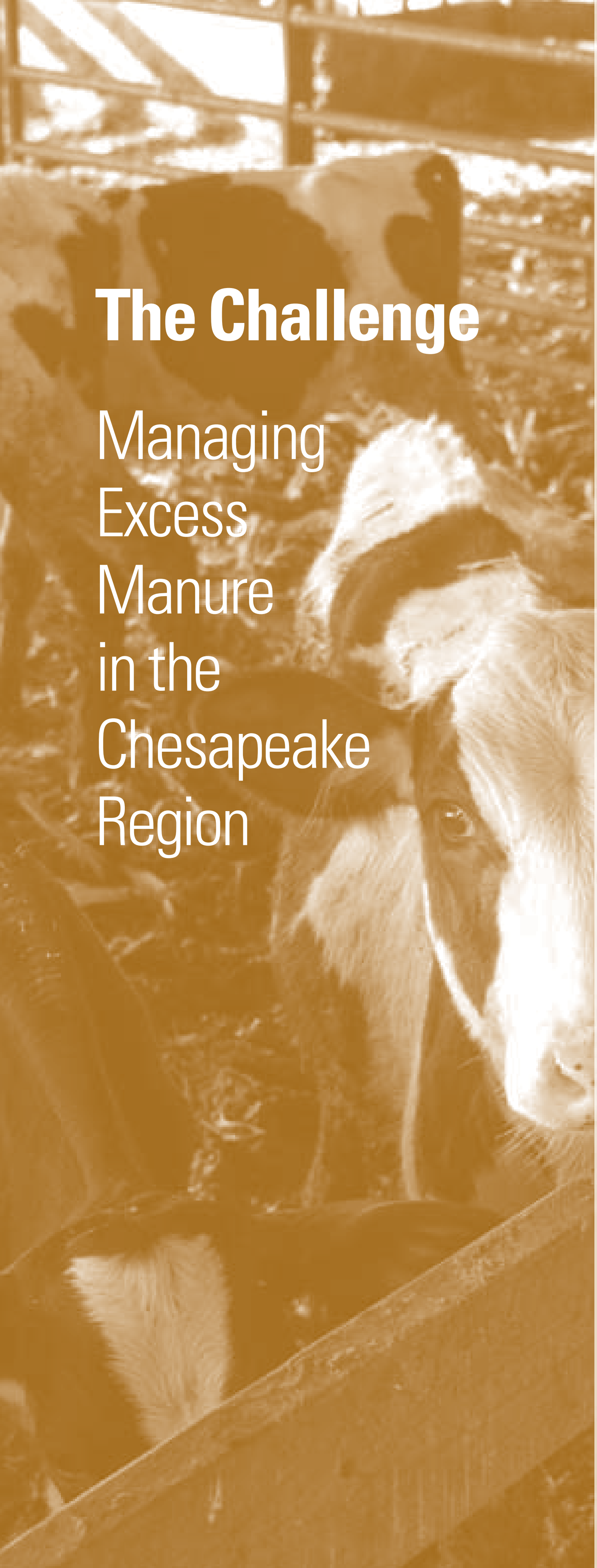
■ TOP: Technology must be matched to the type of livestock and scaled to a particular location. Jim Harkins, Director of Maryland Environmental Service, reviews various technology options. **■ MIDDLE:** James Potter, President of Homeland Renewable Energy (Fibrowatt), suggests that a large incinerator could take in up to 465,000 tons of poultry litter per year, along with wood waste and switchgrass. **■ ABOVE:** Senator Mike Brubaker (Pennsylvania), Senator Mary Margaret Whipple (Virginia), and Warren Elliott (Pennsylvania) mull policy options that can promote deployment of manure-to-energy facilities in the Chesapeake region.

■ BELOW: Maryland Delegate Maggie McIntosh listens intently for opportunities to target manure-to-energy projects where livestock concentrations exacerbate water quality problems. **■ MIDDLE:** John Ingersoll, President of EcoCorp, ranks policy actions that would support the production and use of manure-based energy. **■ BOTTOM:** Senator Emmett Hanger from Virginia's Shenandoah Valley and Pennsylvania Representative Mike Sturla of Lancaster City learn about adding crop and municipal food waste to digesters to enhance energy production.

■ BELOW: Former Senator Bernie Fowler (Maryland), Delegate John Wood (Maryland), and Senator Emmett Hanger (Virginia) marvel as Steve Reinford describes how a digester has significantly improved his cash flow, providing heat for his farm and electricity to sell back to the grid. **■ BOTTOM:** Verna Harrison and Pat Stuntz represented the Keith Campbell Foundation at the summit. The summit would not have been possible without support from the Campbell Foundation, which continues to champion opportunities for manure-based energy.

■ TOP: Farm Pilot Project Coordination, Inc., is funded by Congress to find innovative, viable technology that would capture nutrients from waste at animal operations. General Manager Bob Monley explains the benefits that various manure-to-energy technologies hold for both farmers and water quality. **■ ABOVE:** In Virginia, roughly a third of nutrient loadings to the Bay are believed to originate with animal manure. Assistant Secretary of Natural Resources Anthony Moore studies options for manure-based energy.

■ LEFT: The challenge of restoring nutrient balance is not unique to the Chesapeake. In addition to local experts, attendees learned from the experiences of those outside the Bay region, including Dan Scruton, Dairy and Energy Chief at the Vermont Agency of Agriculture.



The Challenge

Managing Excess Manure in the Chesapeake Region

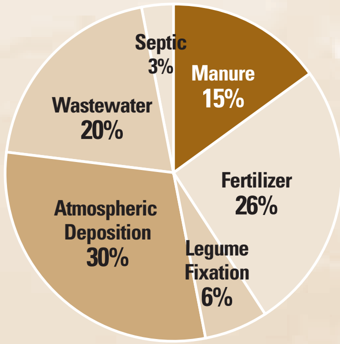
The Chesapeake Bay and its rivers struggle with many forms of pollution and a variety of land use pressures. An over-abundance of nutrients, however, has long been the central challenge in securing a healthier Bay. Nutrients — both nitrogen and phosphorus — help living things grow and are essential for both land and aquatic systems. But nutrient needs on land differ from nutrient needs in the water. The key is to maintain a proper balance. Aquatic systems need 1,000 times less phosphorus than terrestrial systems. Excessive amounts of nutrients in the Chesapeake produce algae that, when they die and decompose, rob the water of oxygen and disrupt aquatic life. The problem is on-going and severe. The entire Chesapeake region is now engaged in its most aggressive nutrient reduction effort to date: states and local governments are working to meet federal mandates for a significant reduction in nutrient loads to the Bay. The requirements call for a combined annual reduction of sixty million pounds of nitrogen and four million pounds of phosphorus by 2025 from the six watershed states — Maryland, Virginia, Pennsylvania, Delaware, West Virginia, New York — and the District of Columbia.

Sources of nutrients in the Chesapeake region are varied, and solutions must be too. Nutrients reaching the Bay and its rivers originate from human sewage, chemical fertilizers, atmospheric deposition, industrial wastewater, stormwater runoff, and animal manure. Some sources, however, contribute more nutrients than others. Manure from animal agriculture is the largest source of phosphorus loading to the Bay and one of the largest sources of nitrogen. Although agricultural production is widespread throughout the Chesapeake watershed, three major animal production areas hold the greatest concentrations of livestock: the Lower Susquehanna River region in Pennsylvania, the Shenandoah Valley in Virginia and West Virginia, and the Delmarva Peninsula in Delaware, Maryland, and Virginia. The Delmarva Peninsula is dominated by integrated chicken production. The Shenandoah Valley has a large network of chicken farms as well as turkey farms and considerable beef and dairy farms. The Susquehanna Valley has very diverse and still mostly independent animal production, led by dairy and beef operations along with egg production and some hog and chicken farms.

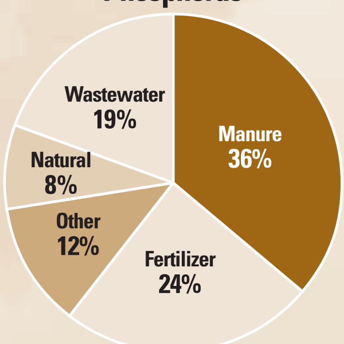
BURDEN ON THE BAY

Sources of nitrogen and phosphorus delivered to the Chesapeake Bay watershed

Nitrogen



Phosphorus



SOURCE: Chesapeake Bay Program Model 5.3.2

The Chesapeake Bay and Its Watershed

- More than **64,000** square miles
- Roughly **41 million** acres draining to tidal waters
- Ratio of land to water volume of **2,743:1**
- **100,000** miles of streams, creeks, and rivers
- Nearly **17 million** people, along with more than **500** species of fish and shellfish
- More than **83,000** farms (mostly family-owned) and **13 million** acres of farmland
- Approximately **4.2 million** animal units (one unit = 1,000 pounds)

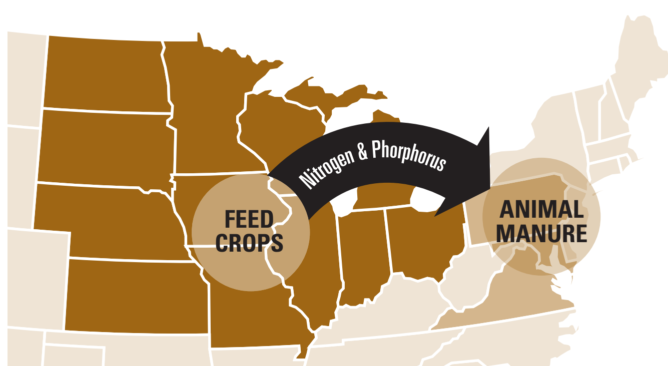
Traditionally, livestock and poultry manure has been a valuable resource for farmers because it provides a cost-effective source of fertilizer for their fields. Applied appropriately, manure adds nutrients as well as organic matter, improving both soil fertility and quality. There is a threshold, however, to the amount of nutrients that can be applied and used productively on fields.

As public consumption of meat products has increased in recent decades, the number of livestock in the watershed has grown, and livestock operations have become more concentrated. Large amounts of feed, along with the nitrogen and phosphorus they contain, are imported to meet the demands placed on animal operations. This creates a huge imbalance between the amount of nutrients coming into the region as feed and the amount going out as agricultural products (see Figure 1).

In addition, the number of animals grown in high density production areas, and the manure produced by

FIGURE 1 *Broken Nutrient Cycle*

The one-way flow of nutrients in animal feed from the Midwestern states into the Chesapeake Bay region has modified the natural nutrient cycle. The Chesapeake Bay Program estimates that 15 percent of the total nitrogen load and 36 percent of the phosphorus load entering the Bay is derived from livestock and poultry.



SOURCE: Chesapeake Bay Program Model 5.3.2

them, is not proportional to the amount of local cropland available for manure application (see Figure 2). This imbalance is exacerbated as the amount of farmland in the region continues to shrink. In fact, a recent study (Water Stewardship, Inc., 2010) estimates that the eleven most animal-intensive counties in the watershed annually generate approximately 3.8 million tons of manure in excess of crop needs.

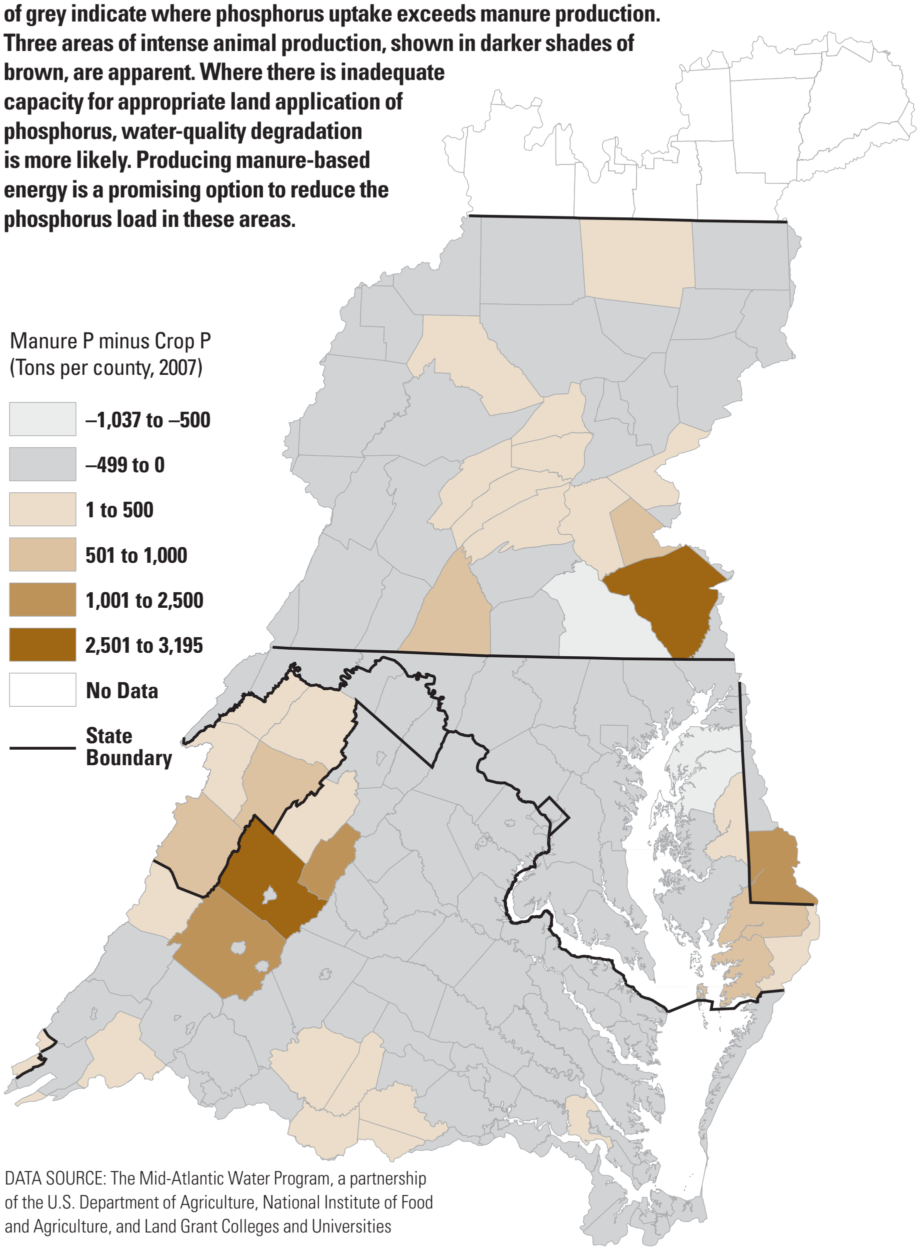
As a result, land application of manure nutrients often exceeds the requirements of crops. Excess nutrients then move through the surrounding ecosystem. They enter groundwater and stormwater runoff; they find their way to the Bay and the rivers that feed it.

The challenge, ultimately, is to restore the nutrient balance in the Bay region. Despite recent efforts to more closely tie manure application rates to crop needs, land application remains the primary use of manure in the watershed. In addition, decades of over-application have caused phosphorus to build up in some soils, posing an added risk when more phosphorus-rich manure is applied. As nearby cropland appropriate for manure application declines, manure must be transported greater distances to nutrient deficient areas or alternative uses of manure must be developed to benefit both water quality and farm viability.

Transporting manure, however, is a challenge. Manure has a high water content and variable nutrient content. This makes it harder to handle and apply effectively in comparison with commercial fertilizers. Transporting liquid manures from swine or dairy operations is especially difficult. Although poultry litter is drier (with 25 to 40 percent moisture), it remains a bulk item, making transportation over long distances uneconomical without subsidies. While some government and industry programs offer financial incentives to transfer nutrients away from hotspots, these subsidies are not sustainable or cost-effective solutions. Therefore, it is essential that alternative uses of manure — both economically and environmentally sustainable — be developed within the Chesapeake region.

FIGURE 2 *Counties With Excess Manure Nutrients*

This map shows the results of a county-by-county nutrient analysis comparing manure phosphorus depositions to crop uptake of phosphorus in the Chesapeake Bay region. Shades of brown indicate where more manure is created than can be effectively used to fertilize available cropland. Shades of grey indicate where phosphorus uptake exceeds manure production. Three areas of intense animal production, shown in darker shades of brown, are apparent. Where there is inadequate capacity for appropriate land application of phosphorus, water-quality degradation is more likely. Producing manure-based energy is a promising option to reduce the phosphorus load in these areas.



DATA SOURCE: The Mid-Atlantic Water Program, a partnership of the U.S. Department of Agriculture, National Institute of Food and Agriculture, and Land Grant Colleges and Universities

The Possibilities

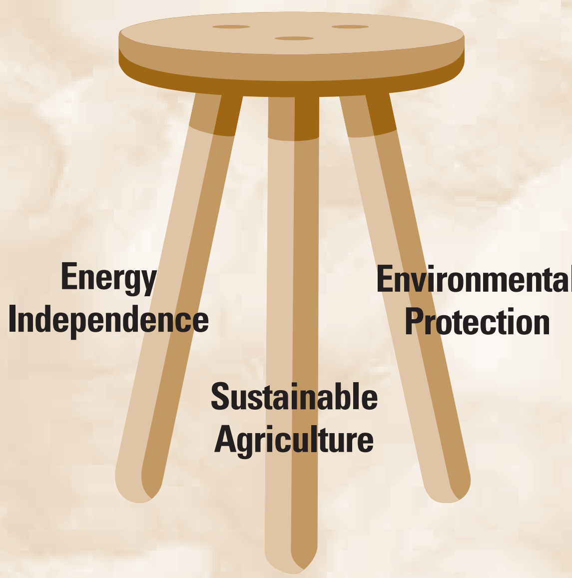
Providing Triple Benefits for the Chesapeake Bay Region

The need to rebalance the use of nutrients and protect water quality in the Bay region, combined with the nation's growing demand for renewable energy, presents a new and potentially huge opportunity: manure-based energy. Drawing on a variety of technologies, the Bay region can use animal manure as a feedstock for boilers and digesters that produce energy in the form of both heat and electricity. Manure-to-energy operations can be located on farms and sometimes supplemented by loads of other "green waste" such as expired foods. They can also exist as community cooperatives or commercial facilities that receive manure from local farms and sell power for general use. Both scenarios offer exciting potential for water quality goals in the Chesapeake region, as excess manure could be increasingly converted to energy in both small- and large-scale operations.

If handled correctly, manure-based energy can protect water quality while producing reliable energy and economic rewards for farmers. These triple benefits are gaining attention from policymakers and farmers alike.

FINDING THE "WIN-WIN-WIN"

Technologies exist to produce energy from manure in ways that also provide the farmer with income and reduce pollution. How can we get more manure-to-energy projects "on the ground" in the Chesapeake region?



RELIABLE ENERGY

Energy produced from manure, a form of biomass, is one of the most dependable forms of energy in the United States. Wind, water, and solar sources of energy all produce an inconsistent flow that demands more effort to stabilize the regional energy grid. The percentage of time in which each of these type of facilities operate at or near their designed capacity ranges from approximately 17 to 30 percent. In contrast, the capacity factor for biomass is 85.5 percent — second only to nuclear on a nationwide scale (see Figure 3). As long as the American consumer relies on a diet of milk, meat, and eggs, there will be a steady supply of animal manure as feedstock for energy projects.

WATER QUALITY PROTECTION

Manure-to-energy projects can also make it more cost-effective to transport nutrients away from areas with a surplus for use in other locations. Although the by-products of manure-to-energy technologies remain rich in nutrients, some technologies (or systems of combined technologies) result in highly concentrated nutrients that are easier to transport than raw manure and liquid waste. The overall process not only provides farmers with more options for manure management, but the potential for revenue as well.

FIGURE 3 *Capacity Factor of Biomass*

Manure, a form of biomass, is among the most dependable, consistent sources of energy available today — ranking second in terms of "capacity factor" on a nationwide scale. The capacity factor is the amount of time in which an energy producing system can be counted on to produce energy at or near the full capacity for which it was designed.

U.S. CAPACITY FACTORS BY FUEL TYPE, 2010

Fuel Type	Average Capacity Factor
Nuclear	91.2%
Biomass	85.5%
Geothermal	71.6%
Coal (Steam Turbine)	65.4%
Gas (Combined Cycle)	45.8%
Hydro	29.4%
Wind	29.1%
Solar	17.7%
Gas (Steam Turbine)	12.9%
Oil (Steam Turbine)	8.9%

SOURCE: Ventyx Velocity Suite/Energy Information Administration (updated April 2011)

ECONOMIC REWARDS

Manure-to-energy operations give farmers more economic options. Some are proven and being utilized now. Others are more dependent upon global circumstances such as supply of resources and development of future markets. Both present significant opportunities to the farmer.

NEAR-TERM OPPORTUNITIES

A farmer who uses manure to produce energy on the farm can use that power for the farm's buildings and equipment, generating significant annual savings in electricity and heating costs. The farmer can also sell surplus energy to the utility companies that manage the local grid or sell their entire supply on the wholesale market.

Additional economic benefits can be realized through the sale of credits, such as those for renewable energy, carbon offsets, or nutrient reduction. Although the markets for these credits are still emerging, their potential is drawing the attention of entrepreneurs.

FUTURE POTENTIAL

Recycling phosphorus from the energy production process has the potential to replace much of the phosphorus that is currently imported to the region to grow crops. Eventually, the phosphorus by-products of manure-based energy could become an increasingly valuable source of income, for exporting beyond the Chesapeake region and abroad.

In the global context, phosphorus is a finite resource. There is no substitute for this vital element in agriculture; the world depends upon it to feed its growing population. However, supplies of phosphorus from mined sources are predicted to peak around 2034 (see Figure 4).

Although some soils in the Chesapeake region are saturated with phosphorus, the nation as a whole is the world's leading importer of phosphate rock, purchasing 2.4 million metric tons in 2010, mostly from Morocco. The United States is also the world's second-largest producer of phosphate rock, second only to China, but domestic production is expected to continue its recent decline through 2015. In contrast, world consumption of phosphate fertilizer is expected to increase 12.5 percent by 2015.

Although exploration and expansion of phosphate rock production continues globally, especially in Africa and Australia, phosphorus from other sources, including the by-products of manure-based energy, will have a growing value in the marketplace.

FOCUS ON POSSIBILITIES

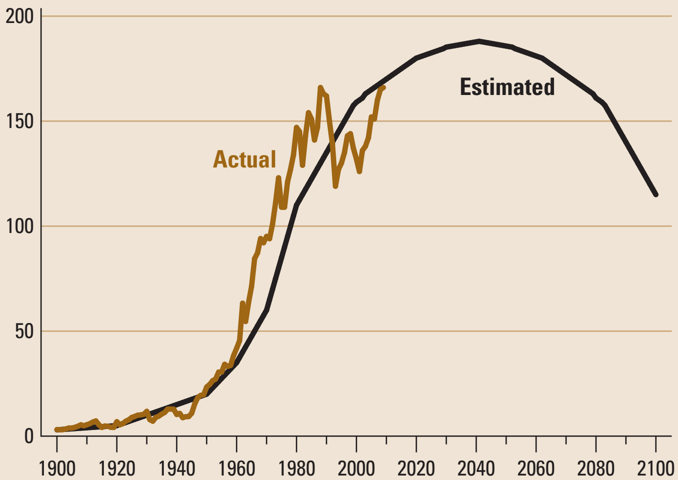
A number of proven technologies already exist for creating energy from manure. Successful operations exist in different forms and locations across the country, internationally, and even here in the Chesapeake watershed. Several kinds of technology are at work, and some are particularly well-suited to this region. So far, however, manure-to-energy projects in the Chesapeake region have been limited to an entrepreneurial few. Farmers, technology providers, and policymakers all have a role to play in expanding the presence and benefits close to home. With better support, manure-to-energy projects could play an important role in meeting nutrient reduction goals for the Bay and its rivers.

The Manure-to-Energy Summit highlighted this important opportunity. Sponsored by the Chesapeake Bay Commission, Chesapeake Bay Foundation, Maryland Technology Development Corporation, and Farm Pilot Project Coordination, Inc., the summit convened 143 participants from across the Bay region, including representatives from industry, academia, government agencies, and state legislatures.

FIGURE 4 *Peak Phosphorus?*

As a finite resource, global supplies of phosphate rock will eventually reach a peak and then decline. The year in which that occurs is open to debate, depending on the amount of total world reserves. The U.S. Geological Survey currently estimates world reserves of phosphate rock at 65 billion metric tons (U.S. Geological Survey, *Mineral Commodity Summaries,* January 2011, p. 119).

GLOBAL PHOSPHATE ROCK PRODUCTION (millions of metric tons per year)



SOURCE: Actual data from D.A. Buckingham and S.M. Jasinski, Phosphate Rock Statistics, U.S. Geological Survey, October 19, 2010. Estimated values based on reports by: D. Cordell, J-O Drangert, and S. White, Global Phosphate Research Initiative, 2009, and P. Déry and B. Anderson, *Peak Phosphorus,* Energy Bulletin, August 13, 2007.

The summit confirmed the preliminary results of months of pre-summit research and dialogue by the project's partners: the need for manure-to-energy projects is real and technology is available for a variety of settings and scales.

The summit also endeavored to answer the following question: How can state and federal policy changes — aimed at near-term results — put more manure-based energy projects on the ground and make meaningful contributions toward a cleaner Bay? A set of policy options, detailed on the following pages, were presented at the summit for discussion, dialogue, and consideration for future action.

Participants were asked to vote for their top three priorities among the policy options. The detailed policy options herein are presented in no particular order, but the five recommendations receiving the most votes are marked with a star.

Technology Basics *From Manure to Energy*

There are two general methods for producing energy from manure: the use of heat and the use of bacteria. A variety of techniques exist under both categories. However, some methods are better suited to different types of manure or scales of operation, which are important considerations in making the right "match" to a particular farm or location.

Both methods also create by-products. These by-products are often rich in nutrients, so their use and handling is an important consideration for manure-to-energy operations in the Chesapeake region. If such operations intend to support water quality goals, they must ensure that the by-products are either used in accordance with a nutrient management plan or processed and sold as commercial fertilizer for different types of agricultural, residential, or commercial use where nutrients are needed.

HEAT: A THERMOCHEMICAL PROCESS

In scientific terms, the use of heat to produce energy from manure is a thermochemical process. The four forms include combustion, gasification, pyrolysis, and torrefaction. Each is well-suited for manure that is relatively dry, such as poultry litter, because the cost to reduce large amounts of moisture in the manure is avoided. Some heat-based systems are adaptable to different scales to suit various farm settings, but vary widely in their effectiveness and cost.

Heat-based processes produce a range of potentially valuable by-products including liquid bio-oils, diesel fuel, and combustible gas. They also produce nutrient-dense products like ash and bio-charcoal (commonly referred to as "biochar"). The concentration of nutrients varies depending on the process, operating parameters, and system design. Biochar has the additional benefit of building soil carbon levels.

Some heat-based processes also generate nutrient-related air emissions. Combustion, which operates in a high-oxygen environment, will produce nitrogen oxides. Nitrogen oxides can form acidic droplets in the atmosphere that rain back down onto land and water. Since one third of the nitrogen pollution in the Bay currently comes from airborne deposition, these emissions are cause for concern. In contrast, heat-based processes that reduce or eliminate oxygen (gasification, pyrolysis, and

■ CASE STUDY COMBUSTION

FOR THE FARMER, FLOCK, AND ENVIRONMENT *Rockingham County, Virginia*

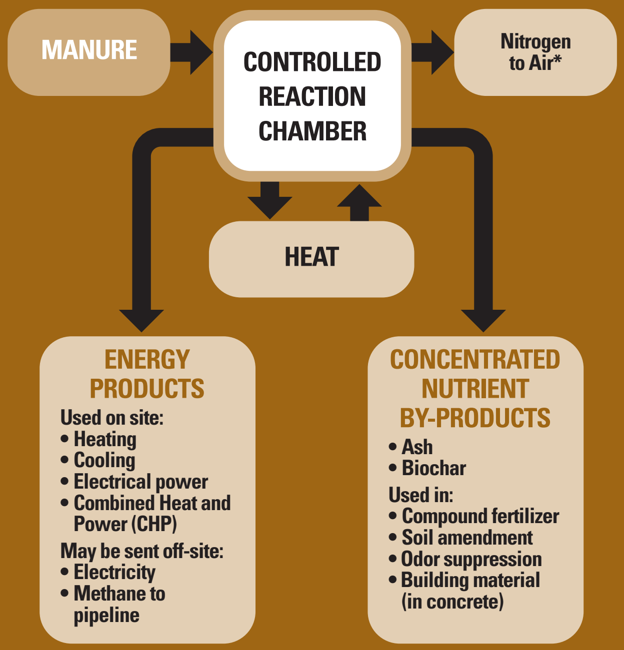
Oren Heatwole is installing a controlled combustion system on his Riverbank Farm outside of Dayton, Virginia, that will use heat to create energy from poultry litter. The system couples sophisticated automation and litter handling with continuous remote management, requiring minimal additional labor.

The system will provide an alternative to spreading poultry litter on the land while producing plentiful heat for use on the farm. Heat is provided to his broilers through a network of hot water pipes and radiators. Unlike conventional propane heating, the Riverbank Farm system will not introduce additional water and carbon dioxide to the houses, greatly improving the environment in which the birds live. This results in greater bird welfare and improved production performance.

Along with production benefits and the avoided cost of propane, the project will benefit the environment by recycling nutrients, reducing ammonia emissions through drier litter, and decreasing greenhouse gasses by replacing the use of fossil fuels.

BASIC THERMOCHEMICAL PROCESS

Predominantly used for drier manure, such as poultry litter. The ability of thermochemical processes to reduce nutrients varies depending upon the temperature and amount of oxygen used. The concentrated nature of the nutrient-rich by-products allows for precision application and transport, reducing the impact of nutrients on water quality.



*NOTE: Thermochemical processes emit the majority of the nitrogen to the atmosphere. This can be addressed by separating the manure particles before processing. Fine particles, which contain the bulk of the nitrogen, can be used for fertilization while the larger particles can be used to produce energy, ash, and biochar.

torrefaction) will minimize nitrogen oxide emissions, with much of the nitrogen being emitted as inert gas.

Although heat-based processes can potentially concentrate and segregate nutrients found in animal manure, they are not yet widely used. Challenges include high capital expense, lack of experience with using manure as an energy feedstock, and concerns about air emissions. There are also additional logistical and cost challenges with connecting to the power grid and upgrading electrical power lines.

BACTERIA: A BIOLOGICAL PROCESS

Anaerobic digestion occurs when helpful bacteria convert organic carbon in manure to methane gas. This process occurs naturally in manure lagoons and storage structures, but can be managed in a "digester" — an airtight tank or covered lagoon. Because anaerobic bacteria require wet environments, they are ideally suited for systems fed by moist manure from cows and swine.

The methane that results from anaerobic digestion is lighter than air and can easily be captured for use as a fuel to produce heat, electricity, or both. Methane can also be cleaned and fed into existing natural gas distribution systems. The capture and use of methane has an added environmental benefit — methane is a greenhouse gas with global warming potential that is twenty times higher than carbon dioxide.

CASE STUDY DIGESTION

ABUNDANT ON-FARM POWER *Juniata County, Pennsylvania*

Operations at Steve Reinford's farm near Port Royal, Pennsylvania, have been completely integrated with an anaerobic digestion system that creates energy from cattle manure. The digester processes manure from 470 cows, as well as local food waste accepted on the farm for a tipping fee.

The system not only reduces the application of manure to farmland, but provides financial rewards for the farm. Reinford sells some of the manure-based energy to a utility company and uses some on-site. The energy powers a number of farm buildings, including cattle parlors, as well as the family residence. It also helps to dry grain and pasteurize milk for his calves.

Reinford processes the slurry by-product in a separator, using about a third of the resulting solids for animal bedding and selling the remainder to local farms.

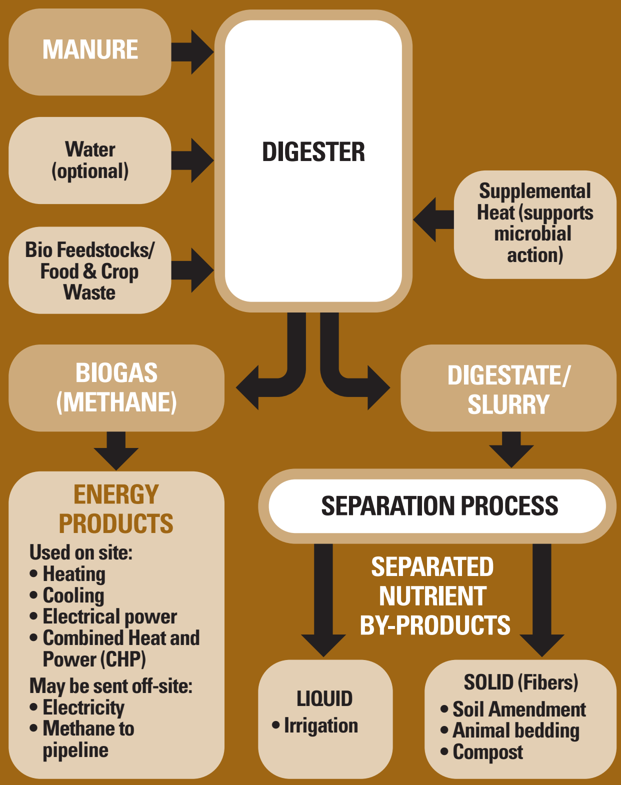
From a water-quality perspective, the greatest challenge in using anaerobic digestion to produce energy is that almost all of the nutrients associated with the manure remain in the by-products. Therefore, the liquid and solids associated with digester effluent must be treated and managed to facilitate material handling, transportation, and proper nutrient control.

One advantage of anaerobic digestion is that the manure feedstock has essentially been "digested" in a container in the absence of air, which greatly reduces odor. The action within the digester minimizes pathogens, including potentially harmful bacteria, in the manure. With reduced odor and pathogens, digested manure is more commercially suitable for use in landscaping or on agricultural fields located near residential homes.

Separating the solid and liquid portions after anaerobic digestion can also help manage the nutrients. Two separation systems that combine chemical additives with physical separation are currently being evaluated in the region. These processes remove phosphorus from the liquid, producing a concentrated phosphorus fertilizer that can then be transported cost-effectively off the farm to locations where it is needed. Much of the nitrogen, however, remains in the liquid portion of the by-product, so traditional nutrient management methods must be employed when the liquid is used for irrigation. In this homogenous liquid form, nitrogen can be more uniformly spread for absorption by the soil and uptake by crops.

BASIC ANAEROBIC DIGESTION PROCESS

Predominantly used for wet manure, such as dairy or swine slurry. Anaerobic digestion alone does not reduce nutrients. Proper management of the nutrient-rich by-products is necessary to realize water quality benefits.



CASE STUDY GASIFICATION

POWER & THE SMART USE OF BY-PRODUCTS *Accomack County, Virginia*

The Eastern Shore of Virginia Research Conservation and Development Council, in partnership with local farmer Dave Lovell and Farm Pilot Project Coordination, Inc., is leading a project that will use poultry litter for heat and electricity production. Located in Melfa, Virginia, Lovell's farm supports eleven poultry houses that produce 1.8 million birds and 2,200 tons of litter annually. More than half of the litter will be used for energy production.

The process will include smart use of the nutrient-rich ash by-product, which has eighty percent less weight and volume than raw litter. Because of food safety concerns, raw poultry litter cannot be used to fertilize vegetables; the sterile ash, however, can be used as a safe alternative to the inorganic phosphorus fertilizer commonly used on these crops. Widespread use of the ash by-product to fertilize local vegetable crops could eliminate the annual import of an estimated 450 tons of inorganic phosphorus into the region. The ash by-product is also more concentrated, making it easier to package and ship for use outside of the immediate area.

A TECHNOLOGY COMPARISON

TECHNOLOGIES USING HEAT
(Combustion, Gasification, Pyrolysis, Torrefaction)

PROS

- Nutrients in the by-products are in a dry, concentrated form, making it easier and more cost-effective to transport them out of the region.
- Most heat-based processes convert much of the nitrogen to a gas that has no environmental impact.
- Some systems are scalable.
- Heat-based processes are well-suited for the use of dry material such as poultry litter.
- Heat and energy can be utilized in farming operations, replacing fossil fuels and providing energy independence.

CONS

- Air emissions of nitrogen, especially from combustion, may require additional treatment at additional cost.
- Systems must be designed to accommodate the unique properties and variable nature of manure.
- Heat-based processes are not well-suited for high-moisture dairy or swine manure slurries without pre-treatment at additional cost.

TECHNOLOGIES USING BACTERIA
(Anaerobic Digestion)

PROS

- The process is well known with a long history of producing methane that generates heat, electricity, or both.
- The process is well-suited for high-moisture, dairy and/or swine manure slurries.
- If the methane is captured and converted to carbon dioxide, a less potent greenhouse gas, the technology reduces significant amounts of greenhouse gas emissions.
- If advanced separation methods are applied to the by-products, phosphorus can be concentrated and more cost-effectively transported to areas where it is needed.
- Digestion reduces the odor associated with manure, potentially expanding the potential for local application to fields where raw manure might result in complaints from neighbors.

CONS

- Systems are typically not cost-effective for smaller operations (under 400 cows) because the process requires a relatively large area for manure containment and can be very expensive.
- Although nutrients are concentrated, most are retained in a sludge by-product that — unless an advanced separation method is used — is not cost-effective to transport long distances.
- Without advanced separation, the nutrient-rich liquid by-product must be stored and managed as a wet nutrient source to be used as crop fertilizer on nearby fields.

CASE STUDY PYROLYSIS

PRODUCING BIO-OIL AND BIOCHAR *Shenandoah Valley, Virginia*

In partnership with researchers from Virginia Tech, BioEnergy Planet is commercializing a pyrolysis technique designed to convert excess poultry litter to bio-oil and biochar, a process that provides an alternative use for excess poultry litter and generates new revenue streams for farms. The design of the system has been specially engineered for commercial applications and tested on a poultry farm in the Shenandoah Valley.

BioEnergy Planet is also using the technology to explore a business model in which a private company would own and operate the technology, paying farmers fair market value for their litter. The company would then own and market the energy and the by-products. BioEnergy Planet is working with Chevron Oil to evaluate the bio-oil for use in refineries, as well as exploring niche market opportunities for biochar.

Policy Options

Moving Forward Now

Getting more manure-to-energy projects on the ground in the Chesapeake Bay region will require multiple solutions. At the 2011 Manure-to-Energy Summit, participants reviewed and prioritized a well-researched collection of proposed policy changes with great potential to deliver results within one to three years. Policy options fell into three categories:

- **Assist market entry**
- **Finance for maximum benefit**
- **Support effective use of by-products**

Prioritizing projects in areas with the highest concentrations of farm animals and therefore the highest concentrations of manure would bring the greatest water quality benefits. In these areas especially, an alternative market for manure nutrients would lower the pressure for land application and ease manure management concerns associated with permit requirements.

In all their efforts, policymakers should bear in mind that manure-based energy is not simply about producing power. Under effective guidelines, it can also promote clean water in streams, rivers, and ultimately the Chesapeake Bay. State and federal governments should promote the triple benefits of such projects — sustainable agriculture, improved water quality, and renewable energy — and support technologies and systems that address all three.

These detailed policy options are presented in no particular order, but the five recommendations receiving the most votes are marked with a star.

ASSIST MARKET ENTRY

★1 ASSIST MARKET ENTRY

Provide incentives for manure-based energy in the states' Renewable Portfolio Standards, similar to the incentives provided for solar energy. For example:

- **Set a specific measurable requirement for the purchase of manure-based energy by utilities.**

- **Increase alternative energy compliance payments for the purchase of manure-based energy that addresses water quality goals.**
- **Establish a credit multiplier for utilities that purchase manure-based energy.**

Many states enacted Renewable Portfolio Standards to require or encourage utilities to purchase a specific amount of energy from renewable sources. In Maryland and Pennsylvania, the Renewable Portfolio Standard is mandatory. In Virginia, the Renewable Portfolio Standard is voluntary.

Maryland and Pennsylvania could use their Renewable Portfolio Standards to set specific purchase requirements for manure-based energy in the same way they have already set requirements for solar energy. In Maryland, for example, 20 percent of the power purchased by utilities must come from renewable sources by 2022 and 2 percent of the total must specifically come from solar energy. In Pennsylvania, 18 percent of the power sold must come from renewable sources by 2021 and 0.5 percent must come from solar energy. A specific requirement for the purchase of manure-based energy would increase demand and selling price, and thereby boost adoption of the technology. Virginia could consider establishing mandatory Renewable Portfolio Standards to boost demand.

In Maryland and Pennsylvania, solar energy also commands a higher "alternative compliance payment" than other renewable sources of energy. A utility makes this payment to the state if it fails to purchase the required amount of renewable energy. These payments are then used to support renewable energy projects in the state. The higher price of alternative compliance payments for solar energy motivates buyers to meet the solar purchase requirement and ensures a higher sale price for them. In Pennsylvania, the payment for a solar Renewable Energy Certificate (REC) was $654.37 while the payment for other renewable sources was only $45.00. As a result of this pricing, in 2010 no alternative compliance payments were made for solar REC's while ten were made for other sources. This type of incentive could be applied to manure-based energy as well.

Another incentive that each of the states could apply, regardless of whether their Renewable Portfolio Standard is voluntary or mandatory, is the adoption of "credit multipliers" for manure-based energy. This provides additional purchase credits for buying energy from a preferred source. In Virginia, for example, a utility receives double credits for purchasing wind or solar energy, and will receive triple credits for purchasing offshore wind. Maryland initially offered a credit multiplier for solar energy, but later replaced this incentive with purchase requirements. Maryland also offered a 120 percent credit for wind power and a 110 percent credit for energy derived from methane. Both of these incentives have now expired. Pennsylvania does not currently award credit multipliers.

While Renewable Portfolio Standards can provide greater incentive for manure-to-energy projects, they have limited ability to ensure that those projects will be built and operated in the Chesapeake region — power companies can satisfy purchase requirements from within any of the twelve states in our regional power transmission area. However, some states have decided to include geographic production targets in their standards. For example, Ohio requires fifty percent of renewable energy to be generated in state, and Michigan allows only twenty-five percent from out-of-state sources. There are, however, currently two active cases in federal court in Massachusetts and Colorado challenging whether this type of preference for purchasing in-state energy violates the U.S. Commerce clause that forbids states from favoring local industry over out-of-state industry for economic reasons. Consequently, at this time, pursuing this policy option is not advised.

Despite this limitation, Renewable Portfolio Standards are a powerful tool for helping manure-to-energy projects participate in the market. Their impact on solar energy is clear. Purchase requirements, combined with tax credits, have been so successful in boosting in-state adoption of solar energy that farmers in Virginia, Maryland, and Pennsylvania are using federal cost-share funds to install solar panels on their farms.

2 ASSIST MARKET ENTRY

Allow aggregation of meters for agricultural energy producers to help farmers realize the full benefits of manure-to-energy projects by offsetting their combined total power cost.

Farms have many buildings that use power in varying amounts — chicken houses and milking parlors, milk coolers, processing plants, barns, and family homes. If farmers invest in manure-to-energy projects, they should be able to use that power to offset the combined total power needs for all of their farm buildings. To do this, farms that produce power must be able to obtain the combined total measurement of power usage from all of their electric meters, whether or not they are physically connected.

Pennsylvania and Maryland already allow for aggregation of meters, and Pennsylvania allows farmers to add properties up to two miles away that are either owned or rented and operated by the farmer to be included in the aggregated total. Both states allow for "virtual" aggregation so that it becomes a billing function and does not require the meters to be physically connected. Virginia legislators introduced a bill in 2011 to allow aggregation, but the bill failed to pass. Legislators will likely re-introduce the bill in the 2012 session.

3

ASSIST MARKET ENTRY

Encourage the poultry industry to support manure-to-energy systems in the same way they currently support propane purchases through contractual agreements.

Poultry houses require considerable heating during the first few weeks of bird age. This is generally achieved by using propane at a significant cost, particularly in winter. Some poultry integrators provide propane along with the birds and feed, or provide discounted rates. This contractual agreement is intended to save growers money; however, the practice unintentionally creates a dis-incentive for manure-to-energy projects: farmers may have less interest in manure-based energy if they lose a mechanism (a form of payment) already in place for their propane. This can be a lost opportunity for the grower, because heating costs are high and manure-based energy can offer substantial savings.

States should work with the poultry industry to emphasize the benefits of on-farm, manure-based energy projects for both water quality and power production; they should ask the industry to support such projects by continuing to provide a heating support system, even when an alternative to propane is used.

★4

ASSIST MARKET ENTRY

Encourage long-term power purchase agreements for manure-based energy.

Renewable energy still costs more than conventional energy. To help manure-based energy providers enter the market, power companies and consumers must accept a higher cost and/or find ways to offset the investment. This is a challenge, but long-term power purchase agreements are critical for ensuring producers and investors that manure-based power will have buyers. States could support this goal by requiring investor-owned utilities to buy a certain amount of manure-based energy, initially at above-market rates.

Because individual farmers reap multiple benefits from manure-to-energy projects, they are not as dependent as a commercial generator on long-term contracts to realize a good return on their investment. For example, the typical farm project derives its value from several sources: producing enough power to cover farm needs; income from tipping fees for accepting other farms' crop and/or food waste that can be used in a digester; cost savings through the use of digester solids for bedding; increased bird health and weight from the use of thermal heat in poultry houses; tax incentives; sales of by-products; and sales of extra energy back to the utility companies.

Nonetheless, a long-term power purchase agreement provides the farmer with a predictable revenue stream which can help to balance an otherwise often unpredictable business. It will also help to attract support from private lenders. For non-farm projects like community-scale or larger projects that do not reap collateral benefits, long-term power purchase agreements at above market rates are crucial to their economic viability.

State governments are themselves large users of energy and could purchase a certain amount of manure-based energy to suit their own needs, including through long-term contracts. The contract price may start out higher than current market price but, if the contract is calculated correctly, market price will eventually exceed the contract price and the state will then pay below-market prices.

Paying above market rates during this time of fiscal austerity can be justified by the multiple benefits of manure-to-energy projects. The environmental benefits of reducing nutrient flow to the Bay from one of its major pollution sources is worth the expense at a time when the U.S. Environmental Protection Agency's Total Maximum Daily Load — or "pollution diet" — for the Chesapeake Bay requires states to make significant nutrient reductions. Maryland, for example, is facing an estimated cost in the $10 billion range in order to meet its mandated reductions.

Other states could follow the example of Maryland, which released a request for proposals in the fall of 2011 to purchase ten megawatts of manure-based energy. The price will be suggested by bidders. The considerable interest expressed in the pre-bid meeting demonstrated that many are ready, willing, and able to get projects on the ground when given the right incentives.

5 ASSIST MARKET ENTRY

Increase net metering limits to allow large farm producers to benefit from manure-to-energy projects.

"Net metering" was designed to allow a small-scale operation to produce energy for its own use and then sell excess energy back to the grid. Excess energy is the net amount produced after most of the energy has been used on site.

State laws limit the total amount of power a residential or commercial enterprise can produce and still be eligible for net metering. Maryland's limit for both residential and commercial projects is quite generous at up to two megawatts per year. The Pennsylvania residential limit is fifty kilowatts, and the Virginia residential limit is twenty kilowatts.

Commercial producers in Pennsylvania who generate less than three megawatts can take advantage of net metering. In Virginia, commercial producers cannot use net metering if they produce over five hundred kilowatt hours unless specifically authorized by the receiving utility. Large farms that base a manure-to-energy project on their manure production will likely be constrained by the lower commercial limits.

As an example, consider the Van Der Hyde Dairy's anaerobic digester in Virginia. The digester runs on the manure from one thousand cows and was just recently connected to the grid. When running at full capacity, and supplemented with food waste that increases methane gas production, it will produce 400 to 950 kilowatt-hours of electricity. Because it will produce over 500 kilowatt-hours, the operation cannot take advantage of net metering rules, which would have allowed them to cover energy needs for the farm and sell extra power to the grid. Instead, they became a wholesale producer: they have to sell all the electricity they produce to the grid at wholesale rates and then buy it back from the utility at the retail price for their own farm needs. The designation as a wholesale producer also made it more difficult for them to connect to the grid and subjected them to greater regulation which caused delay and added to the overall cost of the project.

6 ASSIST MARKET ENTRY

Create a premium brand of electricity called "Bay Farm Power" or "Clean Streams Power" to certify manure-to-energy projects that also promote clean water.

The Chesapeake Bay states, individually or as a team, could work with the private sector to create a premium brand of electricity called "Bay Farm Power" or "Clean Stream Power," similar to "Cow Power" launched successfully in Vermont. Utility companies and alternative electric suppliers could market this to customers as an energy source with a direct connection to clean water in the Bay and its rivers. Suppliers could charge slightly more for this electricity and in turn pay a higher price to energy producers to support implementation.

This branding would give manure-based energy a unique footing. Wind and solar power are both worthy, renewable energy sources, but they are not necessarily produced in-state or even in the Bay region.

States could also use the "Bay Farm Power" brand to set geographic requirements for manure-to-energy operations. For example, participants in the program could be required to produce energy only from within the state, from within the Chesapeake watershed, or from nutrient-producing "hotspots." Because the state is merely identifying and certifying a brand and where it is sourced, as opposed to requiring the purchase of this electricity produced in state, these limitations would not trigger the legal issues under the Commerce Clause that come into play with the Renewable Energy Portfolio.

VERMONT'S COW POWER™

CVPS COW POWER

Since 2005, customers of the Central Vermont Public Service electric company have had an option to pay higher rates to subsidize farm-generated, poop-powered electricity. Farmers receive the four-cent premium to help cover the cost of installing and operating anaerobic digesters that extract methane from cow manure. The program also supports renewable energy generation in the region and provides farmers with incentives to participate. According to one Vermont farmer, "The girls are now officially producing two streams of income, a milk check and a power check."

FINANCE FOR MAXIMUM BENEFIT

FINANCE FOR MAXIMUM BENEFIT 1

Prioritize outreach, funding, and technical assistance for manure-to-energy projects that also address water quality issues.

Several programs exist at both the state and federal level that provide public support for energy generation or water quality improvement projects. However, these programs are rarely coordinated and are focused on only one goal. Instead, funding programs could be revised so that scoring systems favor projects that integrate both energy and water quality benefits. This could be performed administratively or legislatively through the program authorization or appropriations processes. The federal Farm Bill reauthorization is an especially promising opportunity for reform. Existing programs that could be changed to favor manure-to-energy projects that address water quality issues include, but are not limited to, the following:

- **Federal/U.S. Department of Agriculture:** Rural Energy for America Program and Environmental Quality Incentives Program
- **Maryland:** Strategic Energy Investment Fund
- **Pennsylvania:** Alternative and Clean Energy Program
- **Virginia:** Water Quality Improvement Fund

The U.S. Department of Agriculture's (USDA) Rural Energy for America Program (REAP) provides grants and loans for renewable energy and energy efficiency projects. It is administered through the Rural Development program. Grants can cover twenty-five percent of total renewable energy project costs. They can be combined with REAP guaranteed loans and grants from other programs such as the Environmental Quality Incentives Program (EQIP), but the total USDA investment cannot exceed seventy-five percent of total project cost.

The Environmental Quality Incentives Program (EQIP) is administered by the Natural Resources Conservation Service (NRCS). EQIP is a voluntary program that provides financial and technical assistance to agricultural producers through contracts with a maximum term of ten years. Anaerobic digesters are eligible for EQIP funding, and recently NRCS developed an interim practice standard for gasification systems.

Administratively, USDA could change the scoring system for REAP and EQIP to give greater priority for manure-to-energy projects that include an integrative approach to water quality issues. Legislatively, summit attendees endorsed a streamlined program for manure-to-energy projects in the next Farm Bill that could, for example, combine elements of EQIP, REAP, and the Conservation Innovation Grants program (CIG). This program would include the necessary research, technical assistance, grant funding, and loans for the successful deployment of manure-to-energy projects in the Chesapeake region.

Maryland's Strategic Energy Investment Fund (SEIF) is a non-lapsing fund made up of proceeds from the auction of carbon allowances to electric power plants under the Regional Greenhouse Gas Initiative (RGGI). Maryland joined RGGI in 2006 as part of the Healthy Air Act. SEIF does not receive any general funds nor does it include any ratepayer surcharges. By legislation, 10.5 percent of SEIF is dedicated to "Clean Energy and Climate Change Programs, Outreach and Education" and of those funds, only a fraction is available for renewable energy projects. To date, no manure-to-energy projects have been funded. Administratively, the Maryland Energy Administration could make manure-to-energy projects a priority for funding. Legislatively, the amount devoted to clean energy could be increased.

Pennsylvania has more state grants and loans available for manure-to-energy projects than Virginia and Maryland. The largest program is the Alternative and Clean Energy Program, which provides financial assistance in the form of grants and loans for the utilization, development, and construction of alternative and clean energy projects. It is a competitive program and the evaluation criteria include the amount of matching funds, the technical and financial feasibility of the proposed project, and the energy production amount. These scoring criteria could be administratively changed to encourage the deployment of more manure-to-energy projects.

Virginia has no existing state grant or loan programs for renewable energy. The Water Quality Improvement Fund, however, could be used to fund those manure-to-energy projects with an explicit link to improving water quality through nutrient reduction. The Agricultural Best Management Practice Cost-Share Program does allow funding for animal waste facilities and additional priority could be given to qualifying animal waste facilities that included energy production and proper management of nutrient-rich by-products.

By coordinating water quality programs with energy programs, public dollars can be targeted to projects with multiple benefits, improving their cost-effectiveness and ensuring that energy projects will help solve water quality problems.

FIGURE 5 *Comparison of State Alternate Energy Tax Credit Programs in Pennsylvania, Maryland, and Virginia*

State	Legislation	Amount	Transferable/ Refundable	Status
Pennsylvania	H.B. 1 – 2008	15% of cost of project	Transferable	No funds appropriated
Maryland	H.B. 494 – 2010	0.85 cents/kwh	Refundable	Active
Virginia	H.B. 678 – 2011	1.1 cents/kwh	Can be carried over	Legislation did not pass
North Carolina		35% of cost	Can be carried over	Active

North Carolina was highlighted by some industry representatives for its program and is included here for comparative purposes.

FINANCE FOR MAXIMUM BENEFIT 2

Revise alternative energy tax credit programs to provide greater incentives for manure-to-energy projects.

Several programs exist to provide tax credits for alternative energy projects (see Figure 5). However, there are two significant limitations to some of these programs when applied to manure-to-energy projects. First, tax credits that are based on kilowatt-hours of production limit the program to electricity generation only. Manure-to-energy projects are just as likely to produce thermal energy or biogas as electricity, but they are ineligible for the credit. Second, many agricultural producers have a low tax liability and cannot, therefore, take advantage of tax credits. However, if credits are refundable or transferable (that is, sold to those with a higher tax liability) they will retain value for the farmer.

Existing tax credit programs should be fully funded in Pennsylvania and revised in Maryland so that tax credit payments are based on a percentage of project costs, rather than kilowatt-hours generated. Virginia should pursue legislation to establish a tax credit program that is based on project costs and is also transferable or refundable.

FINANCE FOR MAXIMUM BENEFIT 3

Stimulate the nutrient credit trading market by establishing a "credit bank."

Several manure-to-energy operations are relying, in part, on revenues from nutrient credits to finance their projects. Nutrient credit markets allow an entity that creates pollution to offset its impact by funding pollution reductions in other locations. Nutrient credit markets, however, have been slow to develop in the Chesapeake region.

In an attempt to facilitate a nutrient credit trading program, Pennsylvania has created a nutrient trading clearinghouse operated by the Pennsylvania Infrastructure Investment Authority (PENNVEST). Credit buyers and sellers contract with PENNVEST, reducing the risk of credit default and facilitating the exchange of credits among buyers and sellers.

Some technology vendors advocated for more direct government involvement in the nutrient market. That is, they suggested creating a regional bank that would not only serve as a clearinghouse, but also would stimulate the nutrient credit market by purchasing credits with public monies or private investments with public backing. This regional bank could be created legislatively (at the state or federal level) or administratively. However, this concept is controversial; some nutrient trading policy experts do not agree that this is the appropriate approach to enhance the market.

FINANCE FOR MAXIMUM BENEFIT 4

Establish a regional technical review panel to assist in calculating nutrient credit benefits.

There is currently no standardized approach in place for estimating the nutrient credit benefits (expressed in the number of pounds of nitrogen and/or phosphorus reduced to the Bay per year) that accrue from new technology, such as manure-to-energy projects. Reviews are conducted within individual state programs and, in programs where innovative practices are eligible for credit certification, are conducted on a case-by-case basis.

Efforts are underway to establish a regional review panel that would estimate nutrient credits associated with manure-to-energy projects. The committee would be an ad-hoc panel under the auspices of the Chesapeake Bay

Program, with members holding expertise in nutrient trading, Clean Water Act requirements, agronomy, and nutrient management.

SUPPORT EFFECTIVE USE OF BY-PRODUCTS

SUPPORT EFFECTIVE USE OF BY-PRODUCTS ★1

Ensure that nutrient management planning fully accounts for the import and export of nutrients in manure-to-energy by-products as they move from one farm to another.

In some manure-to-energy operations, solids separated from digested slurry are used as a bedding material on dairy farms. However, these solids often contain a significant portion of the phosphorus that was in the original manure. As a bedding material, they can either be used on the originating farm or exported to neighboring farms. These materials may have to be tracked through the generating farm's nutrient management plan, but it is not clear how these nutrient-containing materials are accounted for by the receiving farm. Although the material is being used for a purpose other than its nutrient value or soil amendment properties, it will ultimately be recycled through the farm's waste stream and potentially land-applied. Current state requirements vary:

- **Pennsylvania:** Transfer of manure in excess of twenty-five tons per year to another farm requires a signed agreement and either a nutrient management plan or nutrient balance sheet on the part of the importer.
- **Maryland:** Maryland requires a nutrient management plan for all operations with gross income in excess of $2,500 per year. This plan must document the importation or off-site disposition of all nutrients.
- **Virginia:** Importers of more than ten tons of poultry waste in a 365-day period must report the input. However, there are no requirements or review for non-poultry waste if it comes from an unpermitted animal feeding operation (AFO). If permitted, the Department of Environmental Quality reviews transfers on a case-by-case basis, assessing what the operation wants to do with the separated solids and making sure the use does not counter nutrient management concepts. However, the ten-year AFO permit period ends in 2014. In 2012, the Department of Environmental Quality will establish a regulatory advisory panel and begin updating the permit for the next cycle. It is anticipated that enhanced reporting will be a part of the new process.

These rules are primarily designed to account for manure imported to a farm for direct application on cropland. When a farm imports nutrients in the form of bedding, the nutrients should instead be accounted for under the importing farm's nutrient management or manure management plan. Testing should determine the nutrient value of the bedding, rather than estimated book values.

Nutrient management training programs should communicate the potential for imported manure solids as a nutrient source on the farm and the need to adjust plans accordingly. As the use of manure solids becomes more prevalent, modifications to nutrient management regulations may be needed if training alone appears to be insufficient.

SUPPORT EFFECTIVE USE OF BY-PRODUCTS 2

Increase the demand for by-products by promoting low-impact development and its use on public projects.

Separated solids, compost, and biochar are by-products derived from manure-based energy. They can be valuable soil amendments for post-construction remediation and stormwater control. They are proven to improve yield (for plants that require high potash and elevated pH) and to reduce nutrient leaching, soil acidity, and irrigation and fertilizer requirements. Biochar is also renowned as a means to sequester carbon and the manure utilized results in less direct manure application on land, thereby reducing emissions of greenhouse gases from soil.

Throughout the watershed, state specifications for public projects allow for the use of compost material, but generally fall short of mandating their use due to variability in cost and availability of compost materials. However, states could do more to increase the market for manure-based compost, and even biochar, by promoting its use in public projects, especially those utilizing low-impact development (LID) practices.

LID techniques, such as rain gardens or swales, use compost by design. As these practices become more widespread throughout the construction industry, demand for compost materials will increase. While not specifically required by regulation, the use of LID on public projects can be promoted through funding incentives or design specifications. LID can also be promoted on private projects through programs that will encourage its use, such as stormwater volume control requirements or the assessment of stormwater fees by local government.

★3 SUPPORT EFFECTIVE USE OF BY-PRODUCTS

Clearly classify manure as a "non-waste" instead of a "solid waste" for the purposes of air permitting.

According to the U.S. Environmental Protection Agency's clean air rules, the classification of a project as an incinerator or a boiler depends upon whether the fuel is considered a "non-waste" or "solid waste" material. For manure-to-energy projects, defining manure as a non-waste material could reduce the regulatory cost of the project.

Solid waste incinerators, which burn material for the purpose of disposal, must meet emissions criteria for nine air pollutants and are generally subject to more rigorous regulations than boilers. Boilers use natural gas, coal, wood, or other non-waste materials to produce steam, which is then used to generate electricity or heat.

In early 2011, the Environmental Protection Agency proposed revisions to the permitting rules, followed by additional adjustments in December. Under these rules, the agency will now presume that manure is a solid waste unless the operator can prove that manure used in boilers meets the definition of a non-waste feedstock. This is a departure from the previous approach, in which manure used for power generation was considered a non-waste material, and has therefore caused confusion and concern about extra cost and delays for manure-to-energy projects.

The rules for incinerators and boilers should clearly classify manure used for generation of heat or electricity as a non-waste material. As the rules are modified to accommodate manure-based energy in the non-waste (and less regulated) category, it is also important to ensure that no additional toxic pollutants will be emitted as a result of this classification, thereby promoting the use of "cleaner" manure-to-energy technologies.

4 SUPPORT EFFECTIVE USE OF BY-PRODUCTS

Facilitate use of manure-to-energy by-products as fertilizer for organic food crops.

Producers of organic crops use manure or compost as a source of nutrients for their fields. However, the use of these materials on produce for human consumption is limited due to waiting periods that apply before a crop can be harvested. The waiting periods control the spread of bacteria or other pathogens that could be present in the manure or compost.

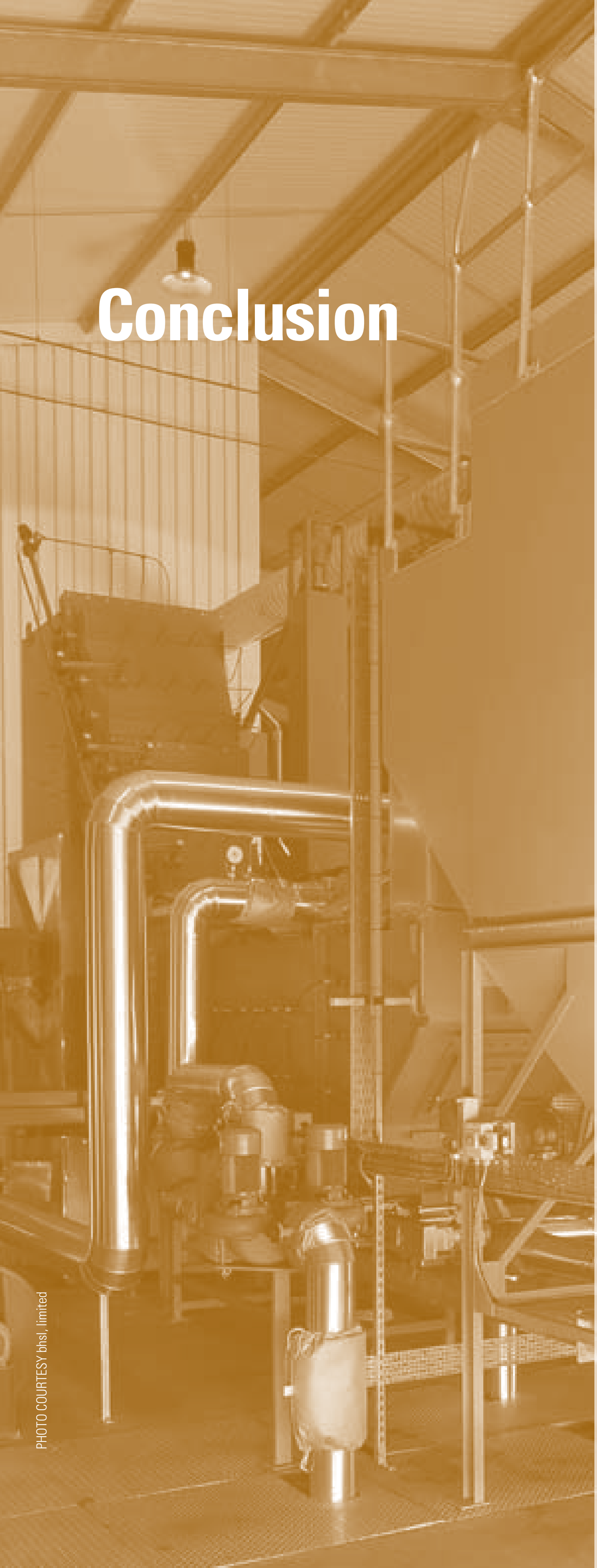
The by-products of manure-to-energy projects, especially the ash produced from thermochemical processes, could be a potentially valuable alternative — a source of pathogen-free nutrients that could be applied closer to harvest.

Research is currently underway in Virginia to investigate the nutrient value of the ash by-product and the proper application rates and methods. This research is being funded through the USDA Specialty Crop Block Grant program. With a block grant, states can determine their funding priorities from year to year and therefore have the flexibility needed to direct a portion of these funds toward manure-to-energy by-products.

As an incentive for early-adopters, the use of by-product material could be eligible for risk management programs such the "BMP (Best Management Practice) Challenge." Offered through a public-private partnership between Agflex, American Farmland Trust, and state and federal agencies, this program compensates a farmer for yield loss when that loss is a direct result of an implemented BMP.

Virginia should continue its research, and Pennsylvania and Maryland should consider similar use of specialty crop research dollars to learn more about the ways in which manure-to-energy by-products could be of value to the organic produce industry.

Conclusion



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Manure-based energy presents a much needed alternative use for excess animal manure in the Chesapeake Bay region while also providing a homegrown source of renewable energy at a time when the nation is seeking to increase and diversify its energy portfolio. Already, progressive farmers and their technology partners have demonstrated the triple benefits of manure-to-energy projects: providing new economic choices for the farmer, reducing the land application of excess manure nutrients that can contribute to water quality problems, and supplying energy to the regional power grid. Their success should not be limited to the pioneering few.

The Manure-to-Energy Summit brought together policy makers, technology vendors and experts, farmers, and government officials to vet policy options that would boost the number of manure-to-energy projects in Pennsylvania, Maryland, and Virginia. A number of creative yet practical ideas are outlined in this report, many of which are ripe for action by policymakers.

For example, specific changes can be made to existing state renewable energy policies to provide additional incentives for manure-based energy, similar to those available for solar energy; federal and state funding mechanisms can be aligned to give preference for projects with an explicit link to water quality goals. A range of options exist for making smart use of nutrient by-products of manure-to-energy projects, which can both expand markets for farmers and put nutrients to work in ways that decrease the pollution risk to local waters.

Obviously, progress will depend on the combined efforts of government, academia, nonprofit organizations, and the private sector, and draw on the leadership of those willing to "think outside the box." Acting on the recommendations of the Manure-to-Energy Summit is an important first step.

CREDITS

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