Poultry Sustainability Guide

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Contents

Foreword

From 1965 to 2010, poultry production's impact on climate change, acidification, and eutrophication decreased by 36%, 29% and 25% per 1000 kg of poultry meat produced.[1] While proud of this track record of efficiency gains and better environmental stewardship, poultry growers, integrators, processors, suppliers, foodservice companies, retailers and outside stakeholders realize the importance of working together to collaborate on the shared goals of implementing best practices, tracking progress, and continuing to drive continuous improvement through the creation of the U.S. Roundtable for Sustainable Poultry & Eggs.

Many of the best management practices outlined in the Poultry Sustainability Guide are highlighted through the U.S. Poultry & Egg Association's Family Farm Environmental Excellence Award, which recognizes exemplary environmental stewardship by family farmers engaged in poultry and egg production. At the next stage of production, the U.S. Poultry & Egg Association also recognizes the outstanding wastewater treatment facilities operated by poultry companies through the Association's Clean Water Award. Whether through awards programs, sustainability frameworks, or guides like this one — stakeholders are working together to continue to improve the outcomes associated with poultry production.

Although developed outside the poultry and egg industry, the Poultry Sustainability Guide is a tool that supports the Roundtable's mission to advance, support and communicate continuous improvement in sustainability through leadership, innovation, multi-stakeholder engagement and collaboration. The guide successfully aggregates a list of best management practices already being utilized on farms and processing operations today as highlighted through the U.S. Poultry & Egg Association's awards programs. We hope it will be a useful reference for people looking to make sustainability improvements in all stages of poultry production, and we look forward to continuing to build on these materials to make information and resources more accessible to the value chain over time. Working together with stakeholders like the Environmental Defense Fund, we hope to continually reaffirm the U.S. poultry and egg value chain as a trusted global leader in being environmentally sound, socially responsible, and economically viable.

Sincerely,

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Executive Director
U.S. Roundtable for Sustainable Poultry & Eggs

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Input and review

This guide is the result of a collaboration between Environmental Defense Fund (EDF) and the food and agriculture advising firm, K·Coe Isom. Through industry interviews, research, and expertise, the report provides resources and information for poultry companies to help them integrate sustainability into business operations and strategy. This guide could not be possible without the input and guidance of leaders in the poultry industry and academia, including:

- Dr. Craig Coufal, Texas A&M University
- Bob Wolfe, Foster Farms
- Dr. Jonathan Moyle, University of Maryland Extension
- Steve Levitsky, Perdue
- Leigh Ann Johnston, Kevin Igli, Steve Patrick, Jamie Burr, Tyson Foods
- Michele Boney and Elizabeth Johnson, West Liberty Foods
- Paul Bredwell, U.S. Poultry & Egg Association

In addition, we appreciate the time and effort of our review committee, who provided feedback on the report content:

- Perdue
- Tyson Foods
- West Liberty Foods
- University of Maryland
- U.S. Poultry & Egg Association

Section I:

The poultry sustainability landscape — A call to action

Introduction

Poultry companies sit in a critical place within the supply chain — working with farmers and upstream suppliers, but also with retailers and grocers. Many poultry companies are consumer facing, as well, with well-known brands and products. From 2016 to 2018 poultry consumption in the US increased 1.6% from 119.2 metric tons to 122.5 metric tons of poultry meat.[2] With this growing demand, poultry companies face external pressure to decrease their environmental footprint by mitigating greenhouse gases (GHG) from their operations and their supply chains. Retailers and CPG brands are increasingly asking suppliers to take action on environmental impacts in their supply chains, and consumers are increasingly using purchasing power to recognize brands doing good for people and the planet.[3,4]

Recent models estimate that the production of broiler chicken in the US annually leads to 30 million metric tons of CO2e, the equivalent of driving 6,369,427 cars each year.[5,6] As consumers demand more accountability from food companies, these brands have an incredible opportunity to work with the stakeholders at their production facilities and farms to track, measure, report, and lead on the environmental outcomes of the production of poultry.

To be successful, sustainability must be integrated into the business operations and strategic direction of the company. Without this integration, companies struggle to reduce material risks to their operations and truly embrace company-wide changes that will result in business benefits. By making sustainability a secondary priority or simply a part of a company's philanthropic branch, the business will not internalize the changes necessary to reap the longer term economic rewards. This guide will help the poultry industry on its sustainability journey as it drives meaningful change in their organizations and supply chains that mitigates environmental impacts, improves resilience, and reduces risks.[7]

Environmental impacts

Climate change impacts the entire food and agriculture value chain. Over the past 40 years, farmers have seen increasing variability and intensity of weather and changing availability and affordability of inputs.[8] This makes crop and poultry production even more challenging. Poultry processors and companies have seen impacts like heat stressed animals, decreased water availability, and a less predictable supply chain, overall. At the same time, the agriculture industry contributes to climate change. In 2016, agriculture accounted for 8.6% of U.S. greenhouse gas emissions and food and agriculture businesses face increasing pressure to reduce emissions and improve water quality by increasing efficiency.[9]

Environmental impacts of poultry production at the plant level include greenhouse gas emissions related to energy use in the production processes, and water quantity and quality impacts from the large quantity of water used in animal processing. Although poultry production has an overall lower footprint than other animal products, poultry processing has been found to be more energy intensive than other meat sectors like beef and pork, and 41% of emissions within the chicken supply chain are the result of energy use.[10] Wastewater generated during these activities typically has high biochemical and chemical oxygen demand (BOD and COD) due to the presence of organic materials in the water from processing — poultry by-products and wastewater may contain up to 100 different species of micro-organisms, demonstrating the importance of proper water management at the poultry processing facility. To address this, poultry processing facilities treat water used in the production of poultry products in accordance with Federal National Pollutant Discharge Elimination System permits, state issued land application discharge permits or municipal sewerage standards before discharging the water to the environment or municipal sewer system. The enforceable treatment standards set for a poultry processing facility is dependent on many factors including the plants locality, water quality criteria of the receiving stream, the capacity of a municipal wastewater treatment plant and more.

On the farm level, the major environmental concerns are from the greenhouse gas and water quality impacts associated with feed production, energy use on farm, and litter management. According to FAO, feed production accounts for around 78% of emissions from the global poultry supply chain.[11] To help farmers access these impacts US Poultry and Egg Association has funded the development

of “The Poultry Calculator”, a regionally specific, physical model of broiler chicken production. The purpose of the model is to simulate broiler performance, resource consumption, and environmental impacts.

Poultry litter impacts environmental quality at the poultry farm itself, as well as on any land it is used to fertilize. Poultry litter is a hotspot in the poultry value chain because of its potential to impact GHGs and water quality if not managed properly. Litter is a valuable resource, as it can be used in lieu of synthetic fertilizers and provide organic matter to a crop farm. However, nutrient run-off from nearby fields can negatively affect sensitive ecosystems. As a result, many poultry growers in these sensitive areas haul litter to fields they may have in other areas or sell their litter to farmers in neighboring communities that have fewer challenges around land application.[12] Impacts to water quality from fertilization and litter management are the focus of many communities around the nation, such as the Chesapeake Bay where farmers implement best management practices to reduce nutrient runoff.[13]

The challenge of uncertainty

The poultry industry is facing substantial challenges in production. The average temperature for the contiguous US has seen an upward trend over the past two decades.[14] The increase in average temperature results in heat stress to chickens, a negative impact to animal welfare and production efficiency that can be identified at as low as 75 degrees Fahrenheit. Mitigation requires additional inputs of energy for barn ventilation and increased water consumption by birds.[15] Decreasing water availability in the United States will continue to affect agriculture, including poultry production. As a key feed ingredient for poultry production, a fifth of U.S. corn is grown in the area sourced by the Ogallala Aquifer. If groundwater sourcing continues at its current pace, research suggests the aquifer will be depleted in by 2070.[16] More than $20 billion of food and agriculture businesses depend on the aquifer, which spans eight states in the Midwestern region where the majority of the nation’s feed corn is grown.[17]

Volatility in the market has impacted the entire supply chain. Consolidation of the market, trade uncertainty and consumer desire to know the products they buy were produced in a sustainable way are all changing the way poultry is produced, processed and marketed.[18]

Improvement opportunities

This report identifies opportunities for improvement at both the plant and farm level. At the plant level, three major areas to focus on improving to achieve significant greenhouse gas and water quality improvements are energy use, refrigeration, and waste management. Implementing practices to improve energy and water-use efficiency often reduce operating costs and reduce wasted resources, as well.

At the farm and poultry barn level, the major areas of focus are feed production, on-farm equipment, waste and litter management, and water use at the poultry barn. Assessing feed grain impacts in your sustainability program is critical because growing and processing feed ingredients for poultry can be resource intensive and contributes up to 82% of greenhouse gas (GHG) emissions within the US poultry supply chain.[19] Energy and water efficiency upgrades provide a significant opportunity for environmental improvement and cost savings for many farmers,[20] so conducting an energy or water-use audit can help your growers identify their biggest opportunity areas for improvement.

Plant level opportunities

There are three major areas to focus on improving to achieve significant greenhouse gas and water quality improvements: A. Energy Use, B. Refrigeration, C. Waste Management and Water Use.

A. Energy use at the plant — assessing performance and improving equipment

There are substantial energy savings to be gained in a poultry processing plant by assessing current energy performance. Plant operators should continually strive to make themselves aware of inefficiencies in their own operations and of the resources and funding opportunities available to capture and mitigate energy inefficiencies. Completing an energy audit can provide insight as to where they can improve their energy efficiency.

ENERGY STAR protocol offers best management practices and behaviors relevant to various areas of plant operation that industrial businesses can adopt to enhance their energy efficiency.

In addition, research has been done by the US Poultry and Egg Association indicating energy efficiency improvements with proven cost benefits from:[21]

EnergyStar Guidance

Operations and maintenance

- Perform energy efficiency audits
- Regularly check/maintain equipment to ensure it functions efficiently
- Revise janitor schedules to reduce hours of lighting per day
- Set goals and methodologies to track and reward improvements
- Inspect insulation on piping, ducting, and equipment for damage

Lighting efficiency

- Turn off lights when not in use
- Maximize daylighting — open blinds, install skylights and/or windows
- Implement a lighting maintenance program
- Remove unnecessary lighting in over-lit areas
- Replace low efficiency incandescent bulbs with LED lighting

Office equipment

- Use power management/sleep mode on computers, printers, copiers, fax machines, etc.
- Consolidate general office equipment where possible (computers, etc.)

Heating and cooling

- Set thermostat warmer in summer, cooler in winter when building is not occupied/after business hours
- Regularly change/clean HVAC filters
- Make sure areas in front of vents are clear of furniture/paper for distribution
- Clean evaporator/condenser coils on heat pumps, air conditioners, chillers
- Repair leaks in compressed air systems and steam traps
- Repair damaged insulation/increase levels of insulation
- Keep exterior doors closed whenever possible

Communicating and educating workers

- Educate employees about how behaviors affect energy use
- Develop an internal energy team and assign responsibilities for pursuing energy efficiency
- Reward energy efficient behaviors to encourage employee engagement
- o Measurement and Tracking
- Measure/track energy performance over time
- Integrate efficiency goals into design of new facilities
- Ask the utility company if they offer free or inexpensive energy audits/equipment rebates

Implementing renewable energy

- Consider building anaerobic digester at your operation
- Ask the utility company about potential wind/solar options

- Insulating steam pipes and valves
- Installing an automatic blowdown system to improve boiler efficiency
- Adding variable speed motors and drives to the cooling towers of the refrigeration system
- Upgrading to energy efficient lighting
- Upgrading to a more efficient air compressor for the plant system

For more information, contact the US Poultry & Egg Association for the latest research and recommendations on how to benefit from these proven technologies.

B. Refrigeration at the plant– changing industrial refrigerants

Refrigeration of the agricultural supply chain accounts for approximately 1% of global greenhouse gas emissions. The impact of the GHG footprint at the plant varies widely based on the type of refrigerant used at the facility. In the past, ammonia and hydrochloroflourocarbons (HCFCs like Freon) have been the primary refrigerants used in poultry plants, but food manufacturers of all kinds must phase out R-22 (a HCFC) due to ozone depleting properties. EPA is requiring all use of R-22 to be phased out in the U.S. by January 2020.[22] Even though the regulatory situation on other HCFCs and hydroflourocarbons (HCF) is uncertain, companies should aim to transition away from HCFC and HCF to prevent exposure to near certain future regulation.

The majority of meat processors in the United States have already completed phase-out of R-22 and shifted towards using more natural refrigerants such as frozen CO2, but those who haven't should set goals to do so, given the upcoming deadline. Under Section 612 of the Clean Air Act, the EPA has established the Significant New Alternatives Policy, or SNAP, Program.[23] This program identifies and evaluates substitutes for ozone-depleting substances by examining overall risks to human health and the environment of existing and new substitutes. For more information, visit EPA's Q&A on SNAP.

C. Waste management and water use at the plant– maintaining sanitation while increasing water efficiency

In terms of solid waste management at the plant, it is likely that your facility already processes or sells poultry by-products. For those who haven't, there are opportunities to reduce waste from processing facilities by understanding options for selling additional solid waste as a value-added by-product. In some case, facilities can employ an anaerobic digester to produce biogas from this waste stream and reuse that gas as a fuel to power or heat the facility. Both activities can reduce the GHG attributed to your facility and potentially improve the economic benefits from your waste stream.

While broilers are one of the least water demanding proteins to produce, there still remain opportunities to increase water efficiency at the processing plant.[24] At the plant, a majority of water is used for hygiene and sanitation purposes, and newer equipment for processing and cleaning helps to reduce the per bird water use. In general, companies can request that facilities use hydrometers to understand and track the water use for various pieces of equipment to determine if flow is consistent and efficient.

Your organization may consider joining the Ceres AgWater Challenge[25] that allows companies to make commitments and implement projects to improve sustainable water use at their company and in their supply chain and provides the potential to learn from similar companies. Remember that water impacts and improvements at the processing facility is relevant if your company communicates progress towards its overarching goals in a Sustainability Report.

Supply chain and farm level opportunities

At the farm and poultry barn, there are four major areas to focus on improving to achieve significant greenhouse gas and water quality improvements, with feed production being the greatest area of opportunity: A. Feed Production, B. Waste and Litter Management, C. On-Farm Equipment, and D. Water Use at the Poultry Barn. It is critical to recognize that while grain growers and poultry producers are key in implementing changes to production, there are other important stakeholders, like farm advisors, agricultural input retailers, equipment companies and farm finance organizations that have a role to play in making the supply chain and farm more sustainable.

Learn more about the value of interacting with farm advisors in the Implementation Guide below.

A. Feed production — improving nutrient management and water usage on the feed grain farm

i. Nutrient Management

Poultry companies should ensure that feed growers within their operational control have properly drafted and implemented high quality nutrient management plans (NMP) or comprehensive nutrient management plans (CNMP). For operations not within their control, there are ways to support suppliers developing and implementing these plans.

One way to ensure a high quality NMP/CNMP is to help growers hire an independent third party to assess the operation and write the plan. USDA and other funding mechanisms exist to help farmers pay for a well-organized, well-documented NMP/CNMP.[26] Given that sub-optimal nutrient and soil management is likely the largest contributor to greenhouse gases and water quality impacts in a poultry company's supply chain, dedicating time to understanding the challenges and opportunities, plus the ability to engage with feed grain growers is critical. Having the plan versus actively implementing it in everyday production makes a substantial difference in overall nutrient management. Once a plan is in place, an annual review process to review implementation and make necessary adjustments ensures that the most effective changes are taking place to help drive the greatest environmental and economic value.

Impacts to water quality and quantity can be heavily impacted by poultry feed production. Impaired water quality resulting from nutrient runoff has been a challenge facing crop growers for decades, increasing scrutiny around nutrient application methods. While every farm is unique and successful sustainability cannot be a one-size-fits all prescription, below are key best management practices to consider.

Priority nutrient use efficiency Best Management Practices (BMP) for feed production

Getting started= foundational sustainability for feed production:

a. Base nutrient management plan
    i. In that base NMP, use science-based process for determining rate. Options include but are not limited to:
        1. Land grant university recommendation,
        2. On-farm trials to determine economic optimum rate,
        3. Stalk nitrate or tissue testing to evaluate and set rate,
        4. N decision support tool to determine rate, or
        5. Field history of yields from which an N recommendation is made based on yield goal system (use of LGU recommended rate preferred)
    ii. Testing protocol in place for manure, soil, crop tissue, and forages.
b. Avoid applying most/significant N in the fall.
c. Split spring applications of N
d. Swath/section control (reduce effects of overlapping applications in a field)
e. Nitrogen stabilizer (see NutrientStar for guidance)

Continued refinement and improvement of nutrient use efficiency (NUE) in feed production:

a. Improved integration and crediting of litter (if used) in crop nutrients
b. Incorporation of litter (if used)
c. Following recommendations using N modeling tool (see NutrientStar for guidance)
d. Tissue analysis to evaluate and refine rate
e. Develop and implement a plan based on zone management
f. Drone normalized difference vegetation index (NDVI) sensing and N recommendations
g. Optical sensor technology and variable rate application (see NutrientStar for guidance)

Priority soil health and edge of field BMPs for feed production

a. Cover crops
b. Conservation tillage or no till
c. Soil health analysis
d. Add additional crop to rotation (or more)
e. Wetland (designed/placed to intercept water flow from field/farm)
f. Riparian buffer (designed/placed to intercept nutrients/soil)
g. Forested buffer (designed/placed to intercept nutrients/soil)
h. Advance cover crops (multi species)
i. Use of evaluation tool to identify unprofitable/high risk areas in field (i.e. AgSolver)

Company case study: Fertilizer optimization program

Smithfield Foods, the world's largest pork producer, purchases $1.7 billion in feed grain each year (7.9 million pounds). When Walmart asked Smithfield to address fertilizer use in its feed grain supply chain, the company set a goal of engaging 75 percent of its direct grain sourcing supply, or 450,000 acres, in sustainable farming practices by 2018.

Smithfield Foods joined forces with the agricultural and scientific experts at Environmental Defense Fund (EDF) to put a fertilizer optimization plan in motion throughout its supply chain. Out of this collaboration, SmithfieldGro was born. Through this program, Smithfield helps farmers growing feed grains to apply fertilizer more efficiently, maintain or increase crop yields and improve soil health — all while reducing water pollution and greenhouse gas emissions.
Smithfield hired agronomists to work directly with local grain growers to assist them in improving their productivity, profitability, and sustainability. The company also offers special promotions like technology trials, discounted cover crop seed, and a contract winter wheat program. In 2018, Smithfield exceeded its grain sustainability goal by improving practices on over 500,000 acres.

According to Kraig Westerbeek, Smithfield's VP of Environment and Support Operations, "We invested in sustainable feed grains for a handful of reasons — but primarily because it's just smart business. We don't fully know the economic potential of SmithfieldGro, but we do know that helping farmers become more efficient while protecting their yields benefits our bottom line — and theirs."

Read more about the Smithfield project in their case study, Shared Value

ii. Water use

Within your company, it is important to engage farmers on the key issues that affect water use and water efficiency because it is a hotspot for the poultry value chain.

In geographies where feed grain is irrigated, sustainability managers should encourage growers and their farm advisors to reduce water usage and/or reuse water as applicable. Better water management and decreased water use reduces the number of hours irrigation equipment operates, which subsequently also lowers the energy needs for powering equipment. In cases where water is sourced from wells, depletion of the water source can occur over time and creates a need to drill new, deeper wells — all at cost to the producer.

B. Litter management

For farm operations, poultry litter is a valuable resource as an organic fertilizer and identifying the best locations to strategically employ poultry litter is important for farmers. In fact, the best way to reduce litter impacts is to ensure that those managing litter have access to resources on how to store and land-apply the litter appropriately. Poultry litter contains valuable plant nutrients (nitrogen — N and phosphorus — P) and land application is the most common fate of the large majority of litter. While the litter N and P fertilize crops, these nutrients can also leave the crop field and cause negative environmental impacts. Phosphorus applied to crop fields at levels which exceed crop needs accumulate in the soil and can be lost to nearby streams through soil erosion. Once soil P levels get high enough, the P can solubilize into surface runoff and be delivered to nearby streams. Nitrogen is more mobile than phosphorus and can leach into groundwater and through surface runoff and be lost to nearby streams. Leached N can also contaminate local groundwater making it unhealthy for human or animal consumption.

Nitrogen levels in applied litter should be optimized to avoid over application of N beyond crop needs and timing of litter application should take into consideration potential losses as a result of rain or from frozen fields. Over applied N can also increase the nitrous oxide losses from crop field. Given nitrous oxide is a powerful GHG, approximately 300 times as potent as CO2, application of N in excess of plant needs should be minimized.

As agriculture inevitably will result in some loss of N and P from fields, various conservation practices can be used to help capture these losses within or at the edge of the crop field. These include riparian buffers, perennial strips within crop fields, and cover crops. Managing fields to minimize erosion losses is also critical.

It can also be used in technologies to produce energy, reducing reliance on fossil fuels. Gasification

Grower expert case study: Nutrient recycling

Jenny Rhodes is an expert at operating a chicken farm with a low environmental impact. An educator of Agriculture and Natural Resources with a drive to make positive change, Jenny has served as President of both Delmarva Poultry Industry, Inc. and Maryland Association of County Agriculture Agents. Her own poultry and irrigated grain farm feeds 30,000 people annually, producing more than 500,000 broiler chickens every year.

Over her 30 years of chicken farming, Jenny has seen great improvements in the technology and conservation efforts around the Chesapeake Bay area. She uses these innovations to continuously reduce the environmental impact of her farm. Just like water conservation, poultry litter recycling is an incredibly important aspect of chicken farming.
“It is a cycle.” Jenny says, “The fertilizer is used on crops like corn. The corn is then used in chicken feed.”
One hundred percent of the poultry litter on Jenny’s farm is recycled. Most is sold to other farmers who raise crops. The rest of the litter is recycled as ‘slow release plant food.’

“We are doing a complete litter clean out on our farm. This is how we recycle. We take the litter out of the poultry houses and recycle it as fertilizer and recycle as slow release plant food. The crop farmer then takes our litter and spreads it onto the field in accordance with a personalized nutrient management plan that has been sanctioned by the state.”

National Chicken Council. How Jenny Minimizes the Environmental Impact of her Chicken Farm. Accessed on 6/20/18 via https://www.chicken-check.in/blog/how-jenny-minimizes-the-environmental-impact-of-her-chicken-farm/

technology can be used to heat poultry houses, however, the cost of the technology far outweighs the savings from reduced fuel costs at this time, so widespread implementation is unlikely and not feasible for most production facilities. Additionally, implementation of gasification and bio-digester technologies is logistically challenging. Implementing these technologies at the plant level makes the most sense (in order to aggregate enough poultry litter to justify capital investment into these systems), but there are biosecurity risks associated with aggregating litter from multiple flocks and locations, in addition to significant challenges associated with litter transportation. Currently, these digesters are most commonly found at processing plants that operate their own poultry farms, rather than individually owned farms. Though this leaves the possibility of a future economic alternative for poultry litter as the technology evolves, there is an opportunity for food companies operating processing plants to partner with their growers on litter use.[27]

There are some technologies and equipment that convert litter into a pelletized, processed fertilizer. The benefit of this technology is that the manure is converted into a form that can be safely and cost-effectively packaged, transported, and distributed. Because of capital input requirements and current resource needs in the industry, poultry companies and co-ops should coordinate and fund this process, though multiple growers would need to engage to ensure that litter supplies are sufficient to break even in this kind of venture.

See Appendix II for more resources on litter stewardship for poultry companies.

C. On-farm equipment — identifying ways to improve energy efficiency, renewable energy and water use

i. Precision agriculture

Precision agriculture has been increasingly adopted on the crop farm. Four technologies are the most commonly used: yield mapping, soil mapping, auto-guidance machinery steering, and variable rate technologies (VRT). These technologies and practices can range from variable rate technologies to more effective crop mapping and auto-guidance systems for tractors that self-steer farm equipment, giving more accurate field navigation than can be done using visual cues. These technologies ultimately decrease the GHG footprint of the producer while reducing the total input cost and improving yields for the farmer.[28] The USDA Economic Research Service conducted research to assess potential cost savings of technology implementation. They found that among corn farmers using these four technologies, those using yield mapping independently or with VRT reported the largest cost savings — about $25 per acre.[29]

When you work with your grow-out farms or contract growers, there are many resources for growers on ways to reduce energy consumption. Through trusted advisors, poultry companies should encourage growers to consult state extension agencies that can provide resources, as well as universities and industry groups.

ii. Energy efficiency

The USDA offers several opportunities for growers to improve their energy footprint, so connecting producers with these resources or supporting by cost-sharing may be a potential route for your company. Growers can cut input costs, maintain production, and reduce dependence on fossil fuels by using conservation practices offered by the USDA's Natural Resources Conservation Services. See Appendix III for more details on NRCS resources. Poultry farm best management practices for energy efficiency include:[30]

- Controllers: installing controllers to maintain temperature, lighting, ventilation, and cooling can coordinate energy use across multiple systems.
- Brooding Curtains: using curtains effectively can help chickens stay warm in a particular area of the poultry house.
- Insulation: a properly insulated house helps reduce costs and make other strategies, like curtains, more effective for maintaining temperature in the house.
- Attic Inlets: ceiling inlets provide pre-warmed air that circulates through the house, keeping litter drier and levels of ammonia lower, while also reducing fuel needs.
- Circulation Fans: using controllers, as well as the proper type and size of fan, can heat houses and reduce reliance on fuels.
- End Wall Doors: making sure the doors are strong, well-maintained, and sealed is key to reducing leaks of heat and cooling from the house.
- Solid Side Walls: combined with well-maintained generators, solid walls help increase energy efficiency. Solid walls can be expensive, so another option available is polypropylene-faced fiberglass batt insulation — which sees immediate energy savings. In fact, farms can see a fuel savings of about 25% with

insulation.

- Radiant Heaters: radiant tubes, quads, and circular heaters are more efficient than forced air heaters. Radiant heating is particularly useful to heating the litter pack, resulting in warmer birds and drier litter. It is important to properly install and clean reflectors and radiant tubes to maintain this efficiency.
- Ventilation Fans: keeping fans and shutters clean and well maintained is key to reducing energy use. Dirty shutters can reduce air flow up to 40%. Farmers should plan on replacing belts annually and should check and maintain belts throughout the year.

Grower resources funding for conservation practices and equipment

New equipment is expensive for the average farmer. But, the USDA has several programs which can assist farmers in acquiring this technology, including:

- FSA Farm Loan Programs: these offer opportunities to family farmers and ranchers to expand and strengthen farming operations.
- Rural Energy for America Program: offers guaranteed loan financing to qualified agricultural growers, including new technologies.

iii. Renewable energy on farm

On farms across the U.S., solar panels, wind turbines, and biofuel use is increasing as a source of clean, alternative energy. Due to potential tax credits, the USDA Rural Energy for America Program (REAP), accelerated depreciation, and predicted energy costs over the next several decades, leading solar providers have estimated that grants and incentives can cover up to 73% of the cost of solar panels on-farm, decreasing payout time.[31]

Innovations, such as solar curtains, are emerging as potential solutions for the poultry farm. For example, leading companies like Perdue have looked at implementing a 'Solar Curtain' at operations on the West coast, which showed a 15–20% reduction in energy.[32]

Additional renewable technologies include on-farm digesters that create energy from waste. Though digesters from poultry litter have mixed success, as noted above, these technologies can reduce farmer reliance on non-renewable fossil fuels, improving the overall environmental impact of the poultry supply chain.[33]

Grower case study:
Solar implementation and cost savings

In 2009, poultry grower Spencer Pope installed nearly 50 solar panels on the roof of one of his poultry houses. Utilizing a Rural Energy for America grant, he saved nearly $250/month on his electricity bill on average. Due to this success, Pope has planned to install nearly another 200 solar panels on farm, enough to fully power his six poultry houses.

Not all poultry houses have the appropriate infrastructure to support solar panels. Before recommending solar technology to poultry growers, you should help them investigate their operation's compatibility with solar.

D. Water use at the poultry farm

It is important to recognize that the majority of water used on poultry farms is for animal consumption, cleaning, and cooling. Water use for cleaning purposes has increased on-farm with the recent Highly Pathogenic Avian Influenza (HPAI) outbreaks. Thus, the cleaning and sanitation of barns has evolved. Finding this balance between water conservation and biosecurity is imperative — sanitizing and re-using water from these processes can help reduce the risk of over-use on the poultry farm and reduce a farm's environmental footprint.

Additionally, water is used on-farm to help regulate temperature. Cooling of poultry houses uses water, but less than the differential of what heat-stressed birds would drink — thus, cooling improves both overall animal health and the environmental footprint of the farm.

Technology and modern housing play a big role in managing water use on the farm. Best management practices to incentivize that improve water efficiency include:[34]

1. Ensure an adequate supply of water for birds
Modern, highly efficient broilers require more water than slower growing broilers in the past. Depending on age and climatic conditions, birds can be consuming from 1.6 to 2 times more water than feed. Therefore, growers have to ensure they have access to enough water to meet the daily requirements of birds.

2. Design, retrofit, and construct water-efficient houses
Birds subjected to warm climatic conditions drink more water than those in a cooler environment. One study showed that water consumption increased 6% for every degree Celsius between 20-32 degrees, and 5% for every one-degree increment from 32-38 degrees Celsius. For the best use of water, birds should be kept in optimal climatic conditions. Those conditions are controlled with the help of water, including cooling and humidifying the poultry house. Retrofitting barns and new construction of houses with proper ventilation systems has a substantial influence on overall water consumption.

3. Choose the right cooling system
Evaporative cooling pads tend to use less water than high-pressure nozzle cooling systems. System efficiency depends on age and maintenance upkeep. Cooling pads typically work best when temperatures need to be lowered in high-humidity conditions, while nozzle cooling is a better option when cooling drier areas.

4. Use an efficient drinker system
Closed-nipple drinker systems are much more water efficient and hygienic than open “bell” drinker systems because water in bell drinkers is more easily spilled and/or contaminated.

5. Manage leaks
Any leakages in water equipment poses a risk of water contamination. Contaminated water used for drinking or cooling purposes can be a health risk for birds and have a negative impact on production. With newer waterer systems, there are multiple different types of bird safe water treatments that can be metered through the water lines to improve water quality and ultimately bird health.

6. Monitoring and controlling water systems
Most modern systems are automated and will alert poultry growers to any problems. New technologies have allowed for much more efficient monitoring and managing of water, as well as water meters that allow growers to monitor water consumption patterns. Changes in baseline consumption rates can be an early indicator of flock health problems or equipment malfunctions, alerting farmers to potential issues early helping them save time and resources.

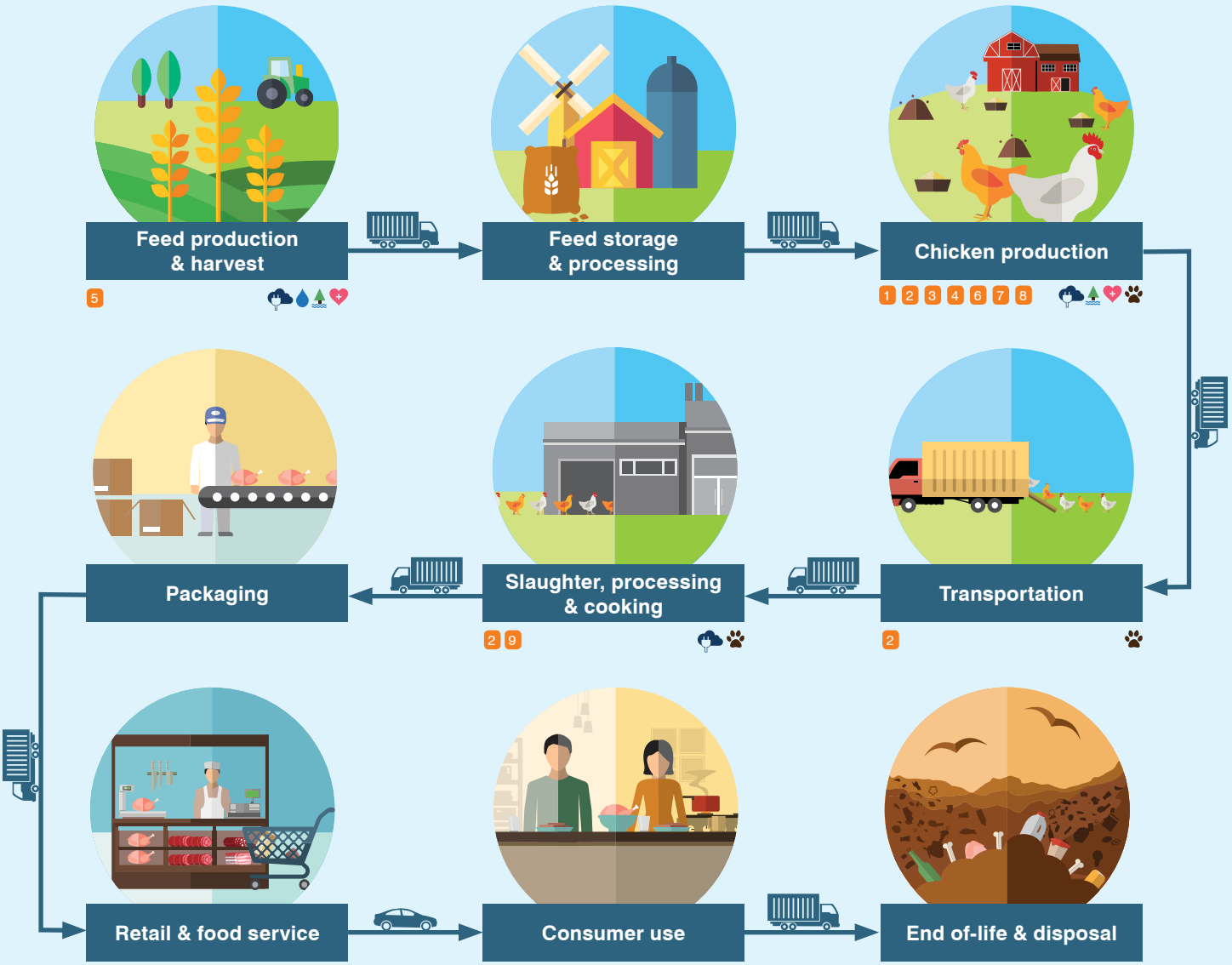
Making an impact on poultry sustainability

Poultry companies have an incredible opportunity to address major hotspots within the poultry production process, from field, to farm, to processing facility. While companies may focus first within their own operations, the true opportunity for making an impact on poultry sustainability comes from engaging with the supply chain.

As we’ve seen, the major hotspots in poultry production (also outlined by The Sustainability Consortium (TSC), a multi-stakeholder initiative of major food retailers and CPG brands), include air quality, energy consumption, manure, and litter management (Figure 1). Environmental hotspots are areas where there is the greatest risk to natural resources that are inputs to poultry production. Without action, these hotspots will only intensify, and so will the environmental, regulatory and market-based pressures to mitigate these risks.

Read on to learn how to create and implement a plan that includes key recommendations from our experts that will help you to track and report reductions in greenhouse gas emissions and improvement in water use and water quality.

Figure 1. The Sustainability Consortium has defined where environmental concerns are occurring throughout the poultry value chain.
Source: The Sustainability Consortium, Chicken Supply Chain Diagram. Accessed online at:
https://www.sustainabilityconsortium.org/wp-content/uploads/2017/03/TSC_Chicken_Supply_Chain_Diagram.pdf



Sustainability Topics: Climate & Energy · Water Use · Land & Ecosystems · Health, Safety & Rights · Animal Welfare

Hotspot: An activity within a product's life cycle that is identified as having a substantialenvironmental or social impact that is supported by significant evidence.

1. **Air quality — Animal farm operations:** Chicken manure releases ammonia that can cause air quality issues for workers and communities.
2. **Animal welfare:** Chickens may face health issues related to proper housing, nutrition, handling, transportation, and slaughter.
3. **Antibiotic use — Animal farm operations:** Chickens may need antibiotics to treat disease but overuse can cause antibiotic resistance in humans and affect the environment.
4. **Energy consumption — Animal farm operations:** Chicken housing operations use electricity and fuel, which can lead to climate change and pollution.
5. **Environmental impacts — Feed cultivation:** Improper management of soil, fertilizer, pesticides, water, and energy to grow feed can cause pollution and affect workers, communities, climate, and natural resources.
6. **Labor rights — Animal farm operations:** Workers, especially women and migrants, may face labor issues including unfair pay.
7. **Manure management — Animal farm operations:** Chicken manure releases greenhouse gases and can cause water pollution and climate change.
8. **Worker health and safety — Animal farm operations:** Workers may be exposed to dust, chemicals, or other hazards on the farm.
9. **Energy consumption — Processing:** Processing and cooking chicken uses electricity can lead to climate change and pollution.

Section II:

Implementation guide

Now that you have a better grasp of the scope of the impacts of poultry production and the major opportunities to address them, we'll dive into details for how to develop and implement a plan to engage your plant and farm level partners to track your sustainability progress.

Defining goals, objectives and metrics for poultry sustainability

Use this information to define your program's goal. Once overall goals are identified, you should conduct a scoping process to determine your company's baseline footprint. The first step of this is identifying the key areas where impacts exist and where your organization can make a positive environmental impact. To achieve this, you need to first understand how resources are being used throughout your supply chain. This could include activities such as assessing the energy, waste, and water usage at animal farm and processing operations, assessing nutrient and water management from feed grain production, or through conducting life-cycle analyses or materiality assessments to analyze your business's overall footprint. These analyses will help you identify where data is or is not available and where internal capacity exists or not. This process may require your company to work closely with feed growers and processing plants in your supply chain to help them understand the purpose, goals, and data needs of this process.

Once you have identified the key areas of opportunity in your supply chain, the next step is to create measurable goals and targets to reduce your company's impact. Each goal should have a timeline with specific milestones attached. Easily achieved goals should have short-term timelines with more defined milestones, while more complex goals, such as those involving your supply chain actors, may have longer timelines and more general milestones. Appropriately scoping the short-term and long-term ways that you can accomplish environmental improvements through prioritized action plans is the best approach to accomplishing continuous improvement. One strategy to do this is to utilize Key Performance Indicators (KPIs) that are already used in the industry — such as energy, water, or feed usage — and show that these KPIs are sustainability drivers as well as drivers of business success.

Check out more resources for defining your goals, establishing objectives and metrics.

National Council of Farmer Cooperatives has a practical resource that applies to all types of companies, not just cooperatives. The Field Guide for Farmer Cooperative Sustainability Programs provides steps, as reflected here in this guide, to developing, implementing, and evaluating your sustainability program. The field guide may be found at: http://co-opsustainability.org/wp-content/uploads/2017/03/NCFC-Sustainability-Field-Guide-1.pdf

Implementing your plan

Once overall goals and targets have been developed, the next step is to begin implementing and tracking improvements. In creating a plan of action, it is important to implement a plan in a way that allows the company to track progress over time and decide where to enhance the program for the most impact.

Want to learn more about identifying key stakeholders?

I. Who and how to engage at the plant level

Start with employees at the plant or operational facilities.

It is critical to find key program advocates to bring them along in the sustainability process. After socializing the concepts of the program with employees, look for leaders who are interested in participating or champions already acting as advocates for the work. Training and employee engagement, and creating employee incentives to drive continuous improvement is crucial to the long-term success of your program and creates an environment where employees feel empowered to affect change and make improvement. Some of these critical employees may be plant managers, operations managers, and engineers. Since many of the potential improvements relate to the machinery function, you'll need to work closely with operations managers to identify, track and implement the best opportunities for these plants.

A. Energy use at the plant — how to improve energy efficiency and reduce GHG impacts

Oftentimes, poultry companies are tracking energy use because it has a direct impact on cost and profitability. In fact, your company may have decades of energy use data associated with accounting and general ledger activities in your company. That same data can be leveraged for sustainability goal-setting, measurement, or reporting purposes; and, this is an opportunity for poultry companies to determine their impact and engage internally on continuous improvement. Being data-driven can help poultry companies prioritize areas of improvement, focus activities, and use technology effectively. Energy efficiency can be reported out through an annual Sustainability Report, through the Energy Star program, or as a part of a company's action on their carbon accounting of scope 1 and 2 emissions.

B. Refrigeration at the plant — how to reduce your climate impact

Switching to alternative refrigeration may seem like a daunting task for those in charge of the refrigeration equipment. With your plant managers, explore which options will allow you to switch away from risky and ozone-depleting HCFCs and HFCs. You can ask for a refrigeration expert to join you on a plant tour to identify the largest potential savings or you could create a competitive program between plants to come up with refrigeration recommendations and reward the winning plant.

C. Waste Management and Water Use at the Plant — how to reduce water and GHG impacts

By establishing water accounting metrics in these facilities the operations manager can monitor and

evaluate water usage and set a goal to improve water use or to reduce wastewater discharges. For example, some researchers advocate for the change in measurement from gallons per bird to gallons per 1,000 pounds of product to get a better picture of overall water use as it factors in the additional processing steps that occur in the poultry supply chain.[35] Regardless of the metric that you are using, you'll want to understand how water move throughout the processing facility. You can create a map to track major water flows and assess opportunities for enhancing the efficiency of equipment that uses water.

II. Who and how to engage through the supply chain

Despite the low-hanging fruit being within your 'four-walls,' the most pressing environmental concerns are outside of your company's plant or complex footprint. For companies who own and operate poultry farms, engagement can be made directly with the flock supervisors and regional managers to gain their insight and advise them directly on the topics in this guide.

For those without direct connection to the grower level, sustainability managers should work through the supply chain, first with your contracted poultry farmers to prioritize areas of improvement, provide technical advice, incentivize good production and animal health practices, and modernize poultry farms and technologies. Consider partnering with farm advisors and crop consultants who provide key strategic advice to poultry farmers on their production. These trusted advisors will likely have the ability to give guidance to multiple farmers. As a first step, you should identify the main advisors and consultant groups within your production regions and see what types of sustainability programming they may have already been implementing.

A critical factor for success on the ground will be connecting to and working with the farm adviser and conservation experts known and trusted by your own staff and your supplying or member farmers. These trusted agricultural service professionals will be essential for assessing and making changes on the farm, sustaining practices for full value and evaluating what those practices mean for the farm's economics and financial planning. Ag service professionals include agronomists (crop or ag consultants), resource conservation specialists (such as conservation districts, NRCS, Extension, or a consultant), ag retailers, and nutritionists.

You may have insight into operations and practices at your feed mills. If your poultry company owns feed mills, you should coordinate with your grain co-operatives to pass knowledge and innovation strategies directly to feed growers. If your company does not own or operate feed mills, you should identify your sourcing area and develop a plan to engage with the advisors who work with the poultry growers who grow their own feed or farmers that grow feed for local co-ops. Independent crop consultants, local cooperatives, and extension personnel can all provide guidance to feed grain producers. In some cases, grow-out farmers are also growing grain to feed the birds, so engagement with these farms is especially important to drive change where the grower has direct control.

Ultimately, engaging with feed grain and poultry growers is an iterative process. When considering grower engagement, you should discuss with internal sustainability partners the strategic investment your company can make to drive change in sustainability at the farm-level. You may be able to offer training, technical advice, technology trials, and other solutions to help growers make change in their operations. All of these strategies are being considered or implemented across the food and agriculture supply-chain to drive continuous improvement.

Sustainability managers should use research and external resources from this guide and industry resources, like the National Chicken Council, U.S. Poultry and Egg Association, and Sustainability Programming for Agricultural Retailers and Crop Consultants (SPARC), to educate their company about grower engagement strategies and innovative practices being implemented at the farm level.[36]

In addition to direct communication, managers should engage with applicable non-profit organizations and environmental NGOs, universities, and other established sources to reach grower groups that your company does not have direct communication with.

As a sustainability manager, you may also be managing multiple impacts from the same sources within your supply chain. Community engagement on sustainability is also a must. For example, litter from poultry houses releases ammonia, which

can cause downwind environmental issues from nitrogen loading, which we will tackle later in this section with the poultry farmer best practices. However, ammonia release has also been associated with breathing and air quality issues for workers and nearby communities. To mitigate that concern, air ventilation systems and appropriate practices are put into place to address the issue. Taking this example into consideration, there may be multiple groups to engage on different solutions for a single concern.

As stated earlier, you can significantly enhance farmer participation by communicating the value to them of participating: the economic value of many conservation practices, the value to better sustained yields over time and in the face of challenging weather, the ability to get out from under concerns or pressure from regulations, the opportunity to boost community perceptions of agriculture, and the opportunity to solidify their good standing in a marketplace increasingly interested in sustainability. Partnering with a grower association or non-governmental organization with experience sorting through and accessing those programs can ease the stress on your cooperative or processor staff and bring help to you in advancing your program overall.

Note that your company is required to follow the Grain Inspection, Packers and Stockyard Act regulations that details the independent contractor relationship. There are regulations regarding what poultry companies can and cannot tell growers to do at their operations, but you can engage poultry growers in educational forums or offer incentives for certain practices.

Connect to farmers' ag service professionals

Working with and through your farmers' ag service professionals will significantly enhance engagement with farmers and secure long-term success. You will want to involve the people your farmers rely upon for guidance when it comes to what practices to implement and how to pay for those practices. This includes an array of agricultural service providers, including agronomists, crop or ag consultants, ag retailers, conservation districts, nutritionists, Extension and university experts, and NRCS staff, as well as the farmer's banker and accountant. You will not need to interact with all of these advisers, but they represent key players in the farmer's team of advisers.

Work with your staff and trusted experts to develop a way to identify the leading ag service professionals working with your member or supplying dairy farmers and develop ways to communicate with those advisers. To identify the ag service professionals, talk with your staff who work regularly with farmers or survey a representative sample of your member or supplying poultry farmers. Once you have a list of these ag service professionals, develop communications channels with those advisers based on their preference for email, phone, text, or other. We recommend you meet with the advisers, as a group or individually, to share with them your goals and the role you hope they will play in working with the farmers to implement and track progress.

Engaging supply chain partners — Actions to consider and questions to ask

1. Identify leaders in your production supply-chain; where is peer-to-peer learning happening? Reach out and facilitate collaboration with supply chain leaders to enhance your own knowledge of available resources and peer-to-peer learning.

2. Assess the local conditions in the growing region; what existing programs through USDA, state programs, extension, etc. are working that you can leverage? Based on the region your growers are located in, create an accessible list that can be distributed to individual growers to encourage adoption.

3. Consider your community; how can you engage the community of growers across your supply-chain to encourage best management to help reach goals? Supporting community growers is a first step to engaging them on best management practices — reach out to growers to identify 'pain points' they are facing, and support them in those areas first to gain trust before directly addressing best management practices.

4. Poultry companies should engage independent poultry growers and grain farmers to encourage the adoption of industry best management practices, especially in the areas of tillage practices, nutrient management, updating and maintaining farm equipment, and adopting renewable energy practices. Engaging farmers directly or through support of grain co-ops in the applicable region is an ideal place to begin showing support and fostering engagement.

Where it is feasible, you should consider forums with independent growers where they can share information through workshops, best practices, and support to pilot new technologies. Any engagement must be met with open dialogue on what the value proposition is on the farm.

A. Feed production — how to reduce GHGs and water impacts from nutrient, soil, and water management

There are many opportunities to work with grain farmers in your grain sourcing region to optimize fertilizer use and enhance soil management to increase overall feed production sustainability: offer innovative technology trials, partner with an agricultural retailer or grain aggregator to offer technical assistance to farmers, or provide agronomic assistance directly to farmers. Such efforts are most likely to be successful when your grain procurement team is involved in their design and implementation. If you don't work with a grain procurement team, you may want to consider working with some of the larger feed grain aggregators that will supply your poultry farms to assess what sustainability programming they are currently implementing and encourage or support those without programs to create them. For more resources to share with you supply chain partners, check out Appendix I.

B. Litter management — how to reduce water and GHG impacts by understanding and managing litter

Appropriately applying poultry litter as a crop nutrient is both an opportunity and a challenge for poultry producers and grain farmers. While poultry litter is a valuable input for crop production and can be an extra revenue stream for their business, it can also be a cost center if litter needs to be transported to appropriate crop land and some growers have limited options for where to apply litter on the landscape for crops.

As a first step, you can identify ways to incentivize growers to benchmark litter management conservation practices. Through the benchmarking process, growers can identify areas where additional conservation practices or changes in litter management will provide the most effective potential for reduction in GHG emissions or water quality impacts. Undertaking a program for continuous improvement of the sustainability of litter management through annual surveys of conservation practices can drive sustainability improvements over time.

NRCS has valuable litter management guidance and local cooperative extension staff can provide region-specific advice.[37] The US Poultry and Egg Association also has training programs to help in the management of GHG emission and water pollution prevention, which you could sponsor on behalf of your poultry producers. Consider hosting a training program in partnership with a local cooperative or agricultural retailer location.[38] For more litter management resources, check out Appendix II.

C. On-farm equipment — how to improve energy efficiency, renewable energy, and water use

Utilizing precision agriculture technology and applying best practices around running and maintaining farm equipment can be a quick win for decreasing greenhouse gas emissions or improving water use efficiency. Sustainability managers at poultry companies can determine why technologies could be most beneficial to growers in their supply chain and test projects that invest in their implementation or loan out equipment to grain growers. You should share these resources with any grain or poultry growers you have direct connections to, or work with your farm managers and flock supervisors down the supply chain to share this information with contract growers. For more resources, check out Appendix III.

Engaging growers on litter management practices

To help your engagement with growers, major livestock commodity groups and protein companies, together with EPA, have published resources through the Animal Agriculture Discussion Group. These are helpful resources to use when engaging internally and with independent farmers on litter management, GHGs, and water quality.

1. Fact Sheet: https://www.epa.gov/sites/production/files/2017-06/documents/aadg_factsheet_-_june2017.pdf
2. Beneficial Uses of Manure and Environmental Protection: https://www.epa.gov/sites/production/files/2015-08/documents/beneficial_uses_of_manure_final_aug2015_1.pdf
3. U.S. Poultry and Egg Videos on Nutrient Management and Water Quality: https://www.youtube.com/user/USPOULTRY/search?query=E2P2

D. Water use at the poultry barn

Working with poultry farms or with trusted advisors, consider these steps to assess water use:

1. Establish whether a grower already has water meters in use at their operation.

2. If growers do not have water meters established at their operations, encourage implementation of meters. With your production managers and/or flock supervisors, you may even consider investing in water meters to be installed at operations in your supply chain.

3. If growers do have water meters, encourage them to track their water use on a monthly basis to identify trends in use and track changes based on time of year, maintenance actions, and equipment updates.

Creating reporting and evaluation structures to track and revise your plan

Once goals are created and programs are implemented, it is important to publicly report progress on goals in a yearly sustainability report. A yearly sustainability report is a way to report out to internal and external stakeholders the outcomes and performance of your sustainability program. It is important that your sustainability report reflects the vision, purpose, and goals you've set out to accomplish in your program. Data-driven metrics are valuable, but only if those are paired with a commitment to improvement and evaluation over time. When engaging with your supply chain partners to implement these practices and track progress, you'll want to develop clear mechanisms so that your farmers or plants can contribute their stories to the broader sustainability report. You can create your own excel-based documents and reporting systems and request quarterly, semi-annual, or more likely, seasonal updates from your partners. You may also find it beneficial to partner with technology companies to do the data collection, aggregation and analysis to consolidate into an annual report. Making sure that all parties are aware of reporting responsibilities and timelines is important to ensure quality data is reported.

After each report is complete, provide feedback to all supply chain partners involved on the results of the report and on ways you intend to revise the overall sustainability plan to accommodate barriers and challenges projects have faced through the year. Some companies find it best to create and distribute a newsletter to all of the growers, agricultural retailers, coops, and advisors that they engage with. Others hold regular meetings to share results at their operations and facilities. Regardless of the method, keeping the lines of communication open with those who are contributing to the success of your sustainability plan is essential.
The steps above provide guidance for how your poultry company can establish an effective and lasting sustainability program encompassing the whole business. In the appendices that follow, we provide additional resources on sustainability topics and management practices to consider while engaging growers at the farm and feed production levels.

For more detail on how to build and implement a sustainability program, visit the EDF Supply Chain Solution Center.

On-Farm water quality checklist for litter management

To help your engagement with growers, here is a quick checklist that poultry producers can use to think about litter management.

1. Evaluate litter management, commodity storage and management, storm water, and mortality management. Identify any problem areas on the farm.
2. Assess status of litter balance or excess. Develop plan to export or alternative use for excess beyond what the farm can use appropriately in feed production.
3. Evaluate litter management: storage needs, barnyard management, application practices, excess litter and need to export.
4. Develop and implement plan for implementing improvements.
5. Annually evaluate the plan, identify improvements, continue to refine and identify opportunities for further improvement.

Appendices —

Resources for grower engagement

As you're developing your program and beginning to engage with growers and their trusted advisors, use these resources as a starting point to expand the variety of solutions that your team can provide.

Appendix I. Resources on feed production — nutrient management and nutrient management planning

Share these resources with interested crop consultants or feed grain producers in your supply chain. A well-managed NMP/CNMP is a meaningful resource for growers because they can make effective and efficient input decisions; and, meaningful for the poultry producer and your company because there is assurance that the litter is applied appropriately for plant use, and won't be excessively applied and run into sensitive waterways.

For you, as the sustainability manager working with customers and stakeholders, NMPs/CNMPs are a vital resource. Though they are not yet regulated in every state, they help you document and demonstrate that farms are judiciously using nutrient inputs, conducting soil testing, and applying manure under best management and precision applications. This recordkeeping helps provide verification throughout the system that these practices are being employed on-farm and help growers manage the continuous improvement process.

1.NRCS assistance on Certified Nutrient Management Plans through EQIP

The National Resource Conservation Service (NRCS), a U.S. government agency, offers cost share assistance for CNMPs through the Environmental Quality Incentives Program, or EQIP. Through co-ops or direct grower engagement, you should encourage growers to reach out to their local NRCS offices to see what funding is available for their farm for nutrient management activities. Details for local offices and types of funding available can be found at www.nrcs.usda.gov. NRCS also offers funding for implementation of other key environmental sustainability practices beyond Comprehensive Nutrient Management Plans.

2. University of Georgia extension guidance for poultry growers

University of Georgia Extension publishes an outline with information needed for poultry growers to develop their own Nutrient Management Plans. Crop consultants and environmental planners are also available to assist growers with their NMPs, but to develop a CNMP, growers must utilize writers that are certified technical service providers. At a minimum, these plans should include information about:

- How nutrients are generated and handled at the operation
- What types of crops are grown at the operation and information about when and how litter is applied to crops
- Phosphorus-Index Calculation Components including the depth to water table, estimated annual field erosion rates, and runoff estimations
- Other information about their operation, including annual mortality and disposal methods, emergency plans and phone numbers, and contingency plans for mass mortality disposal

Appendix II. Resources on litter management

1.How to conduct a nutrient analysis of litter

Because the nutrient content (specifically the N:P ratio) of poultry litter is less predictable than chemical fertilizers, and the nitrogen to phosphorus ratio is not always aligned to crop needs, it is important to conduct nutrient analysis on litter. Given concerns of phosphorus accumulation in soils with regular litter application, farmers should be aware of soil phosphorus levels when considering litter application. Many states have phosphorus index calculators to help farmers understand appropriate phosphorus limits on their land (for example: The Phosphorus Index).

There are a number of resources for calibrating spreaders and conducting nutrient analysis so that

litter is used wisely and appropriately:

i. University of Georgia Calibration of Manure Spreaders
ii. Mississippi State University Calibrating Poultry Spreader Equipment
iii. North Carolina Department of Agriculture

2. Resources to understand government subsidies

While regulatory pressures are not new to poultry and crop farmers, new pressures from increased scrutiny will potentially affect their bottom line. For example, new alternatives to improve the water quality in Lake Erie following harmful algal blooms over the past few years are being considered. The state of Ohio aims to achieve a 40% reduction in phosphorus flowing into the lake. A recent study from The Ohio State University shows that nearly half of the phosphorus going into Lake Erie can be eliminated by taxing farmers on phosphorous purchases, or by paying farmers to avoid applying to their fields. This tax or subsidy model, while estimated to cost up to $20 million annually, would be the least costly of the many potential measures being considered to reduce phosphorus run-off. Other measures being considered, such as reducing application on fields by 50% statewide or tilling phosphorus into the soil, are more expensive to farmers by reducing potential yields and for machinery needed to incorporate phosphorus. Some other measures for nutrient management have been tried and have had little impact on reducing phosphorus. This means the state, as well as stakeholders and the public, are at a tipping point for change. The problem is made worse by the fact that climate change can increase the amount of intense rainfalls over short periods, which can worsen efforts to keep phosphorus from running off a field into the lake or surrounding tributaries.[39]

Appendix III. Resources for on-farm equipment improvements

1. Energy Efficiency Improvements — The NRCS Environmental Quality Incentives Program (EQIP)

To help independent contract growers, the EQIP program provides financial assistance for certain energy retrofits at the operation. To participate in this program, growers must have completed and passed an energy audit at their operation. Through EQIP, NRCS provides growers with financial resources and one-on-one help to plan and implement improvements. Through EQIP's On-farm Energy Initiative, farmers and ranchers can receive financial assistance to inventory and analyze farm systems that use energy and identify opportunities to improve efficiency through the development of an Agricultural Energy Management Plan (AgEMP). This plan provides information to growers, including:

- Itemized energy use by individual systems to establish a baseline for electricity and other fuel improvements;
- Recommendations for equipment improvements and upgrades;
- Potential energy reductions and financial savings for each recommendation;
- Cost estimates of potential improvements; and,
- Length of expected payback for energy efficiency updates

2. Renewable Energy — Rural Energy for America Program (REAP)

The Rural Energy for America program provides guaranteed loan financing to agricultural growers with at least 50% of income coming from agricultural operations or in an area other than a city or town with a population greater than 50,000 residents.

If selected, growers can use the funds in two ways:

1. Implementation of Renewable Energy Systems, including:
    a. Wind Energy
    b. Solar Energy
    c. Biomass (i.e. Digesters)
2. For the purchase, installation, and construction of energy efficiency improvements, such as:
    a. High efficiency heating, ventilation, and air conditioning systems
    b. Improved insulation and/or lighting
    c. Replacement of energy-inefficient equipment

Notes

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[4] https://www.prnewswire.com/news-releases/companies-commitment-to-social-responsibility-influences-buying-decisions-more-than-price-300773358.html

[5] Putman et al. A retrospective analysis of the United States poultry industry: 1965 compared with 2010.

[6] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

[7] This guide focuses on the key environmental topics of greenhouse gases, water quality, and water quantity. Additional related issues to consider that are not addressed in detail in this guide include labor and animal welfare.

[8] https://nca2014.globalchange.gov/report/sectors/agriculture

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[21] http://www.uspoultry.org/research/resproj/PROJ_677.html

[22] https://www.epa.gov/sites/production/files/2015-07/documents/what_technicians_and_contractors_need_to_know_about_phasing_out_hcfc_refrigerants_to_protect_the_ozone_layer.pdf

[23] https://www.govinfo.gov/content/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapVI-sec7671k.htm

[24] https://waterfootprint.org/en/water-footprint/product-water-footprint/water-footprint-crop-and-animal-products/

[25] https://www.ceres.org/our-work/water/water-and-agriculture/cereswwf-agwater-challenge

[26] To satisfy supply-chain KPIs, NMPs must meet the criteria of EPA / USDA for Comprehensive Nutrient Management Planning (CNMP) or the Farmer Sustainability Assessment of the Sustainable Agriculture Initiative (available at http://www.fsatool.com/), or equivalent.

[27] Stakeholder Outreach Interviews, 5/2/18 and 5/17/18

[28] USDA Economic Research Service. Cost Savings from Precision Agriculture Technologies on U.S. Corn Farms. Accessed online: https://www.ers.usda.gov/amber-waves/2016/may/cost-savings-from-precision-agriculture-technologies-on-us-corn-farms/

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