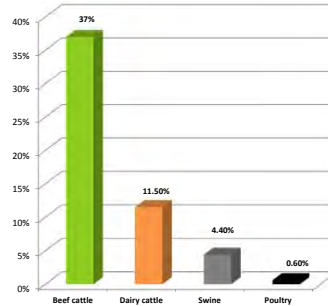


Carbon Foot-print of Poultry Production Farms

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GHG Emissions from Animal Agriculture (EPA 2010)

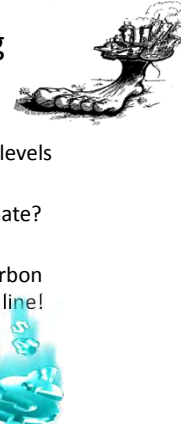
- Agriculture is responsible for 6.3% of the GHG emissions in the US
- Of this 6.3%, 53.5% comes from animal agriculture



| Animal | Percentage of Total Emissions |
|--------------|-------------------------------|
| Beef cattle | 37% |
| Dairy cattle | 11.50% |
| Swine | 4.40% |
| Poultry | 0.60% |

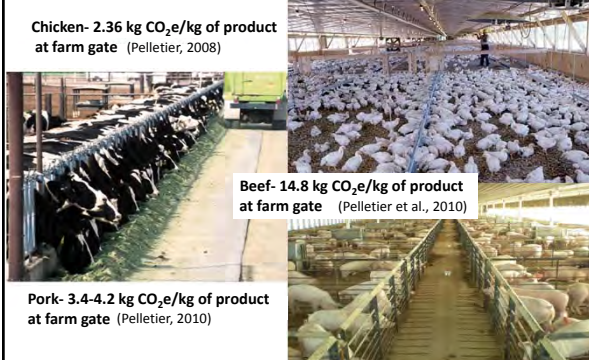
Global Warming

- Real or imagined?
 - There has been an increase in the levels of certain gasses
 - Impacts of these gases on the climate?
 - Knowing the carbon footprint and energy use can help reduce the carbon footprint and improve the bottom line!




Recent findings

- Chicken- 2.36 kg CO₂e/kg of product at farm gate (Pelletier, 2008)
- Beef- 14.8 kg CO₂e/kg of product at farm gate (Pelletier et al., 2010)
- Pork- 3.4-4.2 kg CO₂e/kg of product at farm gate (Pelletier, 2010)




Carbon Footprint?

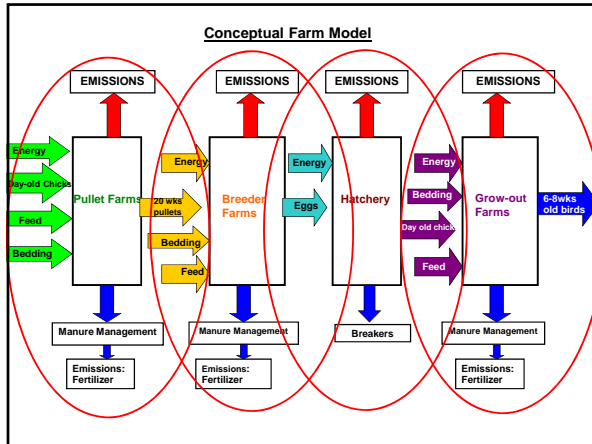
- Your carbon footprint is a measure of the amount of GHGs that are being emitted into the atmosphere because of your activity or product.
- The gasses of particular concern in animal agriculture are;
 - CO₂
 - *CH₄
 - *N₂O
- *They are expressed in carbon equivalents (CO₂e)
 - CH₄:CO₂= 25:1 GWP
 - N₂O:CO₂= 298:1 GWP



Life Cycle Assessment (LCA)

- An inventory of the material and energy inputs and emissions associated with each stage of production (Guinee, 2001).
- "Cradle to grave" energy use
 - Fertilizer production
 - Corn/soy production
 - Transportation of corn/soy
 - Feed additives manufacturing
 - Feed additive transportation
 - Feed production and transportation to production farms
 - Pullet facility
 - Breeder facility
 - Hatchery
 - Grow-out farms
 - Transportation to processing plant
 - Processing
 - Distribution to retail customers
 - Consumer....





Types of Emissions

- **Mechanical**
 - Purchased Electricity
 - Mobile machinery
 - Stationary machinery
- **Non-mechanical**
 - Enteric fermentation
 - Manure management

Georgia Study

- Not a LCA study!
Boundaries were set at the farm gate.
(Information collected is considered the base period).
- A total of 109 farms with 627 houses were tested:
 - Broiler- 87 farms, 538 houses
 - Breeder- 15 farms, 55 houses
 - Pullet- 7 farms, 34 houses

CO₂ emissions Assessed

- **Utilization of fossil fuels:**
 1. Purchased electricity- (*indirect emissions*)
 2. Propane use in furnaces, incinerators,
 3. Diesel use for generators, trucks, tractors etc.

Data Collection and Evaluation

- Survey distributed to growers
- Activity data collected based on questions answered from survey, including:
 - Electricity usage
 - Propane use
 - Diesel oil use
 - Age of house
 - Construction of house
 - Number of birds raised each year, etc.
- GHG emissions evaluated using IPCC spreadsheets some of which were pre-populated with emission factors.

CH₄ emissions assessed

- **Utilization of fossil fuels:**
 1. Purchased electricity- (*indirect emissions*)
 2. Propane use in furnaces, incinerators,
 3. Diesel use for generators, trucks, tractors etc.

N₂O emissions assessed

- **Utilization of fossil fuels:**
 1. Purchased electricity- (indirect emissions)
 2. Propane use in furnaces, incinerators,
 3. Diesel use for generators, trucks, tractors etc.

Non-mechanical CH₄ emissions

- **Enteric fermentation:**
 - CH₄ is a part of the normal digestive processes in animals
 - Significantly less in birds and other non-ruminants than ruminants
- **Manure management:**
 - Anaerobic decomposition of manure produces CH₄

Mechanical Emissions

- ~96% of GHG emitted on broiler and pullet farms is from propane use
- ~82% of GHG emitted on breeder farms is from electricity use

| House Type | Stationary Combustion (%) | Transportation Fuel (%) | Purchased Electricity (%) |
|---------------|---------------------------|-------------------------|---------------------------|
| Broiler House | ~96 | ~0 | ~4 |
| Breeder House | ~18 | ~5 | ~77 |
| Pullet House | ~96 | ~0 | ~4 |

Non-mechanical CH₄ emissions

- Most of the poultry manure is stored in dry storage under aerobic conditions
- CH₄ production from animal manure increases with temperature

Mechanical Emissions

- Avg. broiler house emits ~790 tonne CO₂e
- Avg. breeder house emits ~35 tonne CO₂e
- Avg. pullet house emits ~448 tonne CO₂e

| House Type | Stationary Combustion | Transportation Fuel | Purchased Electricity |
|---------------|-----------------------|---------------------|-----------------------|
| Broiler House | ~790 | ~0 | ~10 |
| Breeder House | ~10 | ~5 | ~20 |
| Pullet House | ~448 | ~0 | ~10 |

Non-mechanical N₂O emissions

- **Manure Management:**
 - **Direct emissions** from nitrification and denitrification of the organic nitrogen in the manure and urine
 - **Indirect emissions** from volatilization, run-off and leaching of nitrogen during treatment storage and transportation
 - N₂O emission will occur in manure that is stored aerobically

Non-mechanical N₂O emissions

- N₂O emissions are influenced by environmental factors;
 - Oxygen status
 - Temperature
 - Moisture content

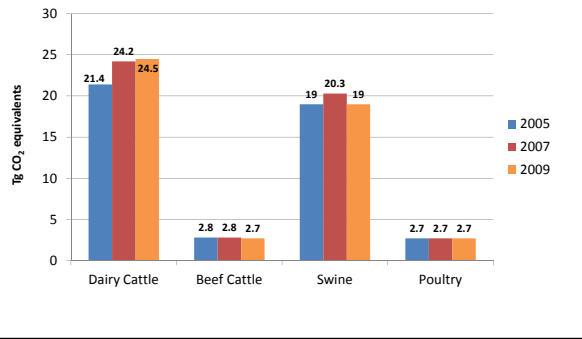


- Mixture of manure and bedding combined with the partial compaction of the bedding creates a condition that favors passive aeration- results in uncontrolled nitrification and denitrification

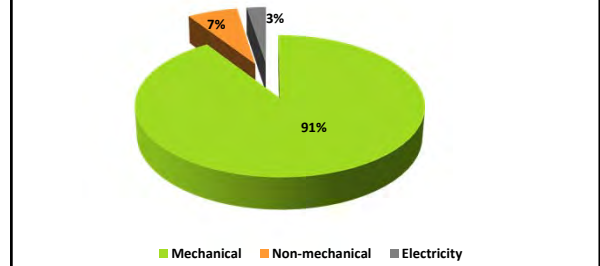
GHG Inventory- Broiler House

| Emissions Categories | GHG Emissions (metric tonnes) | | | |
|-----------------------|-------------------------------|-----------------|------------------|-------------------|
| | Base Period: 2009 | | | |
| | CO ₂ | CH ₄ | N ₂ O | CO ₂ e |
| Scope 1 | | | | |
| Mechanical | | | | |
| Mobile Machinery | 2.58 | 0.0004 | 0.00007 | 2.58 |
| Stationary Machinery | 764.91 | 0.0606 | 0.0012 | 766.783 |
| Total | 767.49 | 0.061 | 0.00127 | 769.363 |
| Non-mechanical | | | | |
| Enteric fermentation | - | - | - | - |
| Manure management | - | 0.32 | 0.1614 | 56.1 |
| Total | - | 0.32 | 0.1614 | 56.1 |
| Total Scope 1 | 767.49 | 0.381 | 0.16267 | 825.463 |
| Scope 2 | | | | |
| Purchased Electricity | 21.52 | 0.0004 | 0.0004 | 21.54 |
| Total Scope 2 | 21.52 | 0.0004 | 0.0004 | 21.54 |
| Total Scopes | 789.01 | 0.3215 | 0.16307 | 847.003 |
| Total Mechanical | 767.49 | 0.061 | 0.00127 | 769.363 |
| Total Non-mechanical | - | 0.32 | 0.16267 | 56.1 |

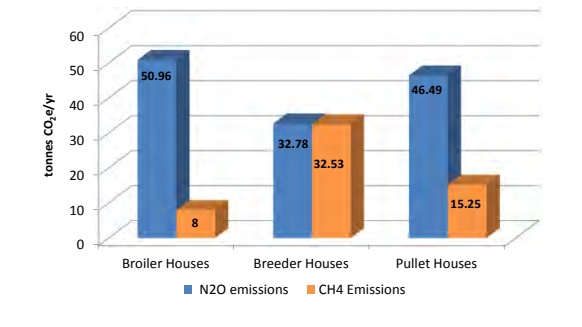
N₂O emissions from manure management- (EPA 2010)



Broiler House Emissions

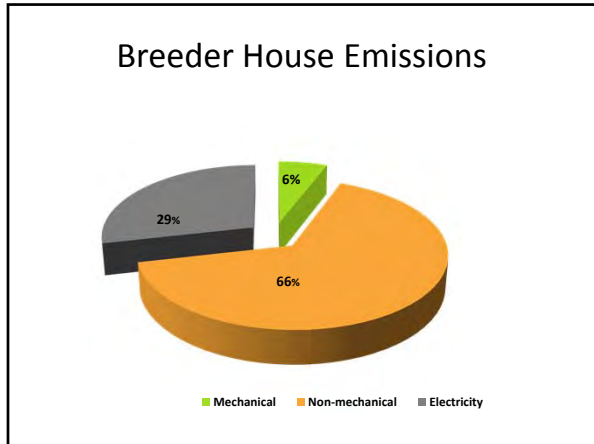


Non-Mechanical Emissions



GHG Inventory- Breeder House

| Emissions Categories | GHG Emissions (metric tonnes) | | | |
|-----------------------|-------------------------------|-----------------|------------------|-------------------|
| | Base Period: 2009 | | | |
| | CO ₂ | CH ₄ | N ₂ O | CO ₂ e |
| Scope 1 | | | | |
| Mechanical | | | | |
| Mobile Machinery | 4.612 | 0.001 | 0.0001 | 4.66 |
| Stationary Machinery | 1.38 | 0.00011 | 0.00002 | 1.39 |
| Total | 5.992 | 0.00111 | 0.00012 | 6.05 |
| Non-mechanical | | | | |
| Enteric fermentation | - | - | - | - |
| Manure management | - | 1.3 | 0.1165 | 67.22 |
| Total | - | 1.3 | 0.1165 | 67.22 |
| Total Scope 1 | 5.992 | 1.30111 | 0.11662 | 73.27 |
| Scope 2 | | | | |
| Purchased Electricity | 29.13 | 0.0005 | 0.0005 | 29.292 |
| Total Scope 2 | 29.13 | 0.0005 | 0.0005 | 29.292 |
| Total Scopes | 35.122 | 1.30161 | 0.11712 | 102.562 |
| Total Mechanical | 5.992 | 0.00111 | 0.0002 | 6.05 |
| Total Non-mechanical | - | 1.3 | 0.1165 | 67.22 |

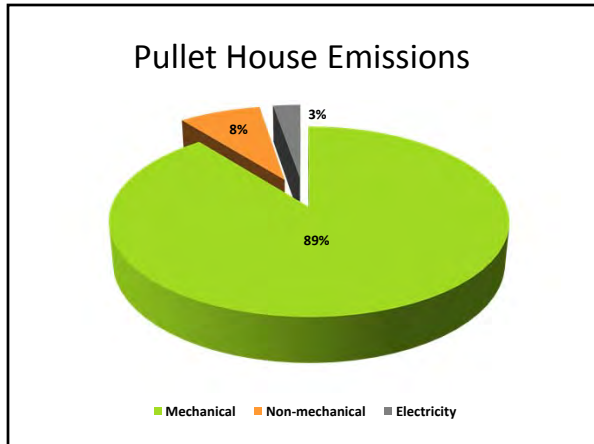
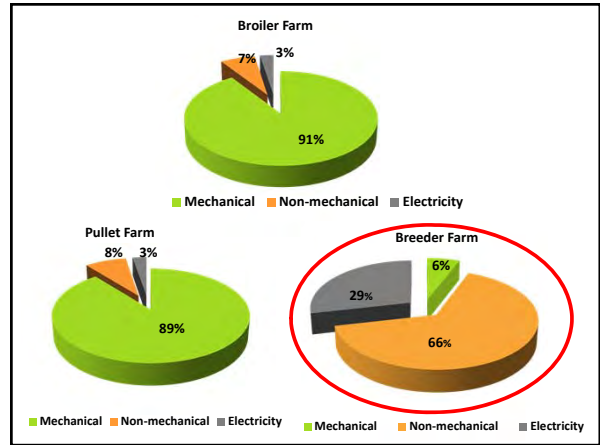


Reducing GHG emissions

- Reducing energy use will also reduce the amount of GHGs that is emitted
- Reduction must to be done on a farm by farm basis
- Reduce propane use by preventing heat loss;
 - Enclose houses that are not solid walls
 - Insulate curtain openings, walls and ceiling

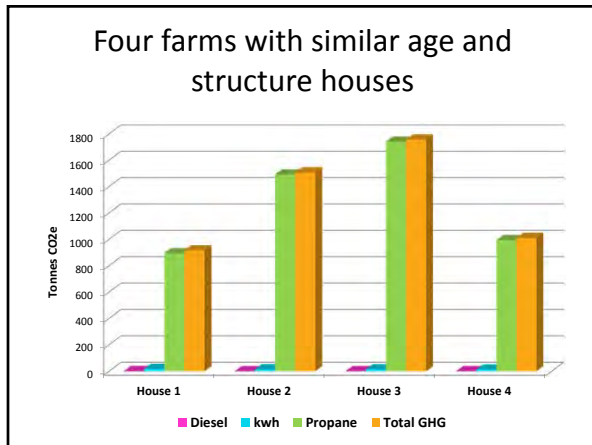
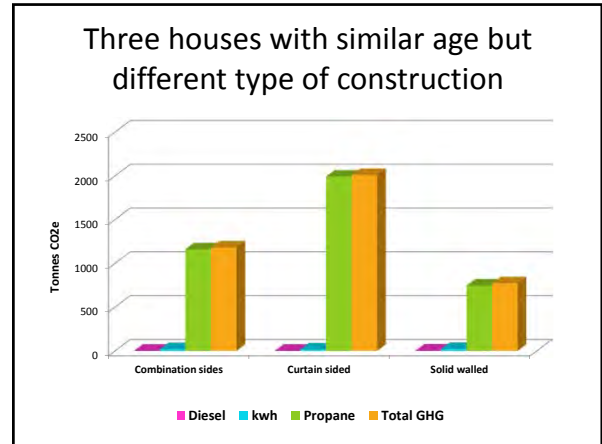
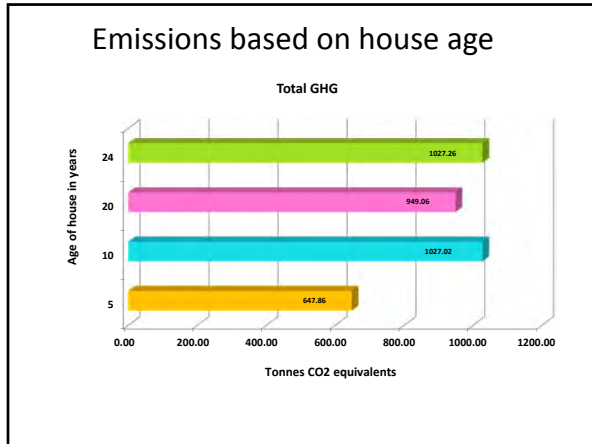
GHG Inventory- Pullet House

| Emissions Categories | GHG Emissions (metric tonnes) | | | |
|-----------------------|-------------------------------|-----------------|------------------|-------------------|
| | CO ₂ | CH ₄ | N ₂ O | CO ₂ e |
| Base Period: 2009 | | | | |
| Scope 1 | | | | |
| Mechanical | | | | |
| Mobile Machinery | 1.33 | 0.0002 | 0.00003 | 1.344 |
| Stationary Machinery | 434.37 | 0.0014 | 0.00034 | 434.506 |
| Total | 435.7 | 0.0016 | 0.00037 | 435.85 |
| Non-mechanical | | | | |
| Enteric Fermentation | - | - | - | - |
| Manure management | - | 0.61 | 0.079 | 38.79 |
| Total | - | 0.61 | 0.079 | 38.79 |
| Total Scope 1 | 435.7 | 0.6116 | 0.080 | 474.64 |
| Scope 2 | | | | |
| Purchased Electricity | 12.96 | 0.0002 | 0.0002 | 13.03 |
| Total Scope 2 | 12.96 | 0.0002 | 0.0002 | 13.03 |
| Total Scopes | 448.66 | 0.6118 | 0.0802 | 487.67 |
| Total Mechanical | 435.7 | 0.0016 | 0.00037 | 435.85 |
| Total Non-mechanical | 0 | 0.61 | 0.079 | 38.79 |



Reducing GHG emissions

- Reducing energy use will also reduce the amount of GHGs that is emitted
- Reduction must to be done on a farm by farm basis
- Reduce propane use by preventing heat loss;
 - Enclose houses that are not solid walls
 - Insulate curtain openings, walls and ceiling



Reducing GHG emissions

- Use the attic area as a solar energy collector;
 - Install attic outlets
- Use more efficient equipment such as;
 - Fans, generators, lighting, heaters
- Maintenance of equipment;
 - Clean fans
 - Clean outlets/inlets
 - Change fan belts as needed

Reducing GHG emissions

- Reducing energy use will also reduce the amount of GHGs that is emitted
- Reduction must be done on a farm by farm basis
- Reduce propane use by preventing heat loss;
 - Enclose houses that are not solid walls
 - Insulate curtain openings, walls and ceiling

Reducing GHG emissions- Manure Management

- CH₄
 - Manure handled as a solid or spread on land, decompose aerobically and produce little or no CH₄
 - Proper management of bedding (indoor) and manure heaps (in storage sheds) will reduce GHG emissions
 - Avoid prolonged litter storage to reduce CH₄ emissions
 - Minimize compaction
 - Frequent addition of litter
 - Keep litter dry and covered from the elements

Reducing GHG emissions- Manure Management

- N₂O
 - Add nitrification inhibitors to reduce NH₃ emissions
 - Addition of high carbon substrate to manure heaps
 - **Compaction of manure heap to reduce aeration**



Alternative Energy Sources

- These have also been considered;
 - **Wind:** not accessible to all, not practical in all areas
 - **Biomass:** has a low power density, could not be used to power farm, could be used to heat houses



Reducing GHG emissions- Manure Management

- N₂O emission from poultry litter is higher than synthetic fertilizer...but,
- Applying poultry litter to agricultural fields offsets 10% energy use and 1% GHG emissions



Questions?



Alternative Energy Sources

- **Solar:** considered to be expensive to implement with a high cost of recovery
- Solar wall can be used to generate electricity and heat and possibly cool houses
- \$39,000 – \$45,000 for a 500X50 sq. ft. house
- Can be retrofitted to older houses

