

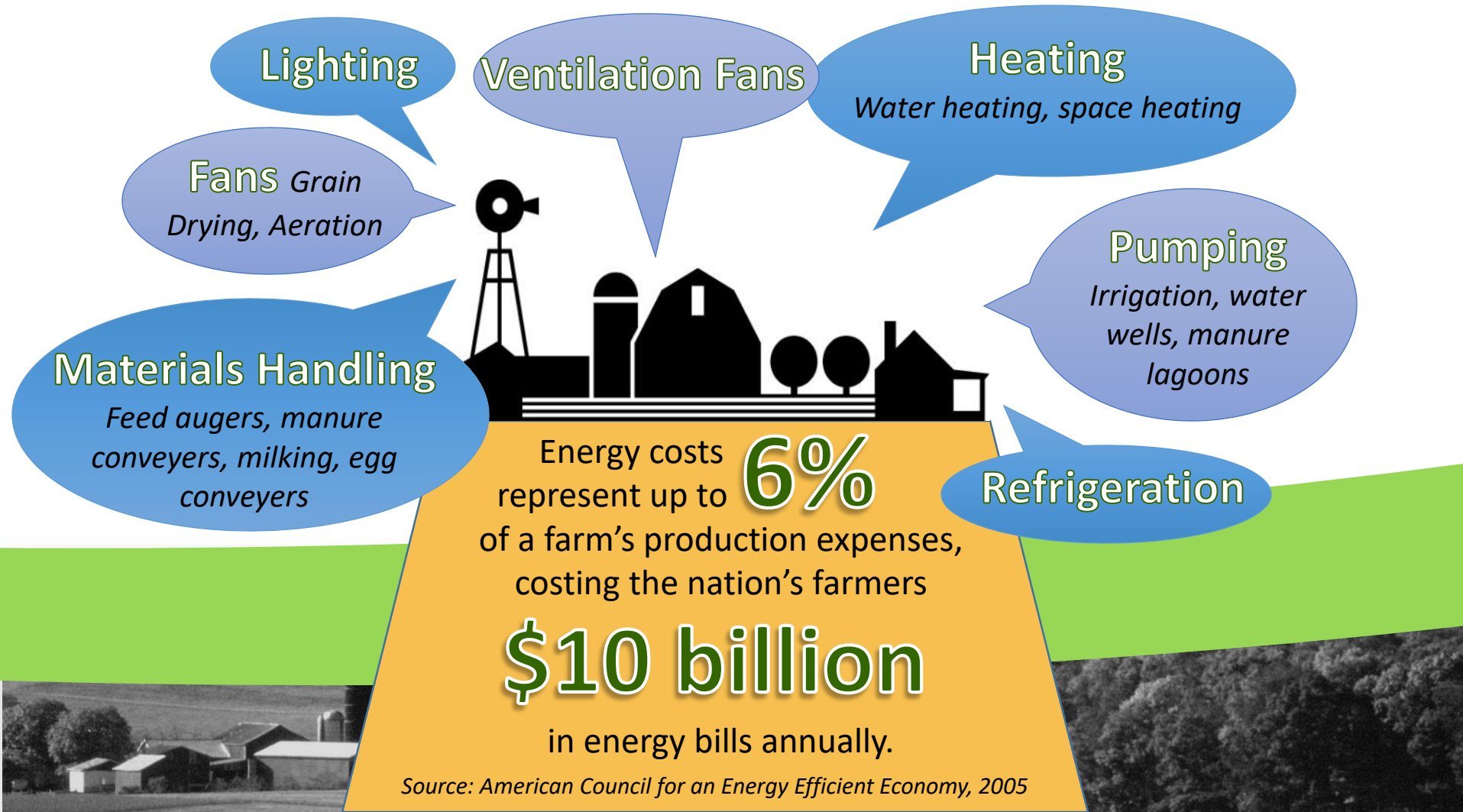


Energy Efficiency on the Farm

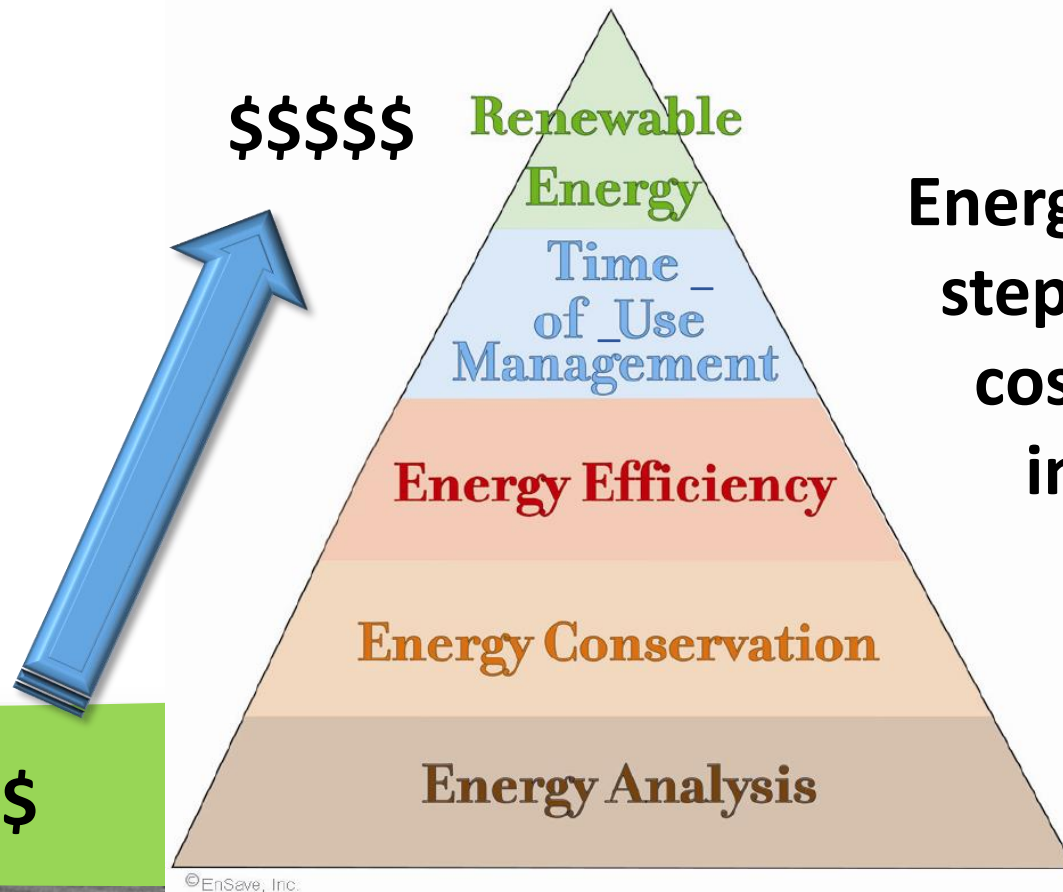
June 14, 2017

Josh Ludgate (Exact Energy Inc.) and Erin Puryear (ODEC)

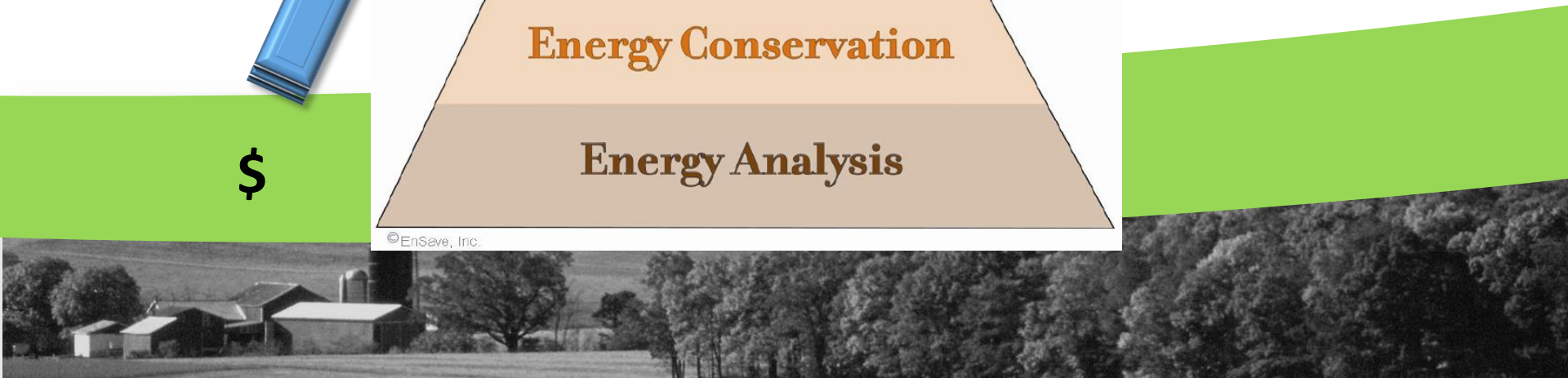
- How do farms use electricity?

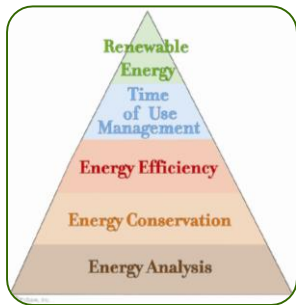


Where are the savings?



**Energy-saving
steps, arranged by
cost/benefit of
improvements**

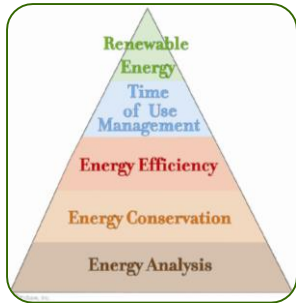




- **Step One: Energy Analysis**

By having an audit or assessment done (or doing an assessment on your own), opportunities to reduce energy use and costs can be identified.

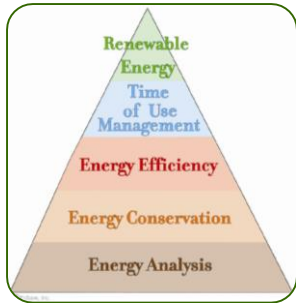




• Step Two: Energy Conservation

The easiest way to conserve energy is to change current behavior: turn off lights if no one's using them, unplug unused equipment, and turn the thermostat lower in the winter and higher in the summer.

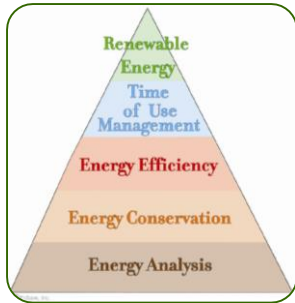




- **Step Three: Energy Efficiency**

The third level on the energy pyramid is energy efficiency, performing the same services while using less energy. Work smarter and save money with more energy-efficient equipment!

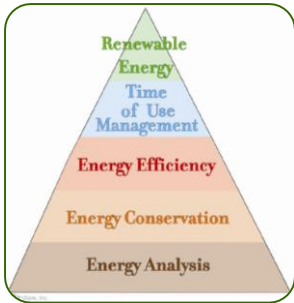




- **Step Four: Time-of-Use Management**

Electricity costs can vary over the course of the day. Running equipment during peak hours can be costly. By running equipment during off-peak hours, money and energy can be saved.





- **Step Five: Renewable Energy**

The last step is renewable energy, using resources that are naturally replenished. Solar power, wind power, hydropower, and biofuels (like methane) are examples.



ODEC and the distribution electric cooperatives wanted to offer programs and savings opportunities to the agribusiness sector.

- Collaborations began as early as 2007 to identify ways to provide assistance to the agribusiness sector to enhance the energy efficiencies of their operations.
- Included in the initial meetings were DMME, USDA-RD, ODEC, SVEC, JMU, and Virginia Cooperative Extension Services



Audits are a great first step, but . . .

- Budgets are slim
 - Audits tell the farmer what he / she needs to do, but actual implementation of those improvements can be cost prohibitive.
- Through our collaborative efforts, we learned that USDA-RD and USDA-NRCS had funding available through grants and guaranteed loans to assist this sector
- In 2013, Virginia Cooperative Extension Service was granted funding through the Virginia Tobacco Commission to support farm energy efficiency in Southside and Southwest Virginia.
- ODEC began supplementing those funds to offer workshops throughout the Commonwealth.



Education and Awareness. . .

- In conjunction with VA Cooperative Extension Services, USDA-RD, USDA-NRCS, Exact Energy and JMU, ODEC began offering energy efficiency workshops by sector.
- The format:
 - Energy expert on best practices and new & emerging technologies for energy efficiency operations
 - Description of the audit process
 - Funding opportunities, both grants and guaranteed loans, through USDA-RD and USDA-NRCS



Education and Awareness. . . (cont'd.)

- Sectors included poultry, dairy, swine, wineries/cideries, greenhouses, and tobacco.
- Additionally, VA Cooperative Extension Services has held many education programs on lighting, emergency generation, ground source heat pump systems, boiler systems, RETScreen training, and solar and wind systems.



Next Steps

- In 2015-2016, our energy group discussed the availability of engaging poultry producers whom Exact Energy had previously audited
- Our plan was to install LED bulbs and metering equipment to see how much these bulbs saved energy and if this technology increased or decreased production rates.
- We focused on a small sample of producers that had not made the conversion from Incandescent and CFL bulbs to LED bulbs



Test Farms

- The farms identified were of typical size, utility rate structure, average aged and condition.
- The houses on each farm were located next to each other to better monitor production and energy consumption rates
- The only difference was one of the farms studied was a “breeder” farm rather than a “broiler” farm



Difference Between Farm Operation

Broiler Farm:

- Typically 5-6 flocks per year per house
- Average flock period can range from: 42-60 days

• Breeder Farm:

- Typically 2 flocks per year per house
- Average flock period is 600-660 days



Broiler Farm:

- Delivered to the farm at 1-2 days old
- Produce meat chickens for human consumption
- Intense amounts of Propane or Natural Gas consumed
- Heavy Energy Intensive (ventilation and tunnel fans)
- Medium Energy Intensity (lighting and feed motors)



Breeding and Egg Laying Farm:

- Delivered to the farm at 18 - 22 weeks old
- Produce eggs for human consumption
- Produce eggs for integrator broiler progeny
- Rarely any Propane or Natural Gas consumed (southeast states)
- Medium Energy Intensive (heavy on tunnel fan and lighting kw/kWh)



Broiler Lighting Requirements:

- 1-2 foot candles at bird height for the first week
- 0.5 foot candles for duration of flock
- “Brooding” chamber has extra lights down the center to direct birds to feed and water
(7-10 days 20-24 hours of light)
- Grow-Out period lasts for up to 18 days
(20-24 days of 18 hours of light)
- Whole House period lasts until birds are sold
(20-30 days of 18 hours of light with dimming)



Typical Lighting Used

- Lighting has been used to facilitate the growth of chickens for many years
- This light was usually 100 watt Incandescent
- In the early 2000's many growers learned about Compact Fluorescent and Cold Cathode lighting technologies
- Integrators were slow to acknowledge this technology due to the worry about bird health and growth



The Big Switch...

- Growers were urged by their integrators to replace Incandescent with CFL's as they failed.
- Growers complained about the flickering, short life and non-dimmable aspect of these new bulbs
- But , the savings were huge!
- Many growers immediately saw their lighting electrical consumption fall by as much as 80%!
- Sadly many growers refused to use these due to the risk of high bird mortality and lower feed conversion



Then along came the LED

- Integrators had an even harder time warming up to this technology
- There were color rendering issues
- There were dimming issues
- But, there were even bigger savings



Farms were chosen

- Two broiler farms and one breeder farm
- First broiler farm had CFL's only
- Second broiler farm had a mix of incandescent and CFL
- The breeder farm had one row of 150 watt High Pressure Sodium lamps



Let the data collection begin

- Existing bulbs were counted and identified by kelvin rating and wattage
- Existing lighting intensities and bulb locations were cataloged
- All 26 watt CFL bulbs were then replaced with 10 watt LED bulbs
- Energy monitoring systems were also installed
- Energy consumption and savings were revealed after several flocks came and went



Energy Savings Realized (House #1)

- 65) 23 watt CFL's were replaced with 65) 10 watt LED's
- Data from two flocks was retrieved
- 1,193 kwh per flock (1.5kW initial load) = \$131.23/ flock
- $\$131.23 \times 6 \text{ flocks} = \787.38
- 519 kWh per flock (0.6 kW initial load) = \$57.10/ flock
- $\$57.10 \times 6 \text{ flocks} = \342.60
- Annual Savings = \$444.78
- 65 bulbs x \$15/bulb = \$975
- $\$975 / \$445 = 2.1 \text{ year payback period}$



Energy Savings Realized (House #2)

- 55) 23 watt CFL's and 22) 60 watt Incandescent bulbs were replaced with 77) 10 watt LED's
- 1,231 kwh per flock (2.6 kW load) = \$135.41/ flock
- \$135.41 x 6 flocks= \$812.46
- 522 kWh per flock (0.77 kW load) = \$57.42/ flock
- \$57.42 x 6 flocks= \$344.52
- Annual Savings = \$467.94
- 77 bulbs x \$15/bulb = \$1,155
- \$1,155/ \$468 = 2.4 year payback period



Energy Savings Realized (House #3)

- 30) 150 watt (188 watts total) HPS's were replaced with 30) 35 watt LED's
- 3,666 kwh per flock (5.6 kW load) = \$403.26/ flock
- \$403.26 x 2 flocks= \$806.52
- 683 kWh per flock (1.05 kW load) = \$75.13/ flock
- \$75.13 x 2 flocks= \$150.26
- Annual Savings = \$656.26
- 30 bulbs x \$60/bulb = \$1,800
- \$1,800/ \$656.26 = 2.7 year payback period



Production Increases or Decreases

- No differences were noted by growers
- Growers have been overly pleased with the study and the equipment installed



Advancements Needed?

- Bulbs are now being specifically made for corrosive Agricultural environments
- Prices are coming down monthly
- more natural lighting mingled with artificial lighting
- More robust data collection nationwide



The bottom line.

- With Virginia has approximately 6,000 poultry farms
- Lighting recommendations alone could save well over 15 MWh's annually based on an average of farms that have not made the transition to LED's (1,200 farms)
- Especially in the breeder/layer houses
- Next: Fans and Pumps... to be continued



Any questions or comments?

Thank you

