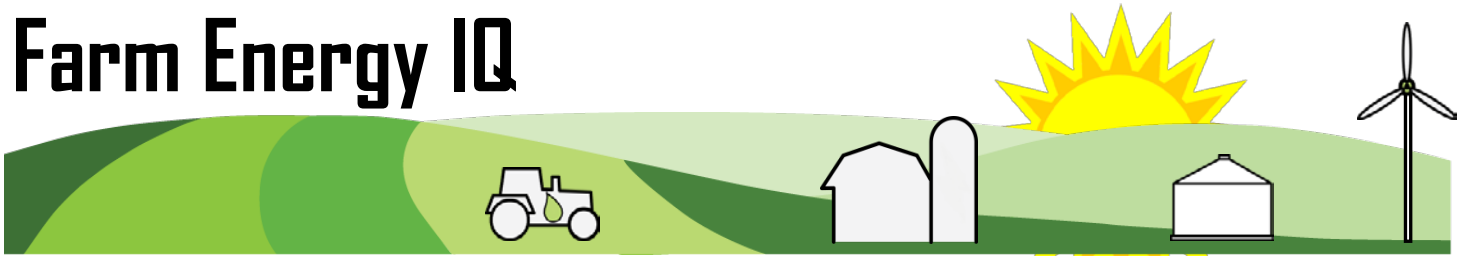
Farm Energy IQ



Farm Energy Audits—ASP Presentation Outline

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Slide 1 Introduction

Slide 2 These are general working definitions of energy audits. An audit report serves two fundamental functions: to present a comprehensive picture of current energy use and to develop and prioritize opportunities for energy conservation.

Slide 3 This is the American Society of Agricultural and Biological Engineers' definition of an audit in its standard for agricultural energy audits (ASABE Standard S612). NRCS audit guidelines reference the ASABE standard. The definition emphasizes the need to establish and document current energy use and identify opportunities for energy conservation.

Slide 4 A useful energy audit report will include information that answers these questions in a clear and straightforward manner. NRCS guidelines for Agricultural Energy Management Plans provide detailed information on data the plan should include and the form and sequence for presenting data.

Slide 5 Agricultural energy use is sufficiently different from residential, commercial, and industrial applications. Auditors with experience in only these sectors may not be well prepared to develop energy management plans that address producers' most important needs in a way that is compatible with the operation. Additionally, different types of farming operations have very different energy needs. Greenhouses, dairies, poultry facilities, horse farms, and other types of operations have unique energy requirements. Energy systems within operations are often specifically tailored for each type of farm.

Slide 6 The compilation of utility bills should include a minimum of 1 year of utility data (electricity, natural gas). A visual Inspection is most often conducted during a walk-through of facilities to identify zones of energy use and energy using systems. An auditor will characterize equipment by collecting detailed information on all major equipment (hp, watts, efficiency, etc.).

Auditors interview owners and operators in an attempt to obtain information related to occupancy, hours of operation, maintenance programs, specific problems, and needs.

Longer term on-site measurement is not often a component of a simple farm energy audit. When longer-term measurements are taken, they can include any of the options shown.

A blower door is a variable speed fan placed in a door or window to evaluate infiltration and leakage.

Power monitoring equipment can continuously monitor and log electrical (or natural gas) use.

IR imaging can show leaks, poor insulation, and other inefficiencies. Lower cost options for infrared imaging may make this technique more common in future farm audits.

Computer simulation modeling, usually reserved for larger facilities, can be basic or very detailed and complex. There are a variety of energy models for different types of agricultural operations, many of them developed for research use rather than for application in practical energy audits.

Slide 7 This is a detailed list of the various aspects of a farm energy audit. The remainder of this presentation provides more detail and examples for each item.

Slide 8 Transition

Slide 9 An operational overview may include the type and size of the operation. A site plan or aerial view can be useful for describing the facilities.

A building summary should include all the structures in the operation, including their square footage, primary use, details of construction and major energy using systems.

The infrastructure summary will describe the facilities for receiving, storing (where applicable), and distributing energy. Electrical supply includes the electrical phase (single or three-phase), voltage, and amperage of main panels. The infrastructure for other energy sources (natural gas, LPG, oil, vehicular fuels, coal, wood, solar, wind, etc.) is also described (size and capacities). The audit report will identify and describe major energy-consuming systems within the operation. Farms may have more than one metering location for natural gas or electricity, and may have multiple fuel storage facilities.

Slide 10 This is an aerial view showing all of the farm structures and their arrangement.

Slide 11 This is a brief summary of the energy uses related to heating, cooling, ventilating and hot water is one building.

Slide 12 Transition

Slide 13 These are categories included in ASABE Standard S612. They are not all applicable to every agricultural operation. The audit report will include descriptive and tabular information related to the applicable uses.

Slide 14 Transition

Slide 15 This is unusual in that it represents six years' worth of history. From this graph we can tell that the most likely area for energy savings will be the office, with its relatively high energy use. The decline in energy use for the irrigation pump reflects operational changes in 2002. The increase in usage in the storage barn is the result of either operational or structural changes. For both the irrigation pump and the storage barn an auditor, with the help of the owner and operators, should be able to explain the observed trends, or investigate further if there is no apparent explanation.

Slide 16 It is not always possible to break electricity or other energy use into different applications. Often there is sufficient information to make some estimates. It is useful to identify areas that are most promising for energy conservation. In this case, air conditioning is the largest energy use and reducing air conditioning electrical use will likely have a greater impact than improving efficiency in other measures.

Slide 17 Transition

Slide 18 This graph, from a poultry operation, shows distinct seasonal patterns. Seasonal variations are often due to weather patterns and changes in production (timing, quantities and types). Among other factors, energy use in agricultural operations can be influenced by holidays.

Slide 19 Farmers and their workers often have very limited time, and energy is often a concern only to the extent that it affects their bottom line. Interviews can help determine what energy issues are important to the farmer and why the operation has adopted specific energy use patterns and procedures. Interviews can be crucial to identify energy consumption that may not be obvious from a walk-through of the facility and schedules and setpoints that vary over time.

Slide 20 Transition

Slide 21 In this example, it is clear that oil and electricity are the largest energy uses. Even though oil represents a slightly higher energy consumption, it may not be the most attractive area for energy conservation because of the electricity typically costs more than oil on a per-Btu basis, as we will see in a subsequent slide. In this particular case, which includes a building with heating and air conditioning, changes (such as adding insulation) which affect electrical use may also impact oil consumption.

Slide 22 Transition

Slide 23 Annual costs for electricity are significantly higher than other energy sources. This changes over time as prices respond to market conditions, but typically electricity will be higher per unit of energy than other sources.

Slide 24 Transition

Slide 25 Energy bills include a cost that is based directly on demand. A high ratio of demand (KVA) to use (kW-hr) in a given month can be an indication that load management (for example, changing operational schedules to reduce peak demands) may be a way or reducing electrical costs.

Peak use and peak demand occur in September. The highest cost is in July, when the average kw-hour charge is higher, and the highest rate is in June, when the demand is high and use is low.

Slide 26 Transition

Slide 27 An energy audit will include more or less information about equipment, depending on how significant the use is and how much information about the equipment and its operation is available.

Slide 28 A table of the characteristics of larger equipment can be used to compare alternatives when it is time for the equipment to be replaced. The fact that a piece of equipment is relatively inefficient is not always a reason to replace it with a newer, more efficient model. Replacing motors that are rarely used will often have a very long payback period.

Slide 29 The make and model information can be used to find more information about the equipment. Often nameplate data on agricultural equipment is unavailable or unreadable. The manufacturer's literature can provide details on efficiencies and other characteristics of the equipment.

Slide 30 A lighting table provides estimated energy use for different lighting systems and can help identify inefficient bulb and fixture types. In this case, T12 fluorescent tubes and incandescent bulbs represent a significant portion of the electricity used for lighting. There are energy efficient replacements for both of these types of lights.

Slide 31 Transition

Slide 32 This is in many respects the most important part of the audit report. NRCS also requires reporting of estimated emissions reductions for greenhouse gases and major pollutants. The table is listed in order of payback period, although the most important opportunities may not be those with the shortest payback. In this case, insulating walls has a much greater impact than replacing light bulbs. NRCS typically will not provide financial support for measures with paybacks longer than five years. Nonetheless, a farmer may wish to implement options with longer paybacks, particular when these measures provide other benefits in addition to energy savings (for example, higher quality products, more comfort for workers and less maintenance).

Slide 33 and 34

An audit report will often include graphics such as these to portray the potential savings of incorporating energy conservation measures.

Slide 35 Questions?

This project supported by the Northeast Sustainable Agriculture Research and Education (SARE) program. SARE is a program of the National Institute of Food and Agriculture, U.S. Department of Agriculture. Significant efforts have been made to ensure the accuracy of the material in this report, but errors do occasionally occur, and variations in system performance are to be expected from location to location and from year to year.