Feed is by far the single most expensive cost of producing pork, accounting for \( \frac{2}{3} \) to \( \frac{3}{4} \) of total production costs on average, and on a nutritional basis, energy is the most expensive nutrient in the diet. I think we all understand the importance that energy intake and density in the diet plays on subsequent growth performance and carcass characteristics in the pig. Therefore, any means by which we can more closely meet the energy requirements of the pig without over- or under-feeding this nutrient can significantly improve not only feed conversion but also decrease the cost per pound of pork produced. Therefore, nutritionists formulating diets on a least cost basis pay special attention to energy level of the diet and cost to provide it. However, depending on energy system used, different ingredients (energy sources) may have different value in the diet.

In general, there are four energy systems to consider. First, Gross Energy (GE) is the total energy contained in a feedstuff, and is determined in a laboratory by burning the feedstuff and measuring the amount of energy liberated. The pig, however, cannot utilize all of the energy, and therefore a more descriptive and animal-specific method is required. The digestible energy (DE) system accounts for loss of energy nutrients not digested and absorbed in the gut and excreted in feces, and is simply calculated as GE minus fecal energy. Most of the energy in feces originated from the feed consumed, but a small amount (dependent on type of feed or ingredients consumed) is endogenous in nature, coming from sloughing of cells and excretion of enzymes and other products by the pig. Use of the DE system is fairly common, especially in Canada. Assuming a corn-soybean meal based diet, DE level may be approximately 85% of GE.

A third system, called the metabolizable energy (ME) system, accounts not only for the fecal energy lost by the pig but also losses in urine and methane gas. Because energy lost in methane is very small in pigs, it is usually not measured. Energy lost in urine, however, can vary considerably in different ingredients, with higher protein components increasing the amount of energy lost through urine. Because most diets are formulated fairly close to pig requirements and excessive protein levels are not usually encountered, the ratio of ME to DE is generally quite constant. The ME system can be thought of as being slightly more precise than the DE system, and is commonly used by nutritionists in the United States. ME for corn-soybean meal based diets is typically around 97% of DE, or 82% of GE.

The newest, and most accurate energy system (theoretically) being used is the net energy (NE) system. Not only is fecal, urinary, and methane (gaseous) losses of energy accounted for, but also heat produced, and thereby losses in energy due to heat loss are accounted for. NE, therefore, is the energy retained by the animal to be used for productive purposes, such as protein and fat deposition and milk production. NE in corn-soybean meal diets may be 55 – 60% of GE, and a great portion of energy is therefore
accounted for with heat loss. The net energy system is especially valuable when considering alternative ingredients besides corn and soybean meal, and is why the NE system is used widely in Europe. When diet ingredients contain high levels of fiber, more energy is liberated as heat and thereby lost, and the NE system can account for the reduction in energy efficiency whereas other energy systems do not. Similarly, because less heat is produced in metabolizing fat into energy, it is given a higher energy value when using the NE system.

Many nutritionists in the U.S. choose not to use the NE system, however. One difficulty is that there are not as many studies evaluating the NE of ingredients, and therefore confidence in NE values listed for individual ingredients in references is sometimes questioned. The process of determining net energy values for ingredients is much more expensive and tedious, requires special equipment and use of animals, and therefore is not the type of measurement one can receive by simply sending a sample into a lab to be analyzed. Also, NE gets one closer to meeting the animal’s biological needs, but is not perfect. Efficiency of energy use is also affected by animal stage of growth and use of the energy (whether for lean or fat tissue accretion), in addition to digestibility and chemical characteristics of the diet and its constituents.

Despite these challenges, however, more and more of the North American swine feeding industry is moving towards utilization of the NE system. John Patience, director of the Prairie Swine Center, has indicated that switching from DE to NE systems for formulating diets saves $1 to $2 per pig sold in Canada using conventional diets. When deciding whether or not to incorporate alternative ingredients, such as distiller’s dried grains or fat sources, it becomes even more economically important to use NE values. As our understanding of energy metabolism and body composition increases in the pig, so will the value of using the NE system. We will be better able to make decisions on amounts and types of ingredients to include in swine diets as market conditions change, thereby improving overall profitability.