Energy Balance Methodology

**Methodology for Conducting an Energy Balance**

The purpose of an energy balance is to look at energy consumption on a smaller (individual energy uses) scale. Lists of equipment and rated energy inputs along with operating hours are required to conduct an energy balance. Most of the time, individual pieces of equipment are not separately metered and estimates are required. Using estimates and spot measurements of equipment loads, the energy consumed by each user (lights, process motors, boilers, dryers, air compressors, refrigeration, etc.) can be found. For some organizations, it is important to include the loads associated with small items such as computers, office light, space heaters, and appliances, which can add up to 5% or more of consumption.

When determining the consumption of an energy system, two factors must be known. The first is the load factor. Load factor is the ratio of the average power or thermal demand by a piece to the nominal rated input during the time the equipment is in service or idling. The second factor needed is the duty factor. Duty factor is defined as the ratio of the time the equipment is actually on and in service (or idling but imminently ready for service) to the nominal operating hours. Once the operating factors are known, equipment energy consumption is determined by multiplying the nominal equipment rating (kW or Btuh) times the load factor, duty factor, and operating hours (see energy balance equation, below).

Energy Consumption = Nominal equipment rating x Duty Factor x Load Factor x Operating Hours

After the estimated energy consumption for all the major pieces of hardware is found, individual loads are summed and compared to the plant energy input. If the estimate agrees with the actual, the consumption for each item is recorded and used to compile a ranking of users. If the estimate does not agree with the actual, you must check to be sure that all the equipment has been included. Then adjust the estimated load and duty factors used in the calculation to balance the actual and estimated usage. An energy balance calculation is iterative and may require several passes to reach agreement.

After the equipment usage is found and the energy systems are ranked in order of total energy consumption from the largest to the smallest, the process of significant energy use identification can begin. Because designation as a significant energy uses involves associated energy management activities such as operational controls, competence, training, procurement, design and monitoring and measurement, the selection process has to be accurate and data driven. An energy balance is one fundamental, accepted approach to the significance identification process.