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"Use it or Lose It: Tracking Industrial Fuel Consumption"

One of industry's biggest—and most misunderstood—business opportunities is the recovery of income lost to energy waste. Out of 17.8 quadrillion Btu of fuel and electricity delivered "to the fence" of industrial facilities in 2001, a conservative estimate claims that 31 percent (5.4 quads) was lost in combustion, distribution, and energy conversion activities. With 2004 fuel prices of about $7 per MMBtu, those losses equated to over $38 billion.

Table 1 presents an overview of the U.S. industry's energy use and losses in 2001.

Table 1:
U.S. MANUFACTURING SECTOR IN 2001
Summary Allocation of Primary Energy Consumption

Stage of manufacturing energy use	*Volume of energy (trillion Btu)*	*Percent of original energy input available at this stage*	*Characterization of losses*
Primary energy input	**24,658**	**100%**	
Offsite losses	-6,884		Energy is lost by power utilities in the generation of electricity. Also, electricity and fuel is lost in transit to industrial facilities.
Central energy plant	**17,774**	**72%**	
Steam generation loss	-1,233		Powerhouse combustion efficiency determines the proportion of fuel that is converted to heat and power.
Power loss	-166		
Energy distribution	**16,375**	**66%**	
Distribution loss	-1,330		Distribution pipes and vessels sustain a variety of leaks and radiation losses.
Energy exported offsite	-79		In some states, manufacturers can sell surplus electricity that they generate onsite.
Energy for facility heating & cooling	-1,405		Not a "loss," but a reduction of energy available to process. These applications can also be inefficient.
Energy conversion	**13,561**	**55%**	A combination of inefficiencies, some avoidable and some not, are encountered as energy is converted to motive energy used by motor drives, pumps, heat exchangers, etc.
Energy conversion inefficiencies	-2,862		
Energy applied as process work	**10,699**	**43%**	An indeterminate volume of residual energy after process work is either reapplied to central generation or is lost without reclamation.

SOURCE: U.S. Department of Energy, Industrial Technologies Program. December 2004. http://www.eere.energy.gov/industry/pdfs/energy_opps_analysis.pdf

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The fundamental laws of physics and thermodynamics make some losses unavoidable, but much of this loss is an opportunity to embrace efficient technologies and practices. Every one percent recapture of energy losses saves industry about $380 million. Estimates of practical energy savings available to industry range from 10 to 20 percent. Note that this is an industry average—some plants can save more than this range, some less. Keep in mind that each dollar of energy cost savings is one extra dollar of net income.

Case studies and research conducted by the Alliance to Save Energy have articulated industry's energy management barriers and strategies.[1] The Alliance shares some major lessons:

- *Technology is crucial* to achieving energy efficiency, but many plant managers are not fully convinced by even by impressive site demonstrations. This is especially true when managers feel that risks are involved.
- *Information is crucial* to adopting energy efficient solutions. But the best of engineering proposals, cash flow projections and even outright public grants cannot always overcome the barriers that manifest within manufacturing organizations.
- *Top management direction* does not always ensure that energy efficiency will be effectively carried out. The conflicting accountabilities that arise from a lack of cooperation across departments and production facilities within a company must first be recognized, then circumvented.
- *Energy management is a process, not a project.* Sure, engineering hardware projects are part of the solution. But energy-smart behaviors, folded into standard operating procedure, represent about 30 percent of potential energy savings.

The barriers to industrial energy efficiency include lack of awareness, lack of cross-departmental cooperation, outdated accounting techniques, restrictive budget and financial criteria, lack of management accountability, lack of resources, and complacency. We will take up a spirited discussion of these in Volume 2.

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[1] C. Russell. *Energy Management Pathfinding.* Alliance to Save Energy, March 2005. http://www.ase.org/section/topic/industry/corporate/pathfinding/