Industrial Electricity Best Management Practices

Summary:
This initiative considers the possible reductions in electricity consumption in the industrial sector via increased efficiency and increased coordination between DEP's Office of Pollution Prevention and Energy Assistance, industrial resource centers at various universities and the U.S. Department of Energy (DOE).

Background:
The DOE, via their Industrial Technology Program (ITP) Best Management Practices (BMPs) has determined that electricity efficiency improvements can result in a 20 percent reduction in consumption from the projected electricity use by the year 2031 are possible. This is consistent with the supply of industrial electricity efficiency opportunities identified in the ACEEE (2009) report through the year 2025. Industrial electricity consumption in Pennsylvania is expected to increase by about 0.4 percent by 2020, according to data from the Energy Information Administration's 2012 Annual Energy Outlook.

The ACEEE et al (2009) report identifies significant energy efficiency opportunities in Pennsylvania's industrial sector.[1] As illustrated in Table 1, industrial electricity supplies are estimated at 16 percent of overall 2025 sales, equal to 9.297 GWh of efficiency improvement potential. This work plan targets approximately 75 percent of this value (7,000 GWh) by 2020.

Table 1. Industrial Electricity Measure Savings and Costs

Measures	Fraction of Savings by Measure	Savings Potential in 2025 (GWh)	Savings Potential in 2025 (%)	Levelized Cost of Saved Energy ($/kWh)
Sensors & Controls	3%	237	0.4	$0.014
EIS	1%	67	0.1	$0.061
Duct/Pipe Insulation	17%	1,587	2.8	$0.052
Electric Supply	18%	1,710	3	$0.010
Lighting	6%	550	1	$0.020
Motors	25%	2,240	3.9	$0.027
Compressed Air	11%	1,030	1.8	$0.000
Pumps	16%	1,523	2.7	$0.008
Fans	2%	231	0.4	$0.024
Refrigeration	1%	123	0.2	$0.003
Total	100%	9,298	16.3	$0.022

Source: updated with 2012 Pennsylvania costs from ACEEE et al. (2009). Energy Efficiency, Demand Response, and Onsite Solar Energy Potential in Pennsylvania. April. http://www.aceee.org/pubs/e093.htm

[1] ACEEE, et al. (2009) Energy Efficiency, Demand Response and Onsite Solar Energy Potential in Pennsylvania. http//www.aceee.org/pubs/e093.htm

Quantification Approach and Assumptions:

- Reductions from the work plan are assumed to begin in 2014 and are implemented at a rate of between 1 percent to 5 percent of energy sales each year through the end of the planning period.
- Reductions take into account the savings already being realized via Act 129 of 2008 and estimated reductions from the industrial sector via Act 129 Phase II such that the reported values only reflect attribution from this work plan initiative.
- Energy efficiency costs are expressed as levelized costs over the life of the energy efficiency options.
- The costs of the work plan are calculated by estimating the annual costs of energy efficiency (capital, O&M, labor) less energy savings.
- These cash flows are then discounted at a real rate of 5 percent.
    - The net present value of cash flows is calculated beginning in 2014 through 2020.
- All prices are in 2010 dollars.
- The levelized cost of electric efficiency measures is $26.03/MWh.[2]
    - This figure includes all utility and participant costs as commonly performed in a total resource cost test.
    - Program fixed costs are assumed to be part of each measure's capital cost, including administrative, marketing, and evaluation costs of 5 percent.[3]
- Avoided electricity prices range from approximately $87/MWh in 2014 to $108/MWh in 2020.
- Electricity transmission and distribution losses are assumed to be 6.6 percent over the analysis period.
- To estimate emission reductions from work plans that are expected to displace conventional grid-supplied electricity (i.e., energy efficiency and conservation) a simple, straightforward approach is used. We assume that these policy recommendations would displace generation from an "average thermal" mix of fuel-based electricity sources. For 2013 through 2020 the assumption made is that this fossil-based thermal mix will be 50 percent coal and 50 percent natural gas. For reference, EIA data from Pennsylvania generation sources reflects an approximate mix of 60% coal and 40% natural gas.
    - The average thermal approach is preferred over alternatives because sources without significant fuel costs would not be displaced—e.g., hydro, nuclear, or renewable generation.
    - This approach provides a transparent way to estimate emission reductions and to avoid double counting (by ensuring that the same MWh from a fossil fuel source are not "avoided" more than once). The approach can be considered a "first-order" approach; it does not attempt to capture a number of factors, such as the distinction between peak, intermediate, and baseload generation; issues in system dispatch and control; impacts of non-dispatchable and intermittent sources, such as wind and solar; or the dynamics of regional electricity markets. These relationships are complex and could mean that policy recommendations affect generation and emissions (as well as costs) in a manner somewhat different from that estimated here. Nonetheless, this approach provides reasonable first-order approximations of emission impacts and offers the advantages of simplicity and transparency that are important for stakeholder processes.

[2] Source: ACEEE et al. (2009).
[3] Source: ACEEE et al. (2009) p. 49.

Work Plan Costs and GHG Reductions:

Table 3. Quantification Results

Annual Results (2020)			Cumulative Results (2014-2020)		
GHG Reductions ($MMtCO_2e$)	Costs (Million $)	Cost-Effectiveness ($/$tCO_2e$)	GHG Reductions ($MMtCO_2e$)	Costs (NPV, Million $)	Cost-Effectiveness ($/$tCO_2e$)
4.0	-$446	- $101	9.5	-$989	-$94.4

Notes: The cost estimates in Table 3 (columns 3 and 6) are incremental costs of energy efficient measures including capital cost, operating and maintenance, and labor, above baseline measure costs. The cost estimates are calculated as the costs less avoided energy expenditures. Also, the difference between the 2020 cost effectiveness (column 3) and the cumulative cost effectiveness (column 6) is due, in part, to the effects of discounting the net cash flows over the analysis period of 2014 to 2020. Also, the energy savings payback time frames are typically very good.

Implementation Steps:

- Tap the resource expertise of the Industrial Assessment Center (IAC) at Lehigh University and similar resources to map out a plan identifying a prioritized list of opportunities and barriers achieving energy reductions.
- Work with community colleges and trade schools to educate and train students and staff to be able to perform resource assessments.
- Conduct DOE-supported workshops that advance best practice implementation for process heating and steam systems.
- Partner with utilities to develop energy use reduction programs for large energy users.

Potential Overlap:

- Act 129 Phases I, II & III
- Energy Efficient Appliances

Subcommittee Comments: