

Top Twenty Opportunities

A list of top opportunities was developed based on inputs obtained at the Energy Loss and Reduction Workshop and previous studies conducted [EI 2003, EI 2004, USCHPA 2001]. These opportunities are illustrated along with the associated energy savings in Table 4.

Table 4 Top Twenty R&D Opportunities (Trillion Btu)					
#	Opportunity Area	Industries Analyzed	Pre-Process Energy Savings	Post-Process Energy Savings	Total Energy & Cost (million \$) Savings
1	Waste heat recovery from gases and liquids in chemicals, petroleum, and forest products, including hot gas cleanup and dehydration of liquid waste streams	chemicals, petroleum, forest products	0	828	828 (\$2210 MM)
2	Combined heat and power systems	forest products, chemicals, food, metals, machinery	634	0	634 (\$2000 MM)
3	Advanced industrial boilers	chemicals, forest products, petroleum, steel and food processing	400	0	400 (\$1090 MM)
4	Heat recovery from drying processes	chemicals, forest products, food processing	160	217	377 (\$1240 MM)
5	Steam best practices (improved generation, distribution and recovery), not including advanced boilers	all manufacturing	310	0	310 (\$850 MM)
6	Pump system optimization in electric motor-driven systems	All manufacturing	*302 (98)	0	*302 (98) (\$1370 MM)
7	Energy system integration	chemicals, petroleum, forest products, iron and steel, food, aluminum	110	150	260 (\$860 MM)
8	Improved process heating/heat transfer systems for chemicals and petroleum industries (improved heat exchangers, new materials, improved heat transport)	petroleum, chemicals	121	139	260 (\$860 MM)
9	Energy efficient motors and improved rewind practices	all manufacturing	*258 (84)	0	*258 (84) (\$1175 MM)
10	Waste heat recovery from gases in metals and non-metallic minerals manufacture (excluding calcining), including hot gas cleanup	iron and steel, cement	0	235	235 (\$1133 MM)
11	Energy source flexibility (heat-activated power generation, waste steam for mechanical drives, indirect vs direct heat vs steam)	chemicals, petroleum, forest products, iron and steel	119	75	194 (\$1100 MM)
12	Improved sensors, controls, automation, robotics	chemicals, petroleum, forest products, iron and steel, food, cement, aluminum	39	152	191 (\$630 MM)
13	Improved process heating/heat transfer for metals melting, heating, annealing (cascade heating, batch to continuous, better heat channeling, modular systems)	iron and steel, metal casting, aluminum	63	127	190 (\$915 MM)
14	Compressed air system optimization in motor-driven systems	all manufacturing	*163 (53)	0	*163 (53) (\$740 MM)
15	Optimized materials processing (grinding, mixing, crushing)	all manufacturing	*145 (47)	0	*145 (47) (\$660 MM)
16	Energy recovery from byproduct gases	petroleum, iron and steel	0	132	132 (\$750 MM)
17	Energy export and co-location (fuels from pulp mills, forest biorefineries, co-location of energy sources/sinks)	forest products	0	105	105 (\$580 MM)
18	Waste heat recovery from calcining (not flue gases)	cement, forest products	11	63	74 (\$159 MM)
19	Heat recovery from metal quenching/cooling processes	iron and steel	0	57	57 (\$275 MM)
20	Advanced process cooling and refrigeration	Food processing, chemicals, petroleum and forest products	*57 (15)	0	*47 (15) (\$212 MM)
TOTALS			2889	2280	5162 (\$18,357 MM)

*Includes losses incurred during offsite generation and transmission of electricity, based on conversion factor of 10500 Btu/kWh. Number in parenthesis does not include losses.