

Energy and Emissions Analyses

This section simply compares the energy usage in the base case and the new design. The differences and percentages are listed in the following tables. A basic emissions analysis is also included.

Energy Usage

The amount of electric and natural gas both changed between the base case and the new design. While the electrical usage greatly decreased, the natural gas usage increased some. This is primarily due to the increased heating loads required by the guest rooms. The original design used water-source heat pumps run off the condenser water loop that was heated indirectly by boilers. The new design uses fan coil units in all the guest rooms that operate directly off the hot water generated by the boiler.

For a comparison of the electric and natural gas usage differences between the base case and the new design, please refer to Table A – Fuel Source Energy Comparisons and Table B – Component Energy Comparison. Positive numbers refer to a savings in energy for the new design over the base case. Negative numbers imply that the new design uses more energy than the base case.

Comparison of the electric and natural gas annual costs are shown after the energy comparisons in Table C – Fuel Source Annual Costs Comparisons and Table D – Component Annual Energy Comparisons. Positive numbers refer to a savings in annual costs for the new design over the base case. Negative numbers imply that the new design costs more than the base case.

Table A - Fuel Source Energy Comparisons

Component	Base Case	New Design	Difference	% Diff
HVAC Components				
Electric (kWh)	13,813,310	2,457,286	11,356,024	82.21%
Natural Gas (Therm)	76,290	173,622	-97,332	-127.58%
Non-HVAC Components				
Electric (kWh)	3,682,840	3,682,840	0	0.00%
Natural Gas (Therm)	0	0	0	0.00%
Totals				
Electric (kWh)	17,496,150	6,140,126	11,356,024	64.91%
Natural Gas (Therm)	76,290	173,622	-97,332	-127.58%

Table B - Component Energy Comparison

Component	Base Case (kBtu)	New Design (kBtu)	Difference (kBtu)	% Diff
Air System Fans	1,611,165	3,423,614	-1,812,449	-112.49%
Cooling	9,513,890	2,735,189	6,778,701	71.25%
Heating	8,101,048	17,442,574	-9,341,526	-115.31%
Pumps	33,564,252	1,527,502	32,036,750	95.45%
Cooling Towers	1,966,906	618,064	1,348,842	68.58%
HVAC Sub-Total	54,757,261	25,746,942	29,010,319	52.98%
Lights	3,954,558	3,954,558	0	0.00%
Electric Equipment	8,611,752	8,611,752	0	0.00%
Non-HVAC Sub-Total	12,566,310	12,566,310	0	0.00%
Grand Total	67,323,571	38,313,252	29,010,319	43.09%

Table C - Fuel Source Annual Costs Comparison

Component	Base Case (/yr)	New Design (/yr)	Difference (/yr)	% Diff
HVAC Components				
Electric	\$959,905	\$181,074	\$778,831	81.14%
Natural Gas	\$17,113	\$34,616	(\$17,503)	-102.28%
HVAC Sub-Total	\$977,018	\$215,690	\$761,328	77.92%
Non-HVAC Components				
Electric	\$255,027	\$256,782	(\$1,755)	-0.69%
Non-HVAC Sub-Total	\$255,027	\$256,782	(\$1,755)	-0.69%
Grand Total	\$1,232,045	\$472,472	\$759,573	61.65%

Table D - Component Annual Costs Comparison

Component	Base Case	New Design	Difference	% Diff
Air System Fans	\$32,896	\$70,277	(\$37,381)	-113.63%
Cooling	\$196,738	\$63,402	\$133,336	67.77%
Heating	\$26,381	\$36,124	(\$9,743)	-36.93%
Pumps	\$681,147	\$31,683	\$649,464	95.35%
Cooling Tower Fans	\$39,921	\$14,213	\$25,708	64.40%
HVAC Sub-Total	\$977,082	\$215,698	\$761,384	77.92%
Lights	\$80,260	\$80,812	(\$552)	-0.69%
Electric Equipment	\$174,777	\$175,979	(\$1,202)	-0.69%
Non-HVAC Sub-Total	\$255,037	\$256,791	(\$1,754)	-0.69%
Grand Total	\$1,232,119	\$472,490	\$759,629	61.65%

Emissions Analysis

A simple emissions analysis was done for the BWI Hilton to compare the carbon dioxide (CO₂), sulfuric acid (SO₂), and nitrous oxides (NO_x) generated by the building's use of electricity and natural gas. The values used for the emissions quantities were calculated by HAP.

For a comparison of the emissions between the base case and the new design, please refer to Table E – Emissions Comparison. Positive numbers refer to a savings in energy for the new design over the base case. Negative numbers imply that the new design uses more energy than the base case.

Table E - Emissions Comparison

Component	Base Case	New Design	Difference	% Diff
CO ₂ (lb)	24,243,440	8,706,425	15,537,015	64.09%
SO ₂ (kg)	59,829	21,002	38,827	64.90%
NO _x (kg)	35,250	12,542	22,708	64.42%

As can be seen in the table above, there is about a 64% reduction in all emissions from the base case to the new design. This can be directly associated to the reduction in the total energy use for the BWI Hilton.