

## CONCLUSIONS AND COMPARISONS

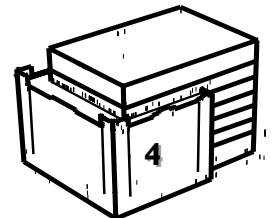
### Summary of Calculation Results

	Building Design		Central Geothermal		Domestic Geothermal		Base Case	
Total Mechanical First Cost	\$1,200,000		\$1,292,398		\$1,217,545		\$485,870	
Total Yearly Maintenance Billing Fees	\$11,343		\$11,343		\$9,843		\$5,421	
Condominium Mechanical First Cost Range	\$26,400	\$69,960	\$28,433	\$75,347	\$26,786	\$70,983	\$10,689	\$28,326
Condo Utility Bill Range	\$1,494	\$3,730	\$1,283	\$3,171	\$1,392	\$3,609	\$1,992	\$4,777
Total Pounds of Emissions	853,100		902,395		962,813		1,244,062	
Total Mbtu's, Site	1,242,685		1,045,412		1,182,802		1,872,096	
Total Mbtu's, Source	2,620,076		3,100,236		3,548,407		5,616,288	
Payback over Base Case	32	40	25	29	27	36	0	0
Payback over Design System	0	0	10	10	4	8	-	-

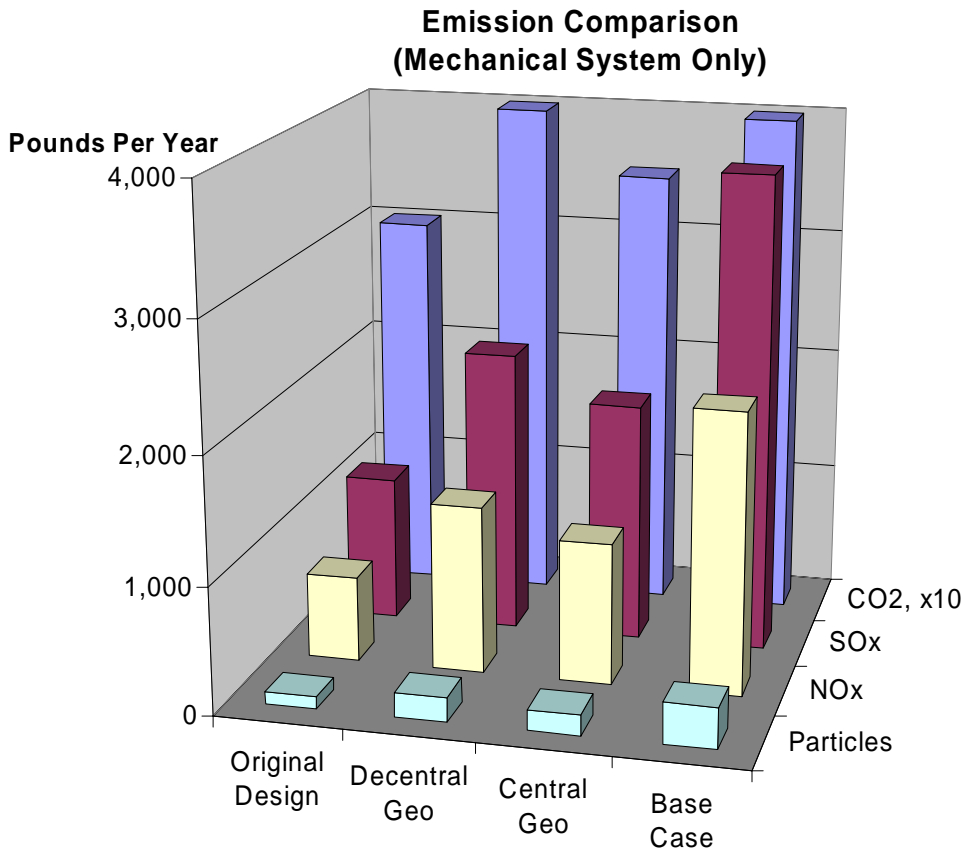
The total utility cost savings is minimal when we compare the design models to the budget system. This is because, even through the heating and cooling consumption decreases, the lighting consumption is still very large and minimizes the percentage change of utility costs from mechanical changes. This also makes the point that major energy conservation cannot be accomplished by changing one aspect of a building.

None of these options are clearly superior when compared to the design goals. If the owner wants to provide a good quality product with a LEED rating, the domestic geothermal system has the best payback for their investment. If the owner wants to provide the most sensibly priced product, they would provide the base case options. If they needed another LEED point, they would use the central geothermal system.

However, if we look at the systems in more general terms, the original design system is clearly superior. Although the original design only saves 20% energy consumption over the base case and the central geothermal system saves almost 30%, the original saves 3% more emissions than the central geothermal system does. This is because the design system boiler uses natural gas very efficiently, and although the heat pumps multiply the effectiveness of the electricity, most of the electric energy is lost in production and transmission before it gets to the heat pumps. Also, the natural gas boiler produces no particles.



	Total Decrease of Energy Consumption Over Base Case	Predicted LEED Credit Rating	Decrease In Pounds of Emissions
Base Case	0.0%	0	0.0%
Central Geo	27.1%	2 to 3	27.5%
Decentral Geo	22.6%	1 to 2	22.6%
Original Design	20.6%	1	31.4%



Because the original design is better environmentally, and has the best price for sufficiently meeting all the design goals, it is clearly the best choice from these designs for this application

Evaluating the other energy factors like lighting and energy source for condominiums would be a telling study. For this paper, the limitations really come down to the need for autonomy in these condominiums. The building uses a large quantity of electricity for lighting because we cannot impose efficient lighting in the apartments. We have to use grid electricity because no owner would want to manage a commercial power plant for a condominium building. If one were to focus on how to decrease pollution from residences, this is an important truth. It will take much more work to significantly improve the energy use of residences than by just altering the mechanical system.

