

## Proposal 2: Central Geothermal Plant

Calculations were completed to determine relative values for the indicators of success

### a. Total energy use for LEED rating

For this proposal, four water to water geothermal units were selected on an n+1 basis to provide heated and chilled water. Geothermal unit manufacturer Water Furnace 50 ton units were selected since this is the largest market available and they have a high cooling efficiency. The units were modeled as boilers with the correct efficiencies, unloading curves, and output temperatures in TRACE. (E-3)

The ground pump energy consumption was calculated separately from TRACE and inserted into the electric load to simplify the energy cost calculations and to find a more accurate peak kw. (C-1)

The outdoor air conditioning consumption was calculated in TRACE with geothermal rooftop unit properties, and an 80% effective sensible wheel.

Shared Space Lighting	49631	Kw hr
Ground Water Pumps	59447	Kw hr
FCU Supply Fans	1058	Kw hr
Heat Pump Cooling	39498	Kw hr
Chilled Water Circulating	1841	Kw hr
Heat Pump Heating	8146	Kw hr
Hot Water Circulating	7242	Kw hr
Outdoor Air Conditioning	134255	Kw hr
Apartment Lighting	344925	Kw hr

Total Mechanical Consumption	251486	Kw hr
Total Lighting Consumption	394556	Kw hr

(C-3)

### b. Resident's utility and building fee costs

Apartment lighting, and residential heat pump energy consumption cost was calculated on a residential rate structure, and the public space conditioning, and hallway lighting and ground pump energy consumption was cost was calculated on a commercial rate structure.

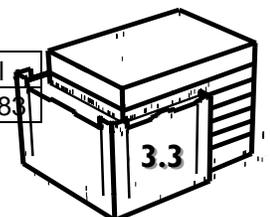
To simulate the charges that residents would see from the building owner having to manage and maintain this central mechanical system, a typical building maintenance cost was estimated and added to the total utility cost. (C-5a). To simulate the quantity of the building costs each apartment would receive, I gave each apartment an arbitrary rating based on its square feet, location, and views. This is a typical method to break up shared building expenses.

To cover the full range of apartment utility costs, I calculated the costs for the smallest apartment on the North side of the building, apartment 2C, and the largest duplex on the South/Western side, apartment 6B7B.

The typical expected monthly utility bills for two apartments (C-5b):

Apartment  
2C

J	F	M	A	M	J	J	A	S	O	N	D	Total
\$102	\$95	\$104	\$99	\$101	\$121	\$125	\$126	\$108	\$100	\$100	\$102	\$1,283



Apartment 6A7B

J	F	M	A	M	J	J	A	S	O	N	D	Total
\$247	\$230	\$250	\$239	\$248	\$307	\$319	\$321	\$275	\$244	\$242	\$247	\$3,171

**c. Price of the total system to the building owner**

The components from the original system were broken out with the original total price from RS Means, and the components for this geothermal system were added \$90,000 more than the original design system, because of the extra cost of having two coil fan coil units, the geothermal wells, and the heat pumps. The total estimated first cost is \$1,290,000 (C-6a)

**d. Condominium price to buyers**

I assume that the owner has enough overhead to charge each condominium purchaser for the true cost of the design mechanical system, so each apartment will cost between 28,000 and 75,000 (C-6)

**e. Emissions**

Electric emissions were estimated from US Department of Energy’s emissions from grid-source electric mix. The total emissions due to this central geothermal mechanical system are as follows, (not including apartment or shared spaces lighting)

	Pounds Particles per Year	Pounds SO2 per year	Pounds NO2 per year	Pounds CO2 per year
Central Geo	162	1,895	1,116	349,971

(C-4)

