Proposal 1: Packaged Geothermal

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

a. Total energy use for LEED rating

This proposal was modeled as a water source heat pump application in TRACE. Geothermal units were selected on a basis of adding 10% to the TRACE apartment load outputs(E-2a). To simplify the TRACE utility calculations, apartments with the most similar peak loads and load profiles and geothermal unit selections were grouped into zones and calculated with geothermal cooling/heating plants of equivalent capacity and efficiency(E-2a).

Geothermal unit efficiencies were calculated with software supplied by Florida Heat Pump. The units have three fan stages, and show that the unloading curves for 0.5 in static pressure are most likely linear or slightly better (E-2b).

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

The outdoor air conditioning consumption was calculated in TRACE with geothermal rooftop unit properties, and an 80% effective sensible wheel. (C-7)

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Shared Space Lighting	49631	Kw hr
Ground Water Pumps	89158	Kw hr
Shared Spaces Conditioning HP	27110	Kw hr
Outdoor Air Tempering, all costs	114993	Kw hr
Apartment Heat Pumps, by Group		
18	2904	Kw hr
18 N	5141	Kw hr
24	2930	Kw hr
24 N	6471	Kw hr
30	5461	Kw hr
18/24	12485	Kw hr
18/24 N	17485	Kw hr
24/30	4099	Kw hr
DHWH	8792	Kw hr
Apartment Lighting	344925	Kw hr

Total Lighting Consumption	394556	kwhr
Total Mechanical Consumption	297029	kwhr

(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
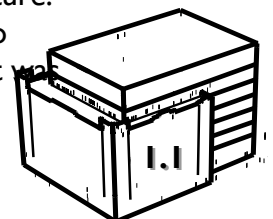
building costs each apartment would receive, I gave each apartment an arbitrary rating based on its square feet, location, and views. This is a typical method to break up shared building expenses.

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
$115	$101	$112	$103	$108	$136	$142	$141	$113	$103	$103	$115	$1,392

Apartment 6A7B

J	F	M	A	M	J	J	A	S	O	N	D	Total
$286	$259	$288	$262	$272	$353	$374	$380	$314	$267	$264	$289	$3,609

c.   Price of the total system to the building owner

I broke out all the components from the original system from RS Means and added the components for this geothermal system. One of the largest costs is constructing a heat recovery wheel for the rooftop units, since the rooftop units only come in 35 ton sizes, two additional AHU's must be built, and additional ductwork must be added to sufficiently separate the exhaust and supply intake. Surprisingly, the total first costs are still nearly equivalent. So, the cost of installing geothermal wells offsets the costs of the original design boiler and chillers. The new predicted cost for this system is $1,220,000 (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 $27,000 and $71,000 (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 decentral geothermal 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
Decentral Geo	191	2,239	1,318	409,814

(C-4)