

SUMMARY OF ANALYSES

PHASE I: FACADE REDESIGN

- Increased potential energy savings from dimming while decreasing overall energy load
- Reduced number of fixtures required per floor by approximately 50%
- Minimized direct solar glare
- Maintained architectural and owner vision of building transparency
- Reduced the annual energy consumption by 23%

PHASE II: COGENERATION PLANT REDESIGN

- Devised a method for building operators to implement a cap on purchased peak electrical demand
- Increased the installed electric generating capacity from 1,400 kW to 3,265 kW
- Reduced the annual building operating costs by 20% compared to the existing CHP system

PHASE III: LATERAL SYSTEM REDESIGN

- Redesigned moment and braced frame lateral system eliminates inherent torsion and reduces required steel by 3.5% while maintaining Thornton Tomasetti's performance requirements
- Removed outrigger at 51st floor to create two additional rentable floors (including a penthouse) to bring in additional revenue
- Analyzed building for progressive collapse resistance; analysis indicates it is not currently resistant according to GSA and DoD standards, but increasing sizes based on static methods does not seem to be a cost effective option

PHASE IV: DISTRIBUTION SYSTEM AND COORDINATION

- Concluded that bus ducts were not a cost effective replacement for wire in conduit
- Replaced existing UFAD system with a more simple raised floor for utility access
- Chose DOAS with ACBs because of reduced space requirements and superior thermal comfort
- Focused on team IPD to allow for constant coordination; zero system clashes were found on the first clash detection analysis
- Achieved a 177 day schedule reduction for the interior fit out portion of the project- 3D coordination model allowed for the creation of 4D models that ultimately aided in utilizing SIPS techniques

SUMMARY OF FINANCES

The costs shown below only reflect those of systems that have been suggested for implementation based on technical analysis. Negative numbers reflect an increased cost, whereas positive numbers represent a savings.

Phase I: Façade Redesign*

	Material	Labor	Typical Floor Cost	Total Building Cost
Existing Façade	\$810,414	\$45,383,218	\$1,606,293	\$83,527,260
Redesigned Façade	\$1,343,285	\$75,223,990	\$2,153,700	\$120,607,208
Difference	-\$532,871	-\$29,840,772	-\$547,407	-\$37,079,948

Phase II: Cogeneration Plant Redesign

	Equipment Cost	Labor	Annual Operating Costs	Payback Period
Existing CHP Plant	\$3,673,500.00	\$114,750.00	\$10,983,700.00	-
Redesigned CHP Plant	\$6,708,800.00	\$255,000.00	\$8,773,200.00	3.15 Years
Difference	-\$3,035,300.00	-\$140,250.00	\$2,210,500.00	

* Additional first costs do have a significant impact on energy savings, which are reflected in the annual operating costs shown in Phase II.

The rise in first costs coupled with the large annual savings can have significant impacts on loan repayment, as shown below:

Interest Rate	Number of Annual Payments	Present Value of Loan	Current Annual Payment	Future Value of Loan at End of Loan Period	Annual Savings Applied to Payments	Potential PV of Loan w/ savings applied to payments	Potential NP w/ savings applied to payment
0.015	25	\$1,041,000,000.00	(\$50,242,255.52)	(\$1,256,056,387.88)	(\$2,210,500.00)	\$1,086,800,700.55	23.74
0.02	25	\$1,041,000,000.00	(\$53,320,476.39)	(\$1,333,011,909.81)	(\$2,210,500.00)	\$1,084,156,600.53	23.73
0.025	25	\$1,041,000,000.00	(\$56,501,233.81)	(\$1,412,530,845.22)	(\$2,210,500.00)	\$1,081,727,084.08	23.72
0.03	25	\$1,041,000,000.00	(\$59,782,413.75)	(\$1,494,560,343.79)	(\$2,210,500.00)	\$1,079,491,762.97	23.71
0.035	25	\$1,041,000,000.00	(\$63,161,670.86)	(\$1,579,041,771.57)	(\$2,210,500.00)	\$1,077,432,388.01	23.69
0.04	25	\$1,041,000,000.00	(\$66,636,453.26)	(\$1,665,911,331.52)	(\$2,210,500.00)	\$1,075,532,607.72	23.67
0.045	25	\$1,041,000,000.00	(\$70,204,028.19)	(\$1,755,100,704.71)	(\$2,210,500.00)	\$1,073,777,755.91	23.65
0.05	25	\$1,041,000,000.00	(\$73,861,508.05)	(\$1,846,537,701.21)	(\$2,210,500.00)	\$1,072,154,664.46	23.63