Attachment E

Donald F. Dickerson Associates — *consulting engineers*

18425 BURBANK BLVD., SUITE 404
TARZANA, CALIFORNIA 91356

PHONE (818) 385-3600
(310) 227-1865
FAX (818) 990-1669

Western & Franklin
1860-1868 N. Western Avenue
5440-5448 W. Franklin Avenue
Los Angeles, California

Building Performance Report

Analysis of Energy Efficiency of Project Compared to Title 24

Based on Architectural Drawings

Prepared For: KTGY Architecture + Planning

By: Donald F. Dickerson Associates

Project No.: 201738

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I. EXECUTIVE SUMMARY

This report summarizes the evaluation of the energy efficiency performance of the proposed Western & Franklin project in comparison to Title 24 – 2016 energy standards. The proposed project is a mixed-use development in the City of Los Angeles consisting of 87 residential units and 15,043 square feet of non-residential use (6,000 square-feet of retail and a 2,526 square foot fitness plus 6,517 square feet of lounge space) and vehicular and bicycle parking in one integrated building on an approximately 0.88 acre site. This analysis focuses on the building envelope, geometry, shading design and energy efficiency. Using an energy model following the Title 24 Alternative Calculation Method (ACM) Manual Model, the analysis compares the energy efficiency of the proposed project against Title 24 2016 standards. As explained further in this report, the proposed project with energy efficiency measures and other aspects of the building design will be 15% more energy efficient than Title 24 standards.

II. ENERGY MODELING

This analysis evaluates the proposed project's energy efficiency level as compared to the Title 2014 2016 standards as a baseline.

To fully understand the actual building performance and effect of various energy efficiency measures, an energy modeling methodology was used to perform the analysis. A model of the Title 24 standards was created and strictly followed the Title 24 Alternative Calculation Method (ACM) Manual. Energy model inputs assumptions such as envelope construction, schedules and internal loads follow Title 24 Reference Method Appendix 5.4 A and B. HVAC system efficiencies were derived from Title 24 2016 standards. Building energy simulations were performed using simulation software that permits modeling of complex building geometry, lighting systems, mechanical systems, central plant equipment, and detailed thermal energy definitions of key characteristics for the building envelope, mechanical equipment, lighting fixtures, and electrical equipment. Systems were simulated with detailed control sequences and utilization schedules. The interactions between all building loads, systems and HVAC equipment were then simulated in hourly time intervals using typical or long-term average weather and solar data for the location to provide a detailed account of energy consumption and demand. For each of the 8,760 hours during the course of a typical year, the program considered site climate data, building construction, occupancy load, connected loads, and the response of the mechanical systems to maintain occupancy comfort to calculate the overall annual building energy utilization profile.

Simulation inputs for this energy analysis are discussed below and were derived from the designed system information, architectural drawings and assumptions provided by the design team, and Title 24 standards.

1. SITE AND CLIMATE

The site of a project is generally the first and most important factor that impacts the energy use of a project. Any location will have characteristics of the climate that will be beneficial, and some that will pose great challenges. One key to sustainable design is to understand the climate and use it with the function of the building, instead of against it.

This project is located in Los Angeles, California. The meteorological data used for the simulations is a full year, 8,760 hour weather data file for Los Angeles, CA obtained from the Department of Energy. The building is oriented with a building azimuth facing True North. General information about the location and weather data have been provided in the table below.

Table 1. Project and Site

Parameter	Description
Project Address	1860-1868 N. Western Ave., 5440-5448 N.W. Franklin Ave., LA
Latitude/Longitude	34° N / 118.38° W
Altitude	384 ft.
Climate Zone	ASHRAE 3B / CA 9
Weather File	CA-Los Angeles-Downtown-7
Summer Design (DB/WB)	89° / 70°F (0.5%)
Winter Design DB	36°F (99%)

2. OCCUPANCY

2.1 Building Schedule

Hourly schedules of operation of the building systems, occupancy, lighting, and other loads were incorporated for the simulation model based on Title 24 factors. They are intended to represent a "typical" week of operation for the type of project uses. The HVAC runs in an occupied/unoccupied (or on/off) fashion to maintain heating and cooling setpoint schedules for each hour. Occupancy, lighting and equipment schedules are fractional type schedules that adjust the peak (or design) densities at each hour of the day.

The general anticipated operating hours for each main area of the project is 24 hours per day, 7 days per week. The figures presented in the section below show the occupancy ("people") profile as a ration of the peak design value for a typical week.

2.2 Hourly Schedules

Hourly schedules of operation of the building systems, occupancy, lighting, and other loads were incorporated into the simulation model based on Title 24 factors. They are intended to represent a "typical" week of operation. The HVAC runs in an occupied/unoccupied (or on/off) fashion to maintain heating and cooling setpoint schedules for each hour. Occupancy, lighting and equipment schedules are fractional type schedules that adjust the peak (or design) densities at each hour of the day.

2.2.1 Residential (Title 24)

Typical residential space occupant schedule.

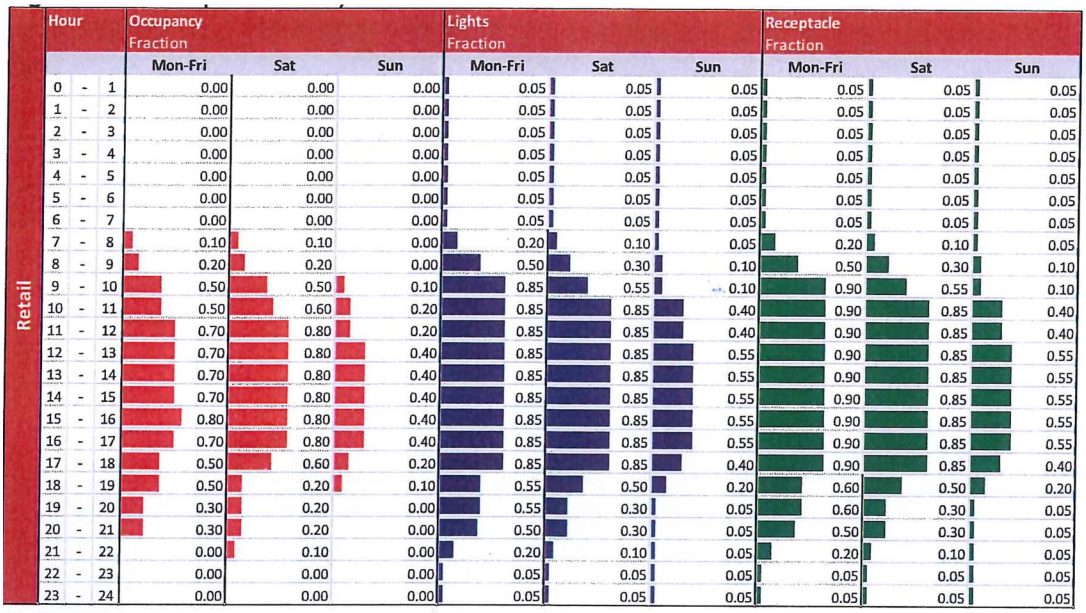
Figure 1. Residential Space Hourly Schedules

	Hour	Occupancy Fraction			Lights Fraction			Receptacle Fraction		
		Mon-Fri	Sat	Sun	Mon-Fri	Sat	Sun	Mon-Fri	Sat	Sun
Residential	0 - 1	0.90	0.90	0.90	0.10	0.10	0.10	0.10	0.10	0.10
	1 - 2	0.90	0.90	0.90	0.10	0.10	0.10	0.10	0.10	0.10
	2 - 3	0.90	0.90	0.90	0.10	0.10	0.10	0.10	0.10	0.10
	3 - 4	0.90	0.90	0.90	0.10	0.10	0.10	0.10	0.10	0.10
	4 - 5	0.90	0.90	0.90	0.10	0.10	0.10	0.10	0.10	0.10
	5 - 6	0.90	0.90	0.90	0.30	0.30	0.30	0.30	0.30	0.30
	6 - 7	0.70	0.70	0.70	0.45	0.45	0.45	0.45	0.45	0.45
	7 - 8	0.40	0.40	0.40	0.45	0.45	0.45	0.45	0.45	0.45
	8 - 9	0.40	0.40	0.40	0.45	0.45	0.45	0.45	0.45	0.45
	9 - 10	0.20	0.20	0.20	0.45	0.45	0.45	0.45	0.45	0.45
	10 - 11	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.30	0.30
	11 - 12	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.30	0.30
	12 - 13	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.30	0.30
	13 - 14	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.30	0.30
	14 - 15	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.30	0.30
	15 - 16	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
	16 - 17	0.50	0.50	0.50	0.30	0.30	0.30	0.30	0.30	0.30
	17 - 18	0.50	0.50	0.50	0.30	0.30	0.30	0.30	0.30	0.30
	18 - 19	0.50	0.50	0.50	0.60	0.60	0.60	0.60	0.60	0.60
	19 - 20	0.70	0.70	0.70	0.80	0.80	0.80	0.80	0.80	0.80
	20 - 21	0.70	0.70	0.70	0.90	0.90	0.90	0.90	0.90	0.90
	21 - 22	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	22 - 23	0.90	0.90	0.90	0.70	0.70	0.70	0.70	0.70	0.70
	23 - 24	0.90	0.90	0.90	0.30	0.30	0.30	0.30	0.30	0.30

2.2.2 Retail (Title 24)

Typical retail space occupant schedule.

Figure 2. Retail Space Hourly Schedules



Retail	Hour	Occupancy Fraction			Lights Fraction			Receptacle Fraction		
		Mon-Fri	Sat	Sun	Mon-Fri	Sat	Sun	Mon-Fri	Sat	Sun
	0 - 1	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05
	1 - 2	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05
	2 - 3	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05
	3 - 4	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05
	4 - 5	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05
	5 - 6	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05
	6 - 7	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05
	7 - 8	0.10	0.10	0.00	0.20	0.10	0.05	0.20	0.10	0.05
	8 - 9	0.20	0.20	0.00	0.50	0.30	0.10	0.50	0.30	0.10
	9 - 10	0.50	0.50	0.10	0.85	0.55	0.10	0.90	0.55	0.10
	10 - 11	0.50	0.60	0.20	0.85	0.85	0.40	0.90	0.85	0.40
	11 - 12	0.70	0.80	0.20	0.85	0.85	0.40	0.90	0.85	0.40
	12 - 13	0.70	0.80	0.40	0.85	0.85	0.55	0.90	0.85	0.55
	13 - 14	0.70	0.80	0.40	0.85	0.85	0.55	0.90	0.85	0.55
	14 - 15	0.70	0.80	0.40	0.85	0.85	0.55	0.90	0.85	0.55
	15 - 16	0.80	0.80	0.40	0.85	0.85	0.55	0.90	0.85	0.55
	16 - 17	0.70	0.80	0.40	0.85	0.85	0.55	0.90	0.85	0.55
	17 - 18	0.50	0.60	0.20	0.85	0.85	0.40	0.90	0.85	0.40
	18 - 19	0.50	0.20	0.10	0.55	0.50	0.20	0.60	0.50	0.20
	19 - 20	0.30	0.20	0.00	0.55	0.30	0.05	0.60	0.30	0.05
	20 - 21	0.30	0.20	0.00	0.50	0.30	0.05	0.50	0.30	0.05
	21 - 22	0.00	0.10	0.00	0.20	0.10	0.05	0.20	0.10	0.05
	22 - 23	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05
	23 - 24	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05

2.2.3 Program and Occupant Density

The program of the project was developed in consultation with the Owner and Architect and is reflected in the energy simulation model. Spaces were classified by their use and grouped together into industry standards use types to share schedules, occupancy densities and other internal load characteristics. The occupant density for the spaces in the project were defined by a combination of building code occupancy rates, or other industry standards. Both the proposed project model and Title 24 standards model used the same occupant density. The occupant density prescribed by Title 24 was incorporated in the models.

Space Description	Floor Area (sf)	Occupant Density (sf/per)	Occupants (# per)
Corridor/Restroom/Stairs/Support Area	11,616	100	116
Electrical, Mechanical, Telephone Rooms	911	333	3
Exercise Center, Gymnasium Areas	2,526	15	168
Residential Living Spaces	63,252	200	316
Lobby, Main Entry	240	15	16
Lounge, Recreation, Leasing Lounge	6,517	15	435
Parking Garage Building, Parking Area	44,682	-	-
Retail Merchandise Sales (See note #2)	6,000	30	200
Total	**135,744**	**-**	**1,254**
Total (Weighted Avg.)	**-**	**108**	**-**

Note 1: The floor area is based on the project architectural drawings, dated December 17, 2017 and includes square footage not included in the City's defined floor area (such as parking, shafts, storage, unconditioned spaces, etc.).
Note 2: For restaurant use the occupants would be based on a density of 1/15 s.f. in dining areas and 1/200 s.f. in kitchen areas, and would not affect the overall building performance.

3. ARCHITECTURE AND FORM

The architecture and building form provide the foundation for the energy use within a building. Though these elements do not consume energy on their own per se; the building orientation, geometric relationships, and material selections define the loads on the building systems and dictate the opportunities to capitalize on the local environment through passive systems and onsite power generation.

3.1 Massing and Orientation

The building consists of 6 stories overall including one level of underground parking. Environmental features include solar panels and cycling amenities. Four stories are residential, with a ground floor level of storefronts and patio seating, ground floor parking and 1 level of subterranean parking. There are 27 ground floor retail and resident parking stalls and 85 private subterranean stalls for a total of 112 parking stalls to accommodate shops, residences, and guests. The ground floor storefront is expected to be a mix of retail and restaurant.

3.2 Opaque Assemblies

Opaque assemblies include roof, wall and floor assemblies that enclose spaces in the project and protect them from the outdoor environment. They are often generalized to the major types that serve 5% or more of the project. The assemblies used in the simulation model are described in the table below. Where detailed design is not yet available, standard assumptions were applied. For Title 24 standards model, the envelope performance follows the prescriptive envelope thermal performance requirements.

Table 3. Performance Characteristics of Opaque Assemblies

Building Component	As-Designed	Title 24 Baseline (2016)
Roof		
Description	5/8" Gypsum Board, Wood Frame w/ R-38 Insulation, ¾" Plywood, 6" of Expanded Polystyrene and 3/8" Built-up Roofing.	1/2" Gypsum Board, Wood Frame w/ 30 insulation, 1/2" Plywood, 1/4" Asphalt Shingles.
Additional Insulation	-	-
U-Factor	0.016	0.028
Aged Solar Reflectance	0.1	0.55
Thermal Emittance	0.85	0.75
Solar Reflectance Index (SRI)	75	75
Metal Framed Wall (1st Level)		
Description	2 X 6 Metal framed wall, 16" o.c., w/R-19 batt insulation in cavity	2 X 6 Metal framed wall, 16" o.c., w/R-19 batt insulation in cavity
Additional Insulation	-	-
U-Factor	0.109	0.062

Wood Framed Wall (2nd through 5th Levels)		
Description	2 X 6 Wood framed wall, R-19 Insulation in cavity	2 X 6 Wood framed wall, R-19 Insulation in cavity
Additional Insulation	-	R-10 additional insulation
U-Factor	0.067	0.059

3.3 Fenestration

The fenestration includes vertical glazing. All the vertical windows were considered as vertical glazing. No skylights are designed for the proposed project.

Table 4. Performance Characteristics of Fenestration

Building Component	As-Designed	Title 24 Baseline (2016)
Vertical Glazing (Lobby)		
Residential Glass	Double glazing w/center of Glass U-Factor of 0.25, 0.5" Argon space	Double glazing w/center of Glass U-Factor of 0.36.
	Fixed/Oper.	**Fixed/Oper.**
U-Factor (Assy / CoG)	0.27/0.28	0.36/0.46
Solar Gain (SHGC)	0.22/0.25	0.25/0.22
Visible Light Transmittance (VLT)	0.5/0.5	0.5/0.5
Non-Residential Glass (Storefront) Thermally Broken		
U-Factor	0.41	0.41
Solar Gain (SHGC)	0.25	0.26
Visible Light Transmittance (VLT)	0.5	0.5

Table 5. Window-to-Wall Ratios by Building and Orientation

	South	West	North	East	Overall
As Designed	23.5%	34.8%	35.2%	28.3%	30.8%
Title 24 Baseline	38%	40%	33%	43%	40%

4. BUILDING SYSTEMS

4.1 Interior Lighting

In order to provide adequate light levels for tasks that will take place in the project spaces, an electric lighting system is designed. The system includes light sources, fixtures, power distribution, and associated controls that adjust levels based on varying needs.

These systems are simulated in the model by entering a design lighting power density in terms of watts per square foot, a schedule that adjusts the design level for each hour of the year, and adjustments to density or schedule based on advanced control systems for each space type.

As the project lighting system has not been fully designed, the proposed project model and Title 24 standards model assumed the Title 24 standards Lighting Power Density (LPD) in the dwelling units and a reduced LPD for the use of LED lighting in the nonresidential spaces.

Table 6. Performance Characteristics of Lighting System

Space Description	Floor Area (sf)	Proposed LPD (W/sf)	Title 24 Baseline LPD (W/sf)
Corridor/Restroom/Stairs/Support Area	11,616	0.60	0.60
Electrical, Mechanical, Telephone Rooms	911	0.70	0.70
Exercise Center, Gymnasium Areas	2,526	0.75	1.00
Residential Living Spaces	63,252	0.4	0.50
Lobby, Main Entry	240	0.3	0.5
Lounge, Recreation, Leasing Lounge	6,517	0.7	0.9
Parking Garage Building, Parking Area	44,682	0.14	0.14
Retail Merchandise Sales	6,000	0.9	1.20
Total	**135,744**	**51,092**	**60,569**
Total (Weighted Avg.)	**-**	**0.38**	**0.45**

Note: For restaurant use, the dining area and kitchen LPD would be comparable and would not affect the overall building performance.

4.2 Daylighting Control

Daylighting control is utilized in the space where the daylight is available. Based on the sensed illuminance for each space, the lighting control is able to adjust the LPD to reduce the lighting energy use while still keeping a visually comfortable indoor environment. For this energy model, daylighting control was not included. Daylighting control is anticipated to result in an energy savings for the project, however, it is conservatively assumed that the difference would not be appreciable and was not included in the comparison to Title 24 standards.

4.3 Exterior Lighting

The exterior lighting energy use is calculated based on the project site area. The site area is determined from the architectural drawing. Exterior lighting energy use is not determined at this stage of design and should not be included in the model. Exterior lighting for this type of project is not anticipated to result in an appreciable difference in the comparison to Title 24 standards.

4.4 HVAC System

4.4.1 Basis of Design Air-Side System

The proposed project would be served by a split system heat pump system, which would serve all the typical floors on the residential portion

of the building. The zoning of the split system heat pump system allows the building to optimize its energy use by delivering variable refrigerant to each individual space while maximizing heat recovery during simultaneous cooling and heating. The building also has a dedicated outdoor air unit providing ventilation to the spaces. The following lists the comparison between proposed split system and the system for Title 24 standards baseline.

Table 7. Proposed and Baseline System Comparison

Models	System No.	System Type	Fan Control	Cooling Type	Heating Type
As Designed	N/A	Split System Heat Pump	VSD	Direct Expansion	Heat Pump
Title 24 Baseline	Sys 2	Four Pipe Fan Coil (FPFC)	VSD	Chilled Water	Boiler

4.5 Miscellaneous Equipment

Equipment included in this section is comprised mainly of equipment plugged into receptacles or other hard-wired equipment that supports the function of the spaces and is not significant enough to break out and calculate separately.

The miscellaneous equipment power densities for subject project is not significant enough to breakout and include in the calculation.

III BUILDING ENERGY PERFORMANCE

There are performance measures and design features of the proposed project that increase the building energy efficiency as compared to Title 24 2016. These include:

a. The balcony design of the proposed project will provide shading benefits on the residential tower to reduce cooling load.
b. High performance glazing system will be used.
c. High efficiency split system, heat pumps with cooling/heating SEER to achieve at least 15-16 for residential areas and 17-20 for non-residential areas.
d. Condensing boiler which achieve efficiency of 97% for the domestic hot water.
e. Efficient lighting design to achieve a minimum of a 30% Lighting Power Density for the first two levels and the parking area.

With the incorporation of these performance measures and design features, the proposed project would have an Energy Use Intensity (EUI) of 67.58 kBtu/sf, which exceeds Title 24 standards of an EUI of kBtu/sf 80.31 by 15.9%. This is demonstrated in Table 8 and Figure 3 below.

These performance estimates are intended to be used for relative comparisons between the proposed project and the Title 24 baseline model. There are many

additional potential energy efficiency measures that can achieve the 15% improvement on energy efficiency compared to Title 24. The final combination of design and energy efficiency measures will be reviewed and selected during the final design of the project. At the time of final design, all design options will be evaluated and chosen to achieve the 15% energy savings.

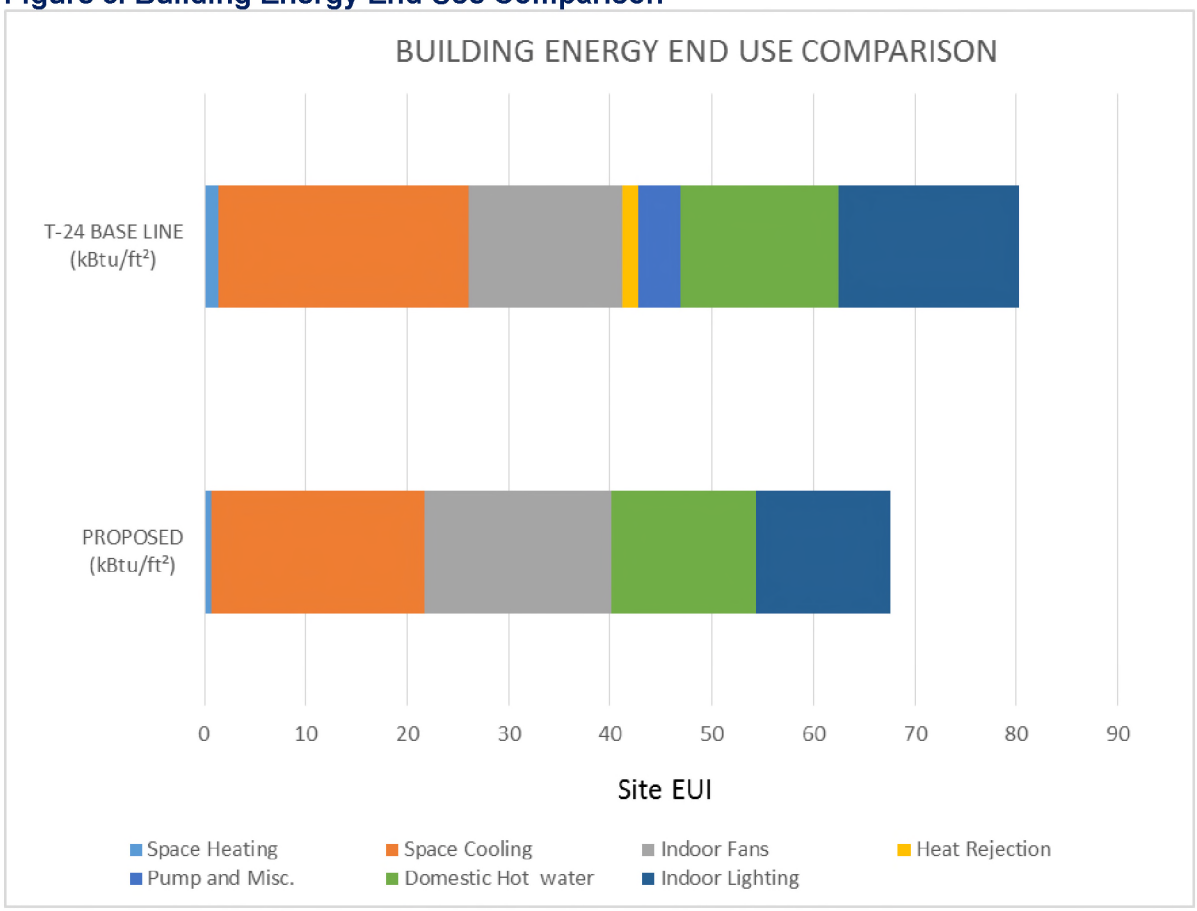
Table 8. Building Energy End Use

Compliance Results for Performance Components (Annual TDV Energy Use, kBtu/ft²-yr)

1. Energy Component	2. Title 24 Baseline (TDV)	3. Proposed Design (TDV)	4. Compliance Margin (TDV)	5. Percent Better than Standard
Space Heating	1.46	0.70	0.76	52.1%
Space Cooling	24.58	20.99	3.59	14.6%
Indoor Fans	15.11	18.39	-3.28	-21.7%
Heat Rejection	1.59	--	1.59	--
Pumps & Misc.	4.26	--	4.26	--
Domestic Hot Water	15.49	14.30	1.19	7.7%
Indoor Lighting	17.82	13.20	4.62	25.9%
COMPLIANCE TOTAL	**80.31**	**67.58**	**12.73**	**15.9%**
Receptacles	43.91	43.91	0.0	0.0%

Note 1: Excerpt from Energy Pro Title 24 calculation.
Note 2: "TDV" is Time Dependent Valuation.
Note 3: Receptacles are not included in a project's energy budget under Title 24.

Figure 3. Building Energy End Use Comparison



IV. CONCLUSION

As discussed above, the proposed project with energy efficiency measures and other aspects of the building design will be 15% more energy efficient than Title 24 standards.