Urban Land Institute

ULI Tenant Energy Optimization Program

Case Study: The Estée Lauder Companies Inc.

Executive Summary: The Estée Lauder Companies' Story

In 2014, The Estée Lauder Companies—one of the world's leading manufacturers and marketers of quality skin care, makeup, fragrance, and hair care products—signed a lease for approximately 10,000 square feet on Floor 26 at 110 East 59th Street, a 36-story, Class-A office tower.

The 612,181-square-foot property, built and owned by Jack Resnick & Sons, is located in the heart of Manhattan's Plaza District on 59th Street between Lexington and Park avenues.

When it was time to design and construct its new space, The Estée Lauder Companies ("the Company") had several major goals, including creating new energy and sustainability design criteria for its real estate and facilities operations. The company believes its long-term success depends on its respect for and conservation of natural and human resources, and it is committed to understanding and managing the economic, environmental, and social impacts throughout its entire value chain.

Enter the Tenant Energy Optimization process—a proven, replicable approach that integrates energy efficiency into tenant space design and construction and delivers excellent financial returns through energy conservation. Working in tandem with a team of experts, the Company evaluated an integrated package of energy performance measures (EPMs)[1] on Floor 26. The chosen EPMs were incorporated into the space design to achieve substantial, cost-effective energy savings and a superior workplace environment.

Over the term of the Company's six-year lease, the project is estimated to provide energy costs savings of $15,862, a 42% return on the Company's investment[2], and a 19.4% internal rate of return (IRR)[3]. The projected payback: only 3.7 years.

The Estée Lauder Companies' project is part of a series of case studies aimed at presenting the energy and cost savings impact of high-performance tenant design. The case studies and companion resource guides[4] provide the market with a replicable model to expand the demand for high-performance tenant spaces and supply of market expertise to deliver strong results from such projects. Spaces using this step-by-step design and construction process typically demonstrate energy savings between 30% to 50%[5], have payback periods of three to five years, and average a 25% annual return.

1. EPMs are technologies and systems that aim to reduce energy use through efficiency and conservation. They are also frequently referred to as Energy Conservation Measures (ECMs).
2. Assuming zero escalation in electricity prices over the lease term and a 5% administrative fee per the terms of tenant's lease.
3. The discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project. (See more: http://www.investopedia.com/terms/i/irr.asp)
4. The guides can be accessed at tenantenergy.uli.org.
5. Compared to American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 90.1-2007 code requirements.

What Is the 10-Step Tenant Energy Optimization Process?

The Tenant Energy Optimization process is a proven, replicable approach that integrates energy efficiency into tenant space design and construction and delivers excellent financial returns through energy conservation.

What Are the Benefits of the Tenant Energy Optimization Process?

It generates an attractive return on investment (ROI)—Tenants using the step-by-step design and construction process typically have experienced:
- Energy savings of 30 percent to 50 percent
- Payback in as little as three to five years
- An average annual internal return rate of 25 percent

It provides a competitive edge—Companies with more sustainable, energy-efficient workplaces enhance their ability to attract, retain and motivate workers who are healthier, happier, and more productive.

It is scalable and replicable—The process can provide energy and financial savings whether the tenant leases 2,500 or 250,000 square feet. Tenants and service providers who have gained expertise through implementation of the process have demonstrated that there is high potential for transferability beyond tenant office space to other property sectors.

It is proven—Through measurement and verification, tenants are able to demonstrate and communicate energy and financial savings.

It is environmentally critical—Energy use in buildings is the largest source of climate-changing carbon pollution and tenant spaces generally account for more than half of a building's total energy consumption, making this process essential to improving the environmental performance of buildings and addressing global climate change.

Overview: The Estée Lauder Companies Project Information and Projected Performance

Building Information				
Tenant Name	The Estée Lauder Companies			
Building Owner	Jack Resnick & Sons			
Location	110 E. 59th St., Plaza District, Manhattan			
Building Size	612,181 SF (36 Floors)			
Principal Use	Office			
Construction Type	Class-A, 1960s Office Tower			
The Estée Lauder Companies Lease Term	Six years			
Floor 26 Buildout	**Projected Design**		**M&V Calibration**	
Modeled Square Footage	7,500 square feet			
Modeled Energy Reduction	10.8%		12.1%[6]	
Annual Electricity Reduction	20,236 kWh	2.7 kWh/SF	13,508 kWh	1.8 kWh/SF
Total Electricity Savings over Lease Term	0.1 GWh	16.2 kWh/SF	0.1 GWh	10.8 kWh/SF
Incremental Implementation Cost: ***Energy Modeling Soft Cost:*** ***State Incentives:***	*$4,188* *$5,500* *$0*	*$0.56/SF* *$0.73/SF* *$0/SF*	*$4,188* *$5,500* *$0*	*$0.56/SF* *$0.73/SF* *$0/SF*
Adjusted Incremental Implementation Cost	$9,688	$1.29/SF	$9,688	$1.29/SF
Total Electricity Costs Savings over Lease Term	$23,069	$3.08/SF	$15,862	$2.11/SF
Electricity Cost Savings over Lease Term (Present Value)	$19,959	$2.66/SF	$13,723	$1.83/SF
Net Present Value of Project Investment	$10,271	$1.37/SF	$4,035	$0.54/SF
Return on Investment over Lease Term	106%		42%	
Internal Rate of Return	40.6%		19.4%	
Payback Period (with Incentives)	2.5 years		3.7 years	

6. Differences in modeled energy reduction is usually due to a discovered underestimation or overestimation of energy use in the measurement and verification process.

Who Is Involved in the Tenant Energy Optimization Process?

It is collaborative—The process connects the dots between tenants, building owners, real estate brokers, project managers, architects, engineers, and other consultants to create energy-efficient workplaces. In this regard, the process reflects ULI's longstanding tradition of bringing together professionals from a variety of real estate disciplines to improve the built environment.

Tenants | Building Owners | Real Estate Brokers | Project Managers | Architects, Engineers, and Contractors | Energy Consultants

Supply and Demand: The Role of the Broker, Tenant, Building Owner, and Consultants

Leasing brokers are influential tenant advisers during the pre-lease phase. If experienced in energy efficiency conversations, brokers can help tenants demand and understand building energy performance information during the site-selection process. Brokers who highlight case studies or examples of work representing tenants in the selection of high-performance spaces may gain additional clients.

Tenants create demand for energy-efficient, high-performing space. Tenants also create demand for consultants who can advise them on how to reach their sustainability goals through the design and construction of energy-efficient space. By prioritizing energy-efficient space and working closely with their advisers, tenants can develop better workplaces to attract and motivate employees, attain recognition for sustainability leadership, and manage costs.

Building owners supply high-performance buildings that help tenants meet their energy performance and financial goals. Real estate owners can gain competitive advantages by marketing energy-efficient buildings' cost-saving energy and operations improvements to attract high-quality, sophisticated tenants. Tenants may prefer longer lease periods in highly efficient buildings that better align with their corporate environmental and social responsibility goals, provide financial benefits, and add recognition value.

Consultants (e.g., architects, engineers, project managers, energy consultants, and contractors) provide the expertise to optimize energy performance and present the technical options and economic case for a comprehensive, cost-effective, and high-performance space while meeting the tenant's schedule and budget. Consultants offering these services may attract additional clients by demonstrating cost savings and other benefits to tenant's business goals.

Key steps for choosing a high-performing space include:

1. Select a leasing broker experienced in energy efficiency.
2. Convene a workplace strategy and energy performance optimization workshop.
3. Perform a financial analysis.
4. Assess high-performance space feasibility.
5. Meet with the building owner to discuss collaboration to improve energy performance.

Selecting an Efficient Base Building

Good:

- ☐ Building reports ENERGY STAR score
- ☐ Ongoing tenant-landlord energy efficiency coordination
- ☐ Landlord willing to allow submetered tenant space

Better—includes all of Good, plus:

- ☐ Building ENERGY STAR score of 75 or higher
- ☐ Central building management system (BMS) with tie-in of tenant heating, ventilating, and air conditioning (HVAC) and lighting
- ☐ Building energy audit, ongoing commissioning activities, and energy capital projects completed
- ☐ Submetered tenant space with energy billed on actual usage

Best—includes all of Better, plus:

- ☐ Subpanels to measure tenant lighting, HVAC, and plug loads separately
- ☐ Tenant energy management program (such as a dashboard)

Questions to Ask the Building Owner

What is the building's ENERGY STAR score? The EPA recognizes top-performing buildings that meet or exceed a score of 75. Even if a building has not achieved ENERGY STAR recognition, an owner that tracks and reports the building's score may be more willing to collaborate on energy efficiency efforts than one who does not currently monitor energy performance.

Is the space submetered, and is the utility billing structure based on actual use? What is the utility rate and average energy cost per square foot? A recent study found that submetered spaces save 21 percent in energy compared to spaces without energy-use information.

What has the building done to improve and maintain energy efficiency and conservation, and when were the improvements installed? Buildings with excellent natural daylight, energy-efficient windows and lighting, envelope walls, advanced equipment controls, and efficient HVAC equipment reduce tenant equipment and energy costs.

Does the building have resources or programs to help with design, construction, and ongoing management of energy-efficient spaces? Request from ownership any design and energy efficiency criteria for the buildout of tenant spaces, recommended cost-effective energy measures with financial value analysis, or a building energy model for reference. Owner-provided resources are a starting point for sensible energy strategies and promote a collaborative relationship between the building owner and tenant. An existing energy model will reduce the upfront cost and effort of implementing the process. Experts can help identify opportunities for cost-saving lighting, outlet plug load, and HVAC opportunities throughout the lease term.

Why The Estée Lauder Companies Chose 110 East 59th Street

Built by current owner Jack Resnick & Sons in 1969, 110 East 59th Street is a modern office building featuring state-of-the-art life safety and communications systems, new elevator systems, and an 800 kW gas-fired cogeneration plant, which provides emergency power for base-building life safety systems. The building's lobby features a double height entry from both 58th and 59th Streets, is attended 24/7, and is secured via electronic turnstiles and a visitor management system. Energy-efficient, double-pane windows were installed in 2011.

The Estée Lauder Companies' space on Floor 26 consists of office space, meeting and conference rooms, a pantry, and small intermediate distribution frame (IDF) room.

A Collaborative Effort

The Estée Lauder Companies attended the Greenbuild International Conference & Expo, a forum dedicated to green building, when it first heard a presentation about the Tenant Energy Optimization process. After some additional research, the process was pitched to its office services division to be rolled out to new projects.

The entire Tenant Energy Optimization process emphasizes the importance of owner and tenant collaboration, particularly since tenant spaces typically account for more than half of a commercial office building's total energy. Overall, the process has seen the strongest results and most significant savings when the landlord engages with the tenant in the process; openly shares the building's energy information; and implements building-wide energy saving measures. The collaboration between Jack Resnick & Sons and The Estée Lauder Companies is a great example of this partnership.

A 2014 survey[7] discovered that 36% of facility, real estate and energy management executives said they were willing to pay a premium for space in a certified green building—a jump from 15% the previous year—and 28% planned to build out tenant space to high-performance standards, an increase from 18% in 2013. Project stakeholders can take advantage of the energy efficiency opportunity by gathering the right information and putting it in front of the right people at the right time during the tenant engagement and decision making process—the earlier the involvement, the more successful the project.

7. The 2014 Energy Efficiency Indicator Survey conducted by Johnson Controls' Institute for Building Efficiency can be found at http://www.institutebe.com/Energy-Efficiency-Indicator/2014-EEI-executive-summary.aspx.

The Project's Key Stakeholders

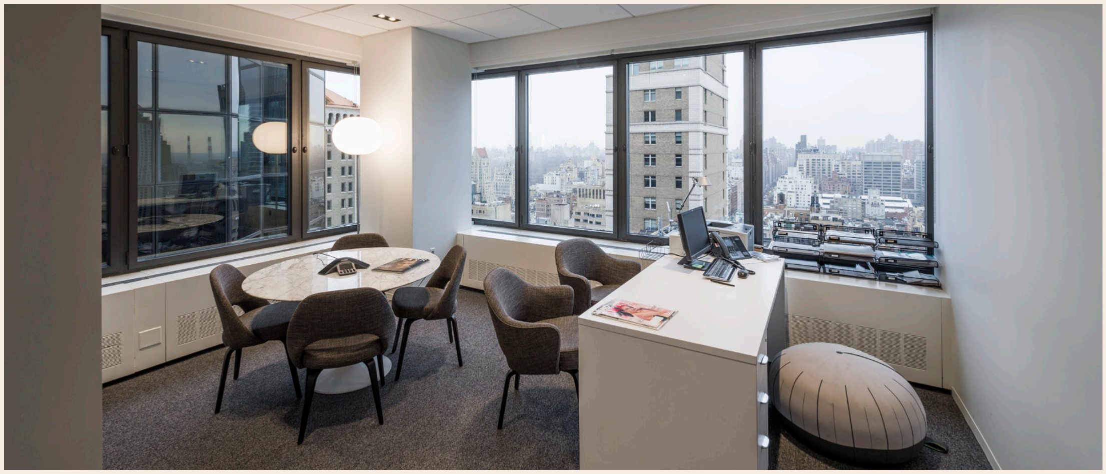
The Tenant: The Estée Lauder Companies

The Estée Lauder Companies was founded in 1946, and the technologically advanced, innovative company has gained a worldwide reputation for prestige beauty and superior quality in skin care, makeup, fragrance, and hair care products. Its products are sold in more than 150 countries and territories. In the U.S., they are available through multiple channels, including department stores, specialty multi-retailers, and online.

The Building Owner: Jack Resnick & Sons

Jack Resnick & Sons owns and manages over six million square feet of commercial office and retail space, and has developed thousands of luxury residences. The company's commercial office portfolio consists of 5 million square feet in Midtown and Downtown Manhattan, and an additional 1.2 million square feet nationwide.

Innovative private offices with daylight, views, and task lighting reduce energy use and increase comfort. Photo by Timothy Schenck.



Perimeter corner offices are included in Estee Lauder Companies' energy monitoring program. Mechanical cooling and heating at the perimeter are provided by the landlord. Photo by Timothy Schenck.

The 10-Step Tenant Energy Optimization Process

PHASE I: PRE-LEASE

Step 1: Select a team

Step 2: Select an office space

PHASE II: DESIGN AND CONSTRUCTION

Step 3: Set energy performance goals

Step 4: Model energy reduction options

Step 5: Calulate projected financial returns

Step 6: Make final decisions

Step 7: Develop a post-occupancy plan

Step 8: Build out the space

PHASE III: POST-OCCUPANCY

Step 9: Execute the post occupancy plan

Step 10: Communicate results

The Estée Lauder Companies Integrates the Tenant Energy Optimization Process

Selecting the Buildout Team

The Estée Lauder Companies Buildout Team

Company	Role
The Estée Lauder Companies	Project Manager
The Estée Lauder Companies	Corporate Sustainability
Gensler	Architect
Robert Derector Associates	Engineer
Gannon Vitolo Contracting	General Contractor
Wendy Fok	Energy Project Director
Arup	Energy Consultant and Modeler (Design)
Integral Group	Energy Consultant (M&V)
Jack Resnick & Sons	Building Owner

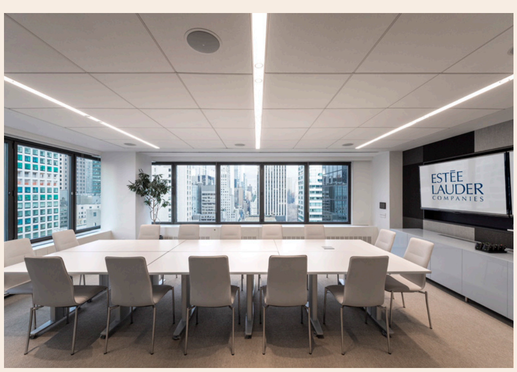
Many of those leading the project team, including the energy modeler, had already been involved in other tenant buildouts utilizing the process.

Setting Energy Performance Goals and Developing a Menu of Measures

The process was kicked off with an energy design workshop in May 2014, which brought together the design and construction team that would be involved in The Estée Lauder Companies' build out. These groups worked in tandem to make sure all energy reduction strategies conformed to the goals and intent of the Company's design. Among important factors the Company wanted to consider in the design were:

- The office would include an open workspace with benching system.
- There would be one large conference room.
- The office would be occupied by corporate innovation team members who act as "Cultural Anthropologists," so it needed to create an innovative environment.
- Other features would include a lab, studio, and shared pantry with additional electric loads, as well as a living room space that flows into a dining room.
- There would be a co-tenant with workstations and one office (with that tenant yet to be decided).

With the Company's objectives in mind, the project team put together tenant space parameters, which formed the basis for the project's energy performance goals:



Conference rooms have abundant natural daylight and ENERGY STAR equipment. Photo by Timothy Schenck.

Glass panel walls allow natural daylight to flow from touchdown work and meeting rooms to the open office areas. Photo by Timothy Schenck.

Menu of Measures

Lighting Power Density (0.7 & 0.9 W/SF): Low Lighting W/SF: This lowers lighting levels to 0.7 W/SF for office spaces and 0.9 W/SF for conference rooms. The assumption is that higher-efficiency fixtures (such as LEDs) are specified and that lower levels of lighting in the space are adequately based on the use of local task lighting. The office and conference spaces cover the majority of the floor area, and there were no lighting changes to other spaces such as the pantry. The average lighting allowance levels when fully illuminated is 1.1 W/SF office spaces and 1.3 W/SF for conference rooms.

Lighting Power Density (0.6 & 0.8 W/SF): Same as above, but further lowers the levels to 0.6 W/SF for office spaces and 0.8 W/SF for conference rooms.

Daylight Harvesting (Sensors 10 Feet from Glazing, 15-Foot Zone Depth): When ample daylight conditions are detected by the daylight sensors, the office lights are automatically dimmed (to 20% output) to reduce artificial lighting usage. This one considers daylight sensors placed 10 feet from the glazing, with lights controlled up to 15 feet away.

Daylight Harvesting (Sensors 15 Feet from Glazing, 25-Foot Zone Depth): Same as above, but considers daylight sensors placed 15 feet from the glazing, with lights controlled up to 25 feet away.

Plug Loads Shutdown (Master Shutoff Switch): A master shutoff switch on plug loads decreases them to 1% of full power (accounts for occasional overrides and other equipment that must remain on). Under normal circumstances, plug loads are assumed to drop to 5% of full power in open office space after 7 p.m. due to automated computer power settings which puts computers that have not been manually turned off into sleep mode.

High-Efficiency Equipment (ENERGY STAR®): If energy-efficient office equipment such as laptops and LED monitors are procured, the office equipment power density is assumed to be 0.4 W/SF. Office equipment when fully powered is assumed to consume 0.75 W/SF in the open office spaces.

Wider Temperature Setpoints (68°F Winter, 75°F Summer): The setpoints were modeled as 75°F in the summer and 68°F in the winter to allow for a wider setpoint range and account for comfort in the summer by adapting clothing to the environmental conditions.

Increase Daytime Setback Duration (9 a.m. to 5:30 p.m.): This increases the daytime setback duration by a small margin by setting back the temperature to 73°F starting at 5 p.m.

Lighting Shutdown (Zone Occupancy Sensors): The overhead office lighting is assumed to be fully on and controlled by one occupancy sensor for the floorplate. The overhead lighting does not turn off until everyone on the floor has left. This EPM adds additional occupancy sensors and controls per zone, so that each zone can be shut off independently. Some zones begin to shut off after 6 p.m., when the majority of occupants have left. Open office spaces are split into eight distinct zones, with conference rooms, breakout areas, and closed offices also independently controllable.

Plug Loads Shutdown (Workstation Occupancy Sensors): Occupancy-based plug strips shut down loads such as monitors and task lights when workers step away from their desks, so that plug loads are reduced. Workstation equipment is assumed to be left on for the majority of the day while workers move around the office.

Conference Room Daytime Setback (HVAC Tied to Occupancy Sensors): This assumes conference rooms are only occupied for four hours per day on average, and that when not occupied, the temperature sets back from 72°F to 74°F in cooling mode and 68°F to 66°F in heating mode.

Automated Shades: This adds interior window shading with 50% transparency for the months of May through October. The shades are assumed to be automatically deployed from the hours of 6 a.m. to 10 a.m. and 3 p.m. to 5 p.m. The shades reduce solar heat gain into the space during those times in the summer when the sunlight would be expected to strike the vertical window surface at a low angle.

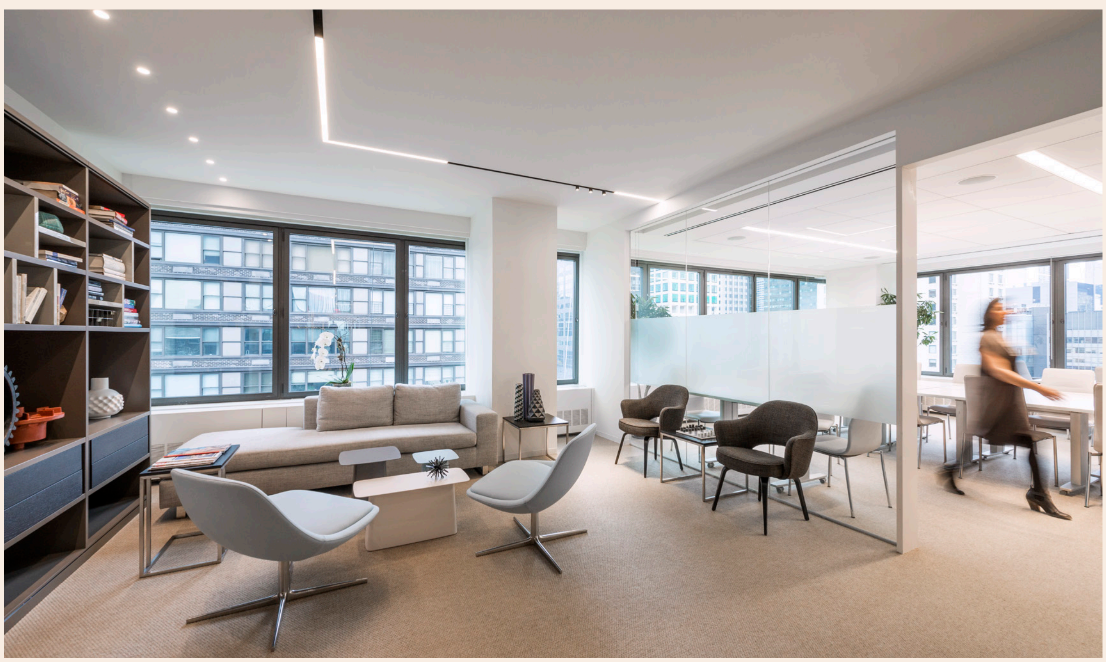
Modeling the Projected Energy Performance

During design development, a predictive energy model was created by Arup using eQuest software, which modeled energy consumption and EPM results for The Estée Lauder Companies' space on Floor 26. The model was later calibrated using metered data gathered during tenant occupation.[8]

Assumptions Present in the Modeling

- Based on 50 peak employees, the occupancy density is 150 square feet per person.
- The space begins occupancy at 9 a.m., with a few people coming in at 8 a.m., and ends occupancy at 6 p.m., with a few people staying until 7 p.m.
- The cooling setpoint in the spaces is 72°F, with a 2°F setback to 74°F. The heating setpoint is 68°F with a 2°F setback to 66°F.
- Illuminations remain on from 7 a.m. to 10 p.m.
- Windows are never opened.
- On a typical day, 95% of the installed lighting is turned on (ignoring daylight harvesting controls but including occupancy sensors).
- On a typical day, greater than 40% of the installed equipment is turned on (without controls).
- Utility rates are based on typical New York City rates. Electricity was assumed to be $0.19/ kWh. Steam was modeled but not included in EPM evaluations.

Recommended EPM[9]	Target Area	Incremental First Cost
Lighting Power Density	Lighting	$14,000
Daylight Harvesting	Lighting	$4,188
Lighting Shutdown (Zone Occupancy Sensors)	Lighting	$9,025
Plug Loads Shutdown (Master Shutoff Switch)	Plug Loads	$2,000
ENERGY STAR® Equipment	Plug Loads	$0



Reception areas and conference rooms are comfortable and energy efficient with a master shutoff switch and energy monitoring. Photo by Timothy Schenck.

8. See Appendix A for detailed analysis.
9. For a more detailed analysis, see The Estée Lauder Companies: The Preliminary Value Analysis.

Performing the Value Analysis

Using energy modeling and incremental costing information, the project team then performed a quantitative value analysis that determined the projected electricity cost savings annually and over the lease term; the resulting payback period; and the tenant's return on investment. This analysis enabled the team to package the energy performance measures to meet the simple payback threshold desired by the Company.

The Estée Lauder Companies' Space: The Preliminary Value Analysis[10]

ID	Energy Performance Measure	Estimated Direct Cost for Project Baseline	Estimated Direct Cost for EPMs	Incremental Cost	Incremental Cost per Square Foot
1	Lighting Power Density - 0.7 / 0.9 W/SF	$191,402	$205,402	**$14,000**	**$1.87**
4	Lighting Shutdown - Based on Zone Occupancy Sensors	-	$9,025	**$9,025**	**$1.20**
5	Daylight Harvesting - Full Dimming Down to 20% Output (Sensors 10)	-	$4,188	**$4,188**	**$0.56**
15	Plug Loads Shutdown - Master Shuttoff Switch	-	$2,000	**$2,000**	**$0.27**
17	Efficient Equipment - 0.4 W/SF	$51,000	$51,000	**-**	**-**

As part of the modeling process, the project team created several sets of measures, also known as "packages," which account for the interactive effects of various EPMs and how they impact payback periods, IRR, and ROI metrics.

In order to understand the interactive effects of measures within a package, the model must be run through repeated cycles incorporating a new EPM with each run, a process called iterative modeling. The results of iterative modeling predict the cumulative effect of implementing a package of EPMs, which accounts for interactions between individual measures that may affect overall energy consumption. For example, a unit of energy saved by utilizing daylight harvesting cannot be saved again through high-efficiency lighting, thus iterative modeling would show less energy savings for this package of EPMs compared to modeling the measures independently.

The output of the model will provide estimated annual energy savings based upon the selected package of measures as compared to the modeled baseline scenario, which can be broken out into identified savings for both the tenant space and the base building systems. For example, certain EPMs may reduce the overall demand on the central building systems, including centralized conditioned air, steam, condenser, and chilled water savings. Depending on the utility billing structure in the lease, such savings are likely to accrue to the building owner (or be shared with all of the other tenants in the building). Savings from lighting, plug load, and server room EPMs typically benefit the tenant directly.

10. Engineer included EPMs at marginal cost above baseline including mark-ups, therefore project baseline and mark-up costs not included.

Reviewing the Budget and Selecting the EPMs

Energy modeling and costing analysis determined the following five EPMs would offer the best value for The Estée Lauder Companies.

1. High Efficiency Lighting (0.7 & 0.9 W/SF)
2. Daylight Harvesting
3. Occupancy Sensor Lighting (Zone-Based Shutdown)
4. ENERGY STAR® Equipment
5. Plug Loads Shutdown (Master Shutoff Switch)

Comparing The Estée Lauder Companies' EPM Packages

Energy Performance Measure	EPM ID	Least Energy Reduction	Moderate Energy Reduction	Significant Energy Reduction
Lighting Power Density 0.7 / 0.9 W/SF	1	+	+	+
Daylight Harvesting - Full Dimming Down to 20% Output (Sensors 10 Feet From Glazing)	5	+	+	+
Plug Loads Shutdown - Master Shutoff Switch	15			+
Efficient Equipment - 0.4 W/SF	17		+	+
Lighting Shutdown - Based On Zone Occupancy Sensors	4		+	+
Conference Room Daytime Setback - HVAC Zones Tied to Occupancy Sensors	25			+

Developing a Post-Occupancy Plan: The Measurement & Verification Process

The Estée Lauder Companies' Initial Energy Model versus the Calibrated Model after the M&V Process

Energy Performance Measure	EPM ID	Good
Occupancy Hours (Weekday)	9 a.m.–6 p.m.	9 a.m.–6 p.m.
Occupancy on Saturday	Yes	No
Peak Office Plug Load Power Design – Office/Conference (W/SF)	0.4	0.2
Minimum Office Plug Load Power—(W/SF)	0.02	0.05
Peak Lighting Power Office (W/SF)	0.70	1.1
Peak Lighting Power Conference (W/SF)	0.9	1.3
Minimum Lighting Power (W/SF)	0.04	0.25
HVAC System Serving Team Room	Base Building	AC-26-1
HVAC Fan Schedule Hours	7 a.m.–7 p.m.	7 a.m.–7 p.m.
Peak IT Power W/SF	4	3
Total Tenant Electricity Consumption—Implemented Package (kWh)	166,977	98,381

As one of the final phases of the process, measurement and verification (M&V) has been performed for The Estée Lauder Companies.

This formalized process shows whether the EPMs have the effect on energy consumption as projected. Often the M&V process is not utilized, as it is assumed the measures were installed and commissioned to work. However, for the Estée Lauder Companies project, M&V was vital in demonstrating that the energy value analysis achieved the level of value projected.

Energy use projections are based on assumptions, and operations and behavior can alter design intent and projects. If the actual results diverge from the projected results, then something went wrong—savings were incorrectly calculated, or a piece of equipment was incorrectly programmed or not operated as intended, or a product did not perform to its specifications. Naturally, The Estée Lauder

Companies wanted to be certain that the demonstration project yielded the project ROI, and if the M&V process showed otherwise, the team would need to re-examine the analysis and implementation to account for the discrepancy between the simulated and measured results.

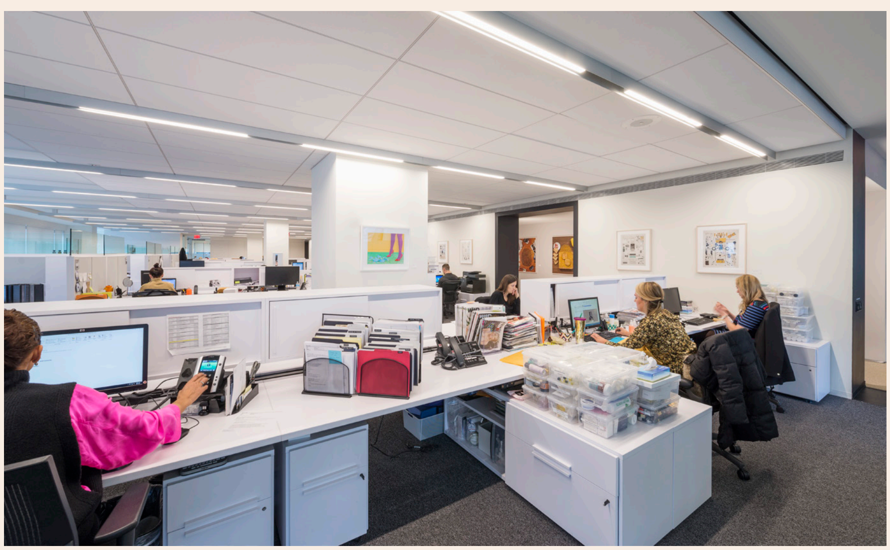
Projects are developed with a specific design strategy, which must be followed through to project completion," said The Estée Lauder Companies VP of Office Services Richard Marzullo. "In order to determine if the design strategy was incorporated, you must have a way of measuring and verifying the final results. It pays to incorporate measurement and verification into every construction project. How else can we be sure that what was designed was incorporated into the final space?"

The monitoring period of The Estée Lauder Companies' space took place between the dates of June 26, 2015 and July 7, 2015. Integral Group collected actual tenant energy consumption data and calibrated the existing energy model to correspond to observed usage.

Results show that the original, uncalibrated energy model overestimated tenant electricity consumption by approximately 40%. Although lighting and plug load power was slightly underestimated by the original model, all HVAC energy was assumed as part of the tenant's consumption. As-built drawings and metering revealed that a single small heat pump serves a team room on the floor, while the remainder of cooling and main air handler fans is provided by the base building core air shafts. The small heat pump's cooling and fan energy has therefore been included in the calibrated results as tenant electricity, while the remainder of fan and cooling power is portioned to the base building.

During the installation of meters to gather tenant energy consumption data, it was revealed that circuits were partially incorrectly labeled. In one instance, two circuits labeled as lighting had no connected load. It was assumed that this panel serves only plug loads, and all lighting is fed from another panel. Savings from lighting measures were very low, while savings from plug loads were comparatively high—so the project team suggested that panel circuiting be checked to confirm assumptions. Circuits labeled as "lighting," which in reality are disconnected from any equipment, violate code requirements and may resulting in incorrect modeling of the baseline (and a skewing of saving estimates).

Metering data revealed that two of the modeled EPMs were implemented: daylight harvesting and high-efficiency equipment (ENERGY STAR®). A new model run was therefore created in the original model to show implemented package savings for comparison to the calibrated model. Detailed observations and impact by measure is found in Appendix A.[11]



Open office areas feature daylight controls and ongoing energy monitoring. Alerts were set up from the sub-metering technology to alert office services if any energy use is detected outside of the regular working schedule. Photo by Timothy Schenck.

11. Note that the results from the Moderate and Significant Energy Reduction packages of the original model do not match the original energy report. It was not able to be determined exactly how these measures were modeled, and it is believed that a later update to the energy model or report were not included for review.

Lighting

Overall lighting power was underestimated by the original model significantly, mostly due to higher-than-expected overnight usage. The original model assumed lighting power would drop to 5% of maximum during unoccupied hours. Metered data revealed overnight and weekend lighting levels of around 23% of maximum installed lighting power. Time-of-day use assumptions were accurate.

Peak lighting power was measured at 1.1 W/SF—significantly higher than the original assumptions of a 0.7 W/SF lighting power design and higher than indicated on the design forms. Incorrect circuit labeling could badly skew this assessment, resulting in lighting power savings being assigned to the plug control measure.

- **High Efficiency Lighting (0.7/0.9 W/SF):** Decreasing the average lighting power density in a building is often one of the most cost-effective means of reducing annual energy use. Lighting power can be reduced in several different ways: carefully determining the lighting power needed for each space; choosing efficient fixtures with high lumen-to-watt ratios; and maximizing appropriate use of controls such as occupancy and vacancy sensors, and timers. Since metered lighting power shows lighting consistent with ASHRAE values, it's assumed this measure was not implemented.
- **Daylight Harvesting:** Metered lighting profiles reveal that some level of daylight harvesting control is present in the space, shown by time-of-day variations corresponding to daylight levels. As-built drawings; however, show daylight sensors installed in the main open office area only. The original model assumed more wide-spread implementation of daylighting sensors, and savings from this measure are therefore reduced in the calibrated model.
- Occupancy Sensor Lighting (Zone Based Shutdown): Metered lighting power shows that the original model correctly assumes full lighting levels remain on until about midnight each day. Without separate zone controls, a few late-night workers will command lighting use for the entire space. This measure assumes zone based control is implemented, allowing lighting power to begin reducing as the majority of workers leave for the day. This measure has not been implemented.

HVAC

The most significant changes to the calibrated model were to the HVAC system configuration and AHU fan power. The original model assumed a single HVAC system serves the entire Floor 26, with fan and cooling power assigned to the tenant. Shop drawings and electrical circuiting configuration show that a small heat pump unit serves a conference/team room in the southwest corner of the floor. The remainder of cooling air is ducted from a core building shaft. Three small transfer fans also exist on the floor to serve the IDF room and pantry. Metering also showed high baseline loading. This has been assumed to be attributed to standby loss of the connected transformer, water heater, and 24-hour operation of the small heat pump unit. Additional savings may be realized if these systems are commissioned, or schedule is adjusted to provide cooling only during occupied hours.

The Second M&V Period

Based on the initial energy monitoring and reporting, The Estée Lauder Companies carefully reviewed the project team's recommendations and made the decision to invest in permanent sub-metering to provide detailed ongoing monitoring of energy use at the circuit level. The decision to install permanent end-use energy monitoring technology demonstrates a strong commitment by The Estée Lauder Companies to manage energy use, while providing a beautiful, comfortable workplace through the alignment of the company's real estate, facilities, and sustainability goals.

Changes made by The Estée Lauder Companies following the M&V include:

- A review with the general contractor to decide whether the electrical contractor will be considered for future projects based on final construction delivery and accountability;
- Janitorial to be completed by 10 p.m., one hour earlier;
- Lights were also scheduled to turn off an hour earlier; and
- Alerts were set up from the sub-metering technology to alert office services if any energy use is detected outside of the regular working schedule.

It was confirmed that panel circuiting labeling provided by the electrical contractor was partially incorrect and may contribute to ongoing operational issues and accuracy of data reporting. It is worth noting an unusually high lighting power density that suggests something else is connected to lighting, which was found to be located in the bathroom area.

In general, differences in energy use monitored may be an improvement in how the occupants control the system between the time of the two measurements. This could be caused by perimeter light sensor setpoint adjustments, or a different lighting scene was set up in the conference rooms. Other issues may be an adjacent space was mis-wired into the panel as an existing load temporarily, or the monitoring equipment require installation and calibration adjustments.

Permanently installed meters can indeed have setup problems, but once they are set up, big changes in power consumption can often have their cause identified. And meter error is not as significant an error when the same meter is configured once and used at all times. The benefit of permanent monitoring is it helps operators track behavior and the impact of changes. Temporary monitoring provides only a snapshot that is very hard to trace back to specific actions or equipment to track and inform operational improvements based on changes in consumption.

Looking Ahead

Since the completion of The Estée Lauder Companies' project, the majority of the EPMs are being implemented into to the decision process for current and future projects.

Further Recommendations

The project team noted that ongoing energy management systems will help ensure the Company's energy use is well managed. End-use sub-metering (lighting, plug, IT room, and HVAC loads) and a tenant energy management platform will keep the energy savings in line and provide feedback for ongoing commissioning and maintenance of the systems.

Appendix A: Original and Final Energy Model Results for Tenant Electricity

Original Model Results

	Description	Total	Lighting	Equipment	Fans	HVAC	Total Savings vs Building Baseline
#	**Name**	**kWh**	**kWh**	**kWh**	**kWh**	**kWh**	
BL	Code-Compliant Tenant Baseline / ASHRAE 90.1-2007 Baseline	187,415	46,008	12,776	9,355	119,274	-
1	High-Efficiency Lighting (0.7/0.9 W/SF)	167,018	31,855	12,776	8,566	113,821	10.9%
5	Daylight Harvesting	174,434	38,469	12,776	8,715	114,474	6.9%
15	Plug Load Management—Master Shutoff Switch	186,345	46,008	11,966	9,323	119,048	0.6%
17	Plug Load Management—High-Efficiency (ENERGY STAR®) Equipment	180,160	46,008	8,489	8,998	116,664	3.9%
4	Occupancy Sensor Lighting—Zone Based Shutdown	173,348	34,455	12,776	9,027	117,089	7.5%
1+5	Least Energy Reduction Package	158,532	26,992	12,776	8,186	110,578	15.4%
5+17	**Implemented Package**	**166,977**	**38,469**	**8,489**	**8,374**	**111,645**	**10.9%**
1+5+17+4	Moderate Energy Reduction Package	142,599	19,150	8,489	7,778	107,182	23.9%
1+5+17+4+15	Significant Energy Reduction Package	140,128	19,150	6,849	7,680	106,450	025.2%
	Savings vs. Baseline Run						
BL	Code-Compliant Tenant Baseline / ASHRAE 90.1-2007 Baseline	N/A	N/A	N/A	N/A	N/A	-
1	High-Efficiency Lighting (0.7/0.9 W/SF)	20,396	14,153	0	790	5,453	10.9%
5	Daylight Harvesting	12,980	7,540	0	641	4,800	6.9%
15	Plug Load Management--Master Shutoff Switch	1,070	0	811	32	227	0.6%
17	Plug Load Management—High-Efficiency (ENERGY STAR®) Equipment	7,255	0	4,287	357	2,611	3.9%
4	Occupancy Sensor Lighting—Zone Based Shutdown	14,066	11,553	0	328	2,185	7.5%
1+5	Least Energy Reduction Package	28,882	19,017	0	1,170	8,696	15.4%
5+17	**Implemented Package**	**20,437**	**7,540**	**4,287**	**982**	**7,629**	**10.9%**
1+5+17+4	Moderate Energy Reduction Package	44,815	26,859	4,287	1,577	12,093	23.9%
1+5+17+4+15	Significant Energy Reduction Package	47,287	26,859	5,927	1,676	12,825	25.2%

Calibrated Model Results - Tenant Electricity

	Description	Total	Lighting	Equipment	HVAC (Including DHW and Xfrmer loss)	Base Building HVAC	Total Electricity (Tenant + Base Bldg)	Electricity Reduction	
#	**Name**	**kWh**	**kWh**	**kWh**	**kWh**	**kWh**		**Tenant Savings vs. Building BL**	**Total Savings vs. Building BL**
BL	Code-Compliant Tenant Baseline / ASHRAE 90.1-2007 Baseline	111,890	55,691	29,567	26,632	116,633	248,937	-	-
1	High-Efficiency Lighting (0.7/0.9 W/SF)	94,429	38,559	29,567	26,303	110,256	224,767	15.6%	9.7%
5	Daylight Harvesting	109,078	52,882	29,567	26,629	114,893	244,382	2.5%	1.8%
15	Plug Load Management—Master Shutoff Switch	107,491	55,691	25,323	26,477	115,157	242,899	3.9%	2.4%
17	Plug Load Management—High-Efficiency (ENERGY STAR®) Equipment	101,194	55,691	18,906	26,597	111,436	233,006	9.6%	6.4%
4	Occupancy Sensor Lighting—Zone Based Shutdown	101,900	45,878	29,567	26,455	112,568	234,702	8.9%	5.7%
1+5	Least Energy Reduction Package	92,639	36,772	29,567	26,301	109,115	221,834	17.2%	10.9%
5+17	**Implemented Package**	**98,381**	**52,882**	**18,906**	**26,593**	**109,679**	**228,432**	**12.1%**	**8.2%**
1+5+17+4	Moderate Energy Reduction Package	79,124	29,943	23,022	26,159	102,189	201,250	29.3%	19.2%
1+5+17+4+15	Significant Energy Reduction Package	76,683	29,943	20,728	26,012	101,489	197,963	31.5%	20.5%
	Savings vs. Baseline Run						Percentage Savings		
BL	Code-Compliant Tenant Baseline / ASHRAE 90.1-2007 Baseline	N/A	N/A	N/A	N/A	N/A	-	-	-
1	High-Efficiency Lighting (0.7/0.9 W/SF)	17,461	17,132	0	329	6,377	24,170	15.6%	9.7%
5	Daylight Harvesting	2,813	2,809	0	3	1,739	4,555	2.5%	1.8%
15	Plug Load Management--Master Shutoff Switch	4,399	0	4,244	156	1,476	6,038	3.9%	2.4%
17	Plug Load Management—High-Efficiency (ENERGY STAR®) Equipment	10,696	0	10,661	35	5,197	15,931	9.6%	6.4%
4	Occupancy Sensor Lighting—Zone Based Shutdown	9,990	9,813	0	177	4,065	14,235	8.9%	5.7%
1+5	Least Energy Reduction Package	19,251	18,920	0	331	7,518	27,103	17.2%	10.9%
5+17	**Implemented Package**	**13,509**	**2,809**	**10,661**	**39**	**6,954**	**20,505**	**12.1%**	**8.2%**
1+5+17+4	Moderate Energy Reduction Package	32,766	25,748	6,545	473	14,444	47,687	29.3%	19.2%
1+5+17+4+15	Significant Energy Reduction Package	35,207	25,748	8,839	620	15,144	50,974	31.5%	20.5%

Appendix B: Energy Model Output by Measure (Original and Calibrated)

Energy Model Output by Measure

EPM Description		Uncalibrated Results			Calibrated Model		
		Annual Electricity Savings (kWh)	**Percent Savings**	**Annual Cost Savings**	**Annual Electricity Savings (kWh)**	**Percent Savings**	**Annual Cost Savings**
BL	Code-Compliant Tenant Baseline / ASHRAE 90.1-2007 Baseline	N/A	N/A	N/A	N/A	N/A	N/A
1	High Efficiency Lighting (0.7/0.9 W/SF)	20,396	10.9%	3,365	17,461	15.6%	2,881
5	Daylight Harvesting	12,980	6.9%	2,142	2,813	2.5%	464
15	Plug Load Management—Master Shutoff Switch	1,070	0.6%	176	4,399	3.9%	726
17	Plug Load Management—High-Efficiency (ENERGY STAR®) Equipment	7,255	3.9%	1,197	10,696	9.6%	1,765
4	Occupancy Sensor Lighting—Zone based shutdown	14,066	7.5%	2,321	9,990	8.9%	1,648
1+5	Least Energy Reduction Package	28,882	15.4%	4,766	19,251	17.2%	3,176
5+17	***Implemented Package***	***20,437***	***10.9%***	***3,372***	***13,509***	***12.1%***	***2,229***
1+5+17+4	Moderate Energy Reduction Package	44,815	23.9%	7,395	32,766	29.3%	5,406
1+5+17+4+15	Significant Energy Reduction Package	47,287	25.2%	7,802	35,207	31.5%	5,809

Notes: Electric rate of $0.165/kWh assumed
All savings reported versus ASHRASE 90.1-2007 Baseline (BL)

About the Urban Land Institute

The mission of the Urban Land Institute is to provide leadership in the responsible use of land and in creating and sustaining thriving communities worldwide. Established in 1936, the Institute today has more than 39,000 members worldwide representing the entire spectrum of the land use and development disciplines. ULI relies heavily on the experience of its members. It is through member involvement and information resources that ULI has been able to set standards of excellence in development practice. The Institute has long been recognized as one of the world's most respected and widely quoted sources of objective information on urban planning, growth, and development.

About the Center for Sustainability

The ULI Center for Sustainability is dedicated to creating healthy, resilient, and high-performance communities around the world. Through the work of ULI's Greenprint Center for Building Performance, the ULI Urban Resilience Program, and other initiatives, the Center advances knowledge and catalyzes adoption of transformative market practices and policies that lead to improved energy performance and portfolio resilience while reducing risks caused by a changing climate.

Acknowledgments

Case Study Participants

The foundation of ULI's Tenant Energy Optimization Program is a ten-step process that, when implemented in ten pilot fit-out projects, yielded impressive energy and cost savings. Pilot projects applying this process were carried out in tenant spaces occupied by Bloomberg L.P., Coty Inc., Cushman & Wakefield, Estée Lauder Companies, Global Brands Group, LinkedIn, New York State Energy Research and Development Authority (NYSERDA), Reed Smith LLP, Shutterstock, and TPG Architecture. Case studies documenting their experiences were written to inform tenants, building owners, real estate brokers, project managers, architects, engineers, contractors, and energy consultants.

Project Director

ULI's Tenant Energy Optimization Program builds on the energy efficiency retrofit project conducted at the Empire State Building under the direction of Wendy Fok, principal of OpDesigned LLC. From 2011 to 2016, Fok led the development of a portfolio of tenant buildouts to create a financial and design template to incorporate energy efficiency in tenant spaces. Fok has been a key contributor to the standards set forth in the Energy Efficiency Improvement Act of 2015 (S. 535), which created the national Tenant Star framework. A registered architect, she received her degree from the University of Texas at Austin with real estate executive education from Harvard Business School.

Funders

Funding to develop the program was generously provided by the Goldman Sachs Center for Environmental Markets, John and Amy Griffin, the Helmsley Charitable Trust, the Natural Resources Defense Council, the Malkin Fund, the SL 2012 Fund, the Ripple Foundation, the Robertson Foundation, and the Rockefeller Foundation.

For More Information

Interested in implementing the process?

ULI provides tools such as technical resource guides, how-to documents, case studies, and other training materials. These materials can be found at: **tenantenergy.uli.org**.