

A Project to Investigate and Produce Solutions to the Electricity Waste in Bilkent Dormitory 78

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Overview

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Introduction

- Dorm 78
 - 586 students, 236 rooms [1]
 - Consuming 1582 kWh / day energy
- Stanford University Dorms: 1.04 kWh / day for each person [2]
- Dormitory 78: 2.69 kWh / day for each person
 - ~2.5 x more electricity used by the average dormitory resident

Problem Definition

- Excessive electrical energy consumption inside Dormitory 78
- Root cause 1:
 - Lack of control mechanisms in the building
- Root cause 2:
 - Out-dated and worn-out lightbulbs
- Root cause 3:
 - Unplanned design and installation of the building's light fixtures

Proposed Solutions

- Solution 1:
 - Installing sensors
- Solution 2:
 - Increasing the efficiency of the light bulbs
 - (Replacing with more efficient LED light bulbs)
- Solution 3:
 - Optimizing the layout of the building's lighting fixture

Optimizing the lighting layout



Taking into account:

- The lighting intensity of LED lights should they be installed
- Positioning the bulbs closer to walls to benefit from the reflection
- Maximize efficiency of one lightbulb while minimizing the quantity of lightbulbs

Optimized Layout



Criteria for Assessing Solutions

- Cost-effectiveness
 - There should be a reasonably satisfactory value (savings) returned from the implemented solutions in relation to the monetary cost of realizing such systems (Return on investment)
- Acceptability
 - The proposed solutions need to be easy for the students to adapt to, and they should not interfere with the students' day-to-day life
- Feasibility
 - The solutions should be technically rational and suitable for the building's condition (e.g. redesign of the light bulb layout should be possible given the building's construction)

Installing sensors

Installing sensors	Cost-effectiveness	Calculations of the installment cost and the savings sensors would provide
	Acceptability	Survey for students, building management interview
	Feasibility	Interview with Chief Electrical Engineer Türesin Özpineci
Increase efficiency of bulbs	Cost-effectiveness	Calculations and comparisons between fluorescent and LED bulbs
	Acceptability	Interview with Dormitories Manager Zeki Samatyalı
	Feasibility	Examining previous similar work
Layout optimization	Cost-effectiveness	Interview with Chief Electrical Engineer Türesin Özpineci
	Acceptability	Survey for students, building management interview
	Feasibility	Interview with Türesin Özpineci and Financial Manager Ali Mehmet Kılıç

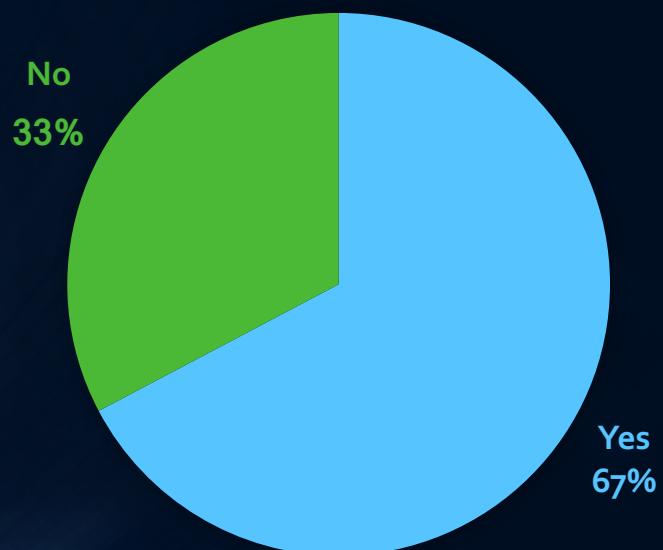
Results & Analysis

Cost-effectiveness of sensors

- Approximately 612 lightbulbs for sensors to be installed
- Cost of a sensor is 17 ₪, total cost: 10,404 ₪ [3]
 - Labor cost: approximately 1000 ₪
- Expecting a 40% cut on uptime of bulbs
 - 1kWh of energy worth ~0.41 ₪ [4]
 - Total savings: 2594.48 ₪ per month, break even: 4-5 months

Acceptability of sensors

DO YOU WANT SENSORS TO BE INSTALLED
TO THE LIGHTING FIXTURES INSIDE
DORMITORY 78



Dormitory Management:
Partially acceptable

Can be implemented alongside
other solutions or modifications

Feasibility of sensors

- Interview with İbrahim Türesin Özpineci
- There are no big adjustments to the electrical grid for the sensors
- Enough technical personnel to realize the system
- The solution is feasible as long as the supply of sensors is ensured

Cost-effectiveness of LED lightbulbs

- Cost of an LED lightbulb: 15 ₪ [6]
- Total cost of replacing 612 bulbs: 9180 ₪
- LEDs use up to 50% less energy compared to fluorescent [7]
- Total savings: 9729 ₪ per month
 - Break even: ~1 month

Acceptability of LED lightbulbs

- Interview with Zeki Samatyalı
- The process is simple and does not require too much work
 - Can be done overnight
- Deemed LED lights 'the most appropriate solution'
- Dormitories Management is on board with the solution

Feasibility of LED lightbulbs

- Case: Stanford University
- Stanford has managed to reduce campus-wide electrical energy usage by 25% as a result of LED lights [5]
- The process is simple and does not require technical expertise

Cost-effectiveness of lightbulb layout optimization

- ~400 lights to be removed and 122 lights to be reinstalled into the ceilings
- Labor cost: ~15,000 ₪
- Approximately 280 lights removed
 - Total savings: 7783 ₪ per month
 - Break even: 2 months

Acceptability of lightbulb layout optimization

- Dormitory management does not accept the solution
- Management states that the proposed solution is too obstructing for both the students and the dorm staff
- Could be implemented if the electrical infrastructure of the building was already being changed

Feasibility of lightbulb layout optimization

- Interviews with Electrical Engineer Türesin Özpineci and Financial Manager Ali Mehmet Kılınç
- The proposed solution is too costly from an economic standpoint
- Too big of an overhaul of the building's construction
- The solution is not feasible

Conclusion & Recommendations



Recommended action plan

- Combination of solution 1 and solution 2
- LED lights should be installed primarily and during the construction process sensors should also be implemented into the new lighting fixtures

References

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