



# Why is there a gap for energy performance? Evidence from green commercial buildings

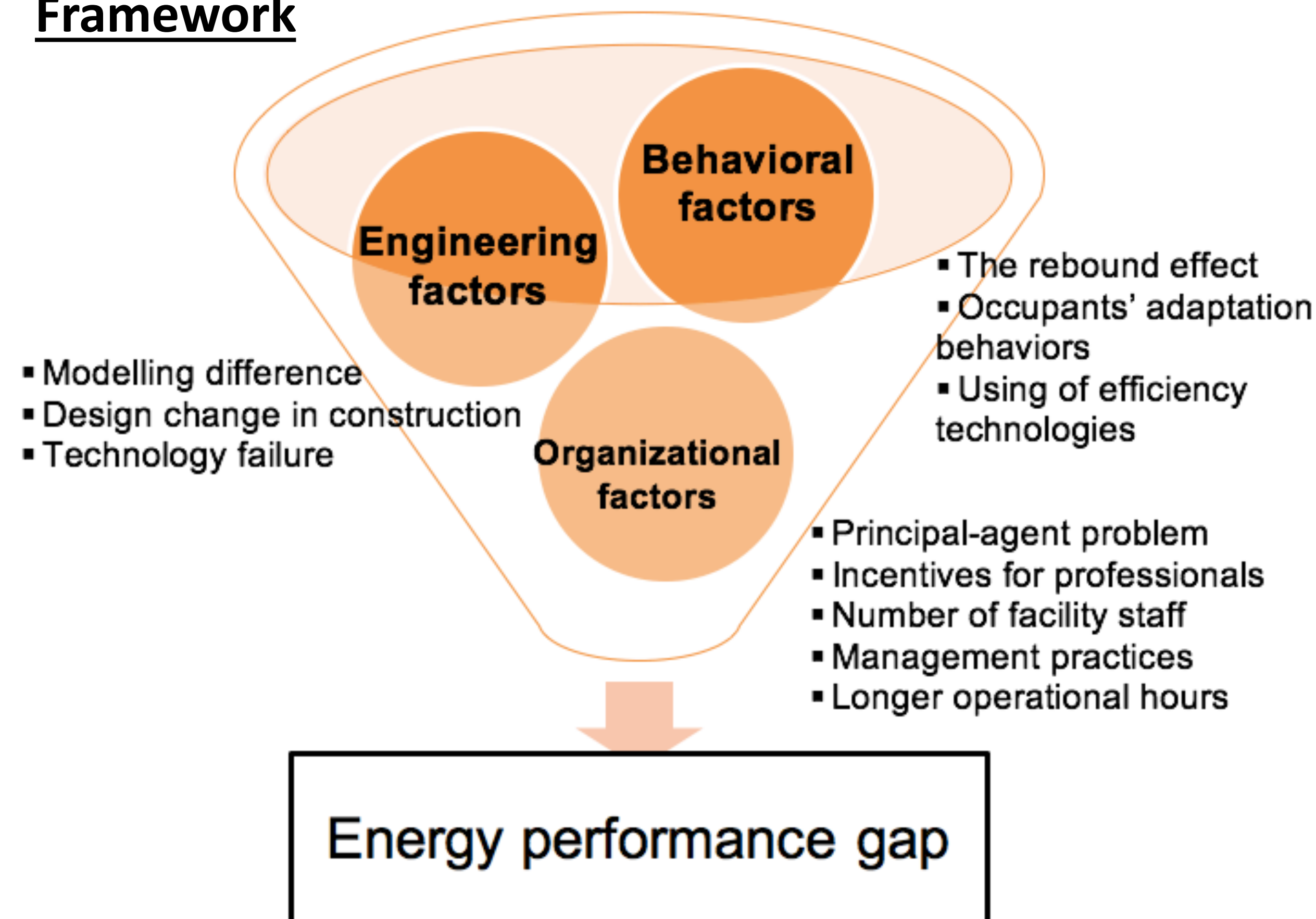
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## Introduction

Buildings are a major component of energy use, accounting for 60% of electrical use in developed nations. To date, there have been numerous energy-efficiency upgrade programs<sup>[1]</sup>. However, a gap exist between realized energy savings and the estimated savings predicted by engineering models<sup>[2, 3]</sup>. This study provides a complete picture of energy sustainability by combining organizational and behavioural factors together with engineering factors.

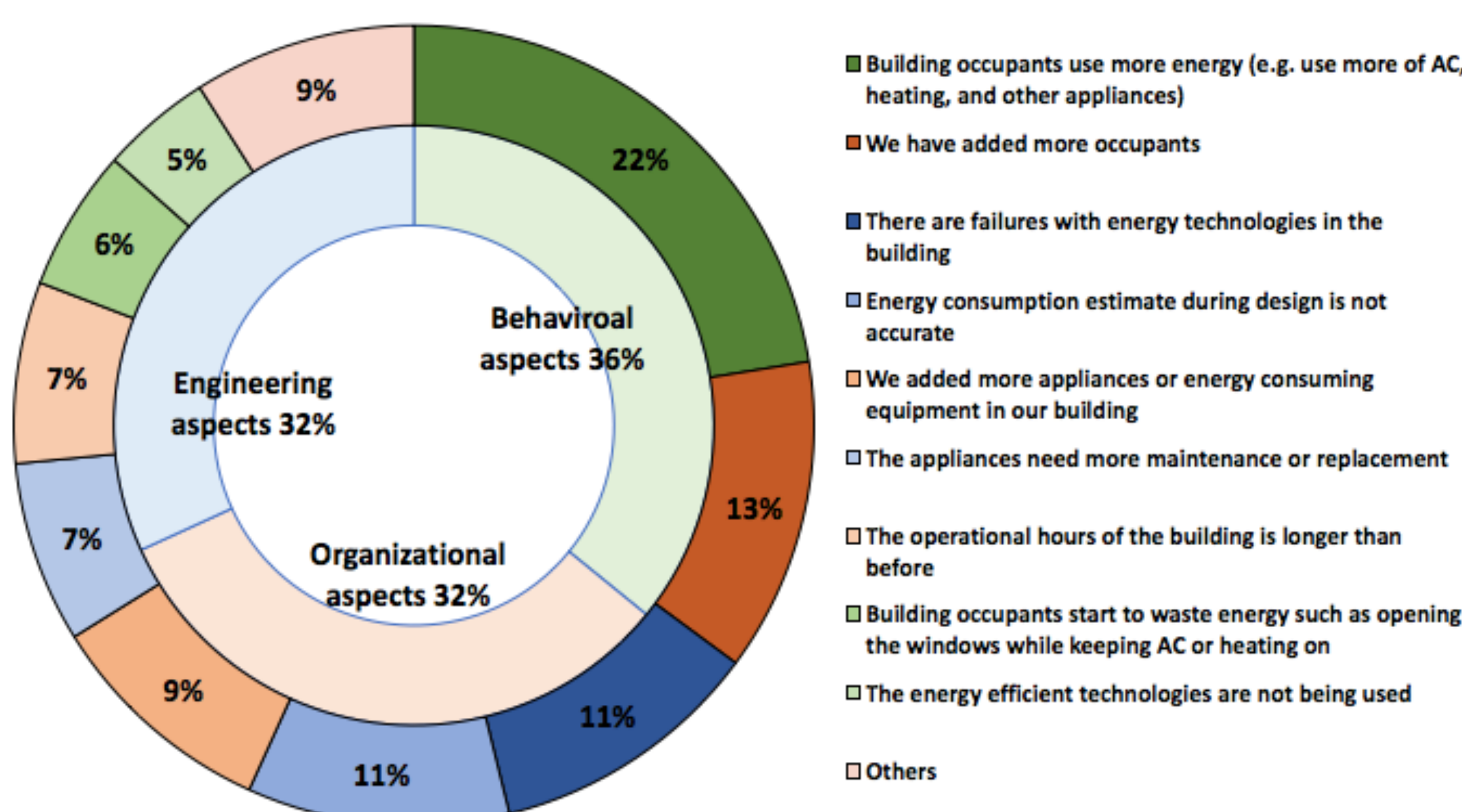
1852 surveys were mailed out to reach facility managers who are managing buildings in Arizona and three cities in Texas (Austin, Houston, and Dallas). The data collections last from December 2016 to July 2017. The response rate is about 11%, with 196 responses and 119 completed surveys. Survey collection is complemented by emails to facility managers across the country in IFMA.

## Framework



## Summary of survey results

Multiple choice selection: the survey participants are asked what the possible reasons for the gap are among nine possible answers.



## Further analysis

Probit model

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

$$y_i^* = \beta_0 + X\beta_1 + \varepsilon_i \quad (2)$$

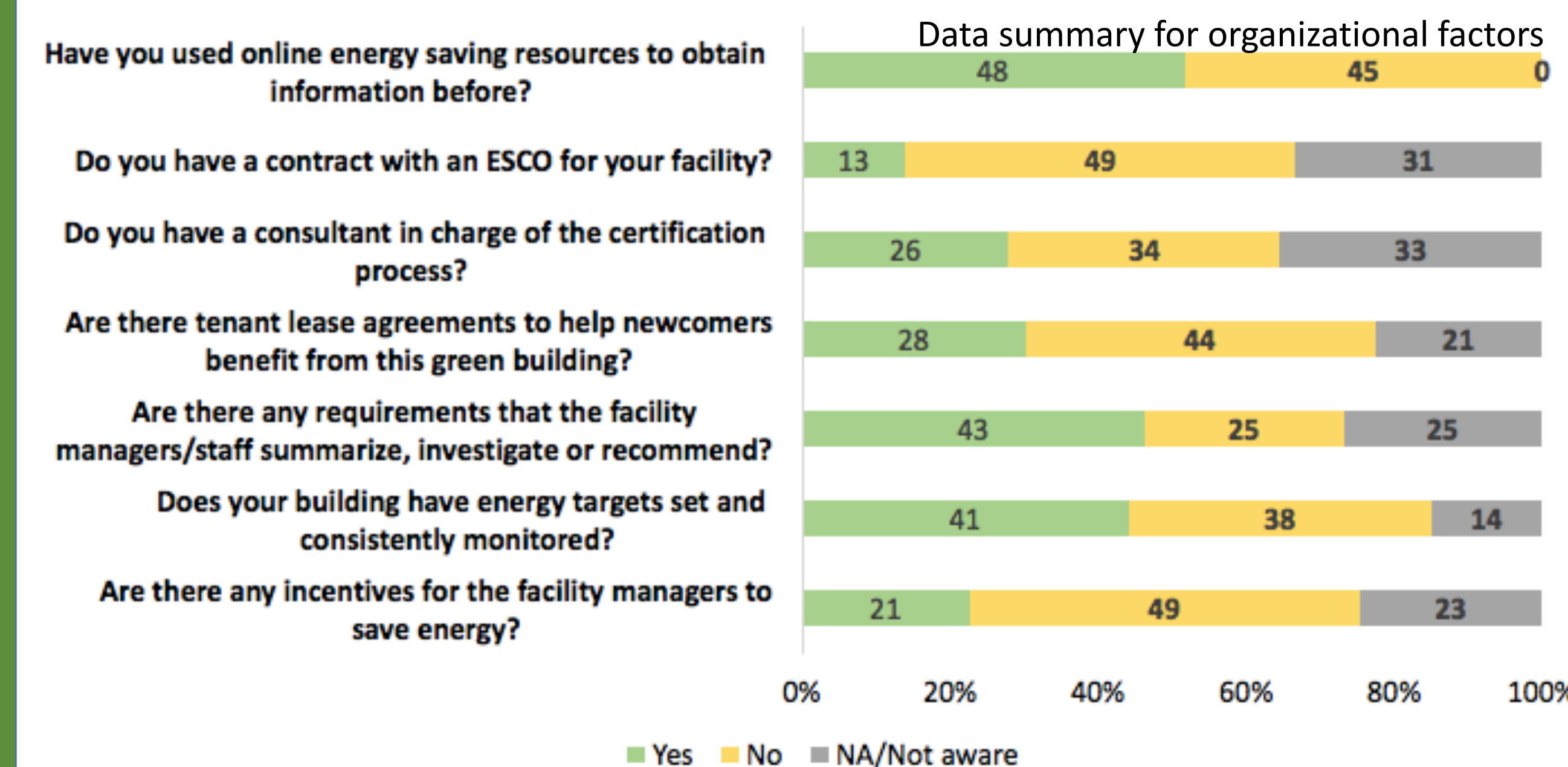
$y$  is LEED (1) or energy star (0) building,  $X$  is a vector of organizational, behavioral and engineering factors.

## Descriptive statistics

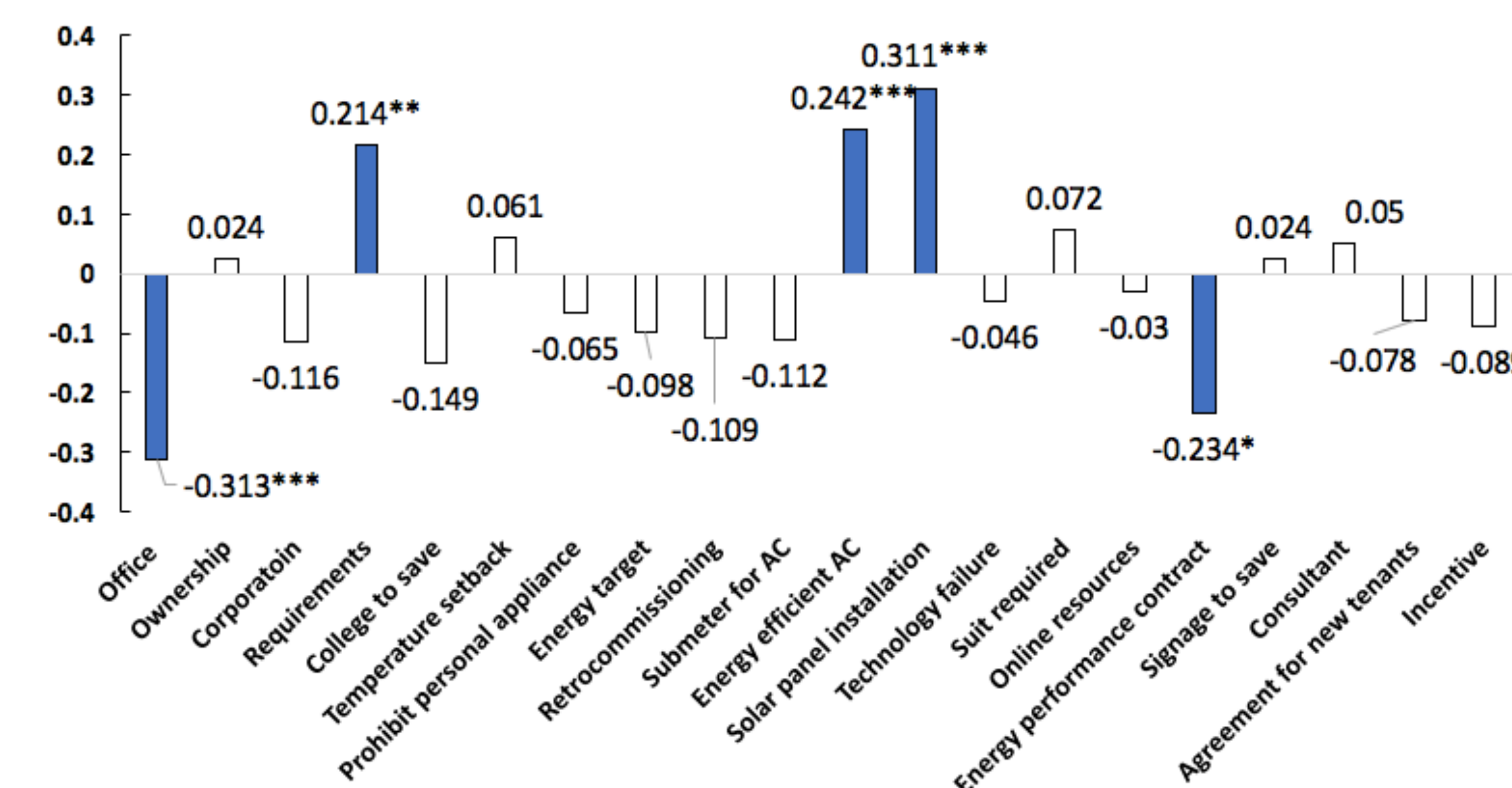
Sample size		119
Building function	Office	38%
	Other	62%
Ownership	Owner occupies or combination of owner and tenants	70%
	Leased to tenants	30%
Business type	Corporation	38%
	Partnership/ sole proprietorship	62%
Facility staff education	College degree or higher	45%
	High school/technical/vocational training	55%
Green building certification	Only LEED	51%
	Only Energy Star	18%
	LEED and Energy Star	15%

## Independent variables:

Organizational, engineering & behavioral factors



## Results



## Conclusion

- The most important reasons for the performance gap are the rebound effect, the increasing occupants and frequent technology failures;
- Closing the performance gap requires addressing the complexity of organization, behavior and engineering factors and many building have potential in management practices and occupants' behavior change.

## References

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- De Wilde, P. (2014). The gap between predicted and measured energy performance of buildings: A framework for investigation. *Automation in Construction*, 41, 40-49.
- Menezes, A. C., Cripps, A., Bouchlaghem, D., & Buswell, R. (2012). Predicted vs. actual energy performance of non-domestic buildings: Using post-occupancy evaluation data to reduce the performance gap. *Applied Energy*, 97, 355-364.