

A Feedback Research Platform

demonstrated with

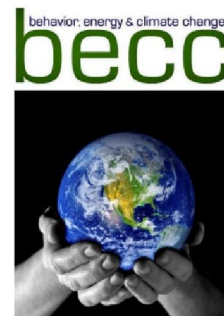
Real-time Social Comparisons

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Project Motivation

- How do we improve feedback to further engage users and encourage energy conservation?
- Limitations of past feedback research:
 - Variable methodologies
 - Lack of feedback design specifics
 - Unclear behaviour changes
 - Real-time social comparisons unstudied

Key Take-Aways

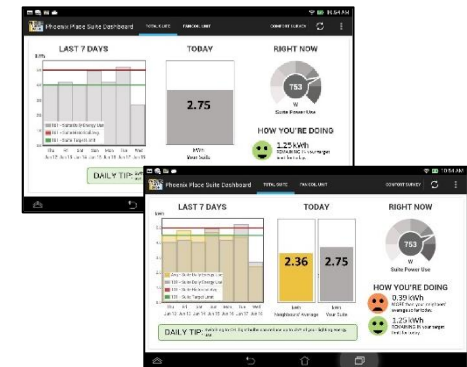
1. FREE: energy feedback research platform

- Give back to open source community
- Build a research community; discover more effective feedback designs



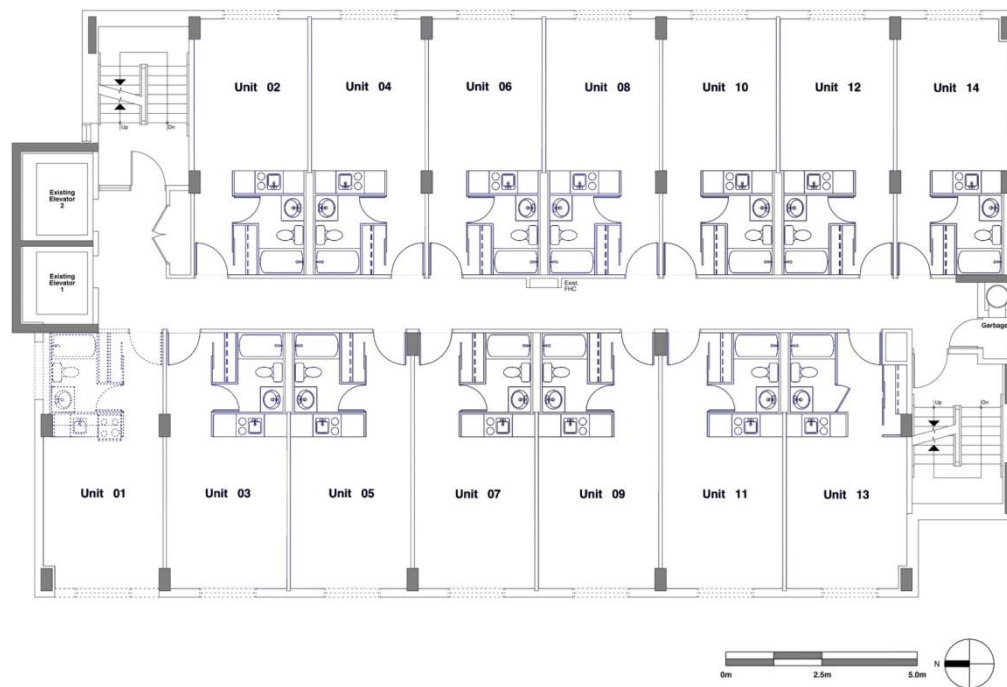
2. 11% savings with real-time feedback

- 3.5% improvement with real-time social comparisons
- Demonstrated in a year-long field study



Field Study Background:

Rental apartment, affordable housing complex



- Low, or fixed income tenants
- Recent immigrants, retired
- 134 near-identical, single-occupancy, bachelor suites
- Common fridges and ovens
- Each unit is sub-metered

Figure: A typical floor plan at study MURB

An Integration of Open Source Software

OpenEnergyMonitor

- Arduino-based wireless sensors
- Raspberry Pi gateway
- Content management system



- Survey creation, app, data management



- Real-time weather feed



- Tablet app to display feedback, surveys

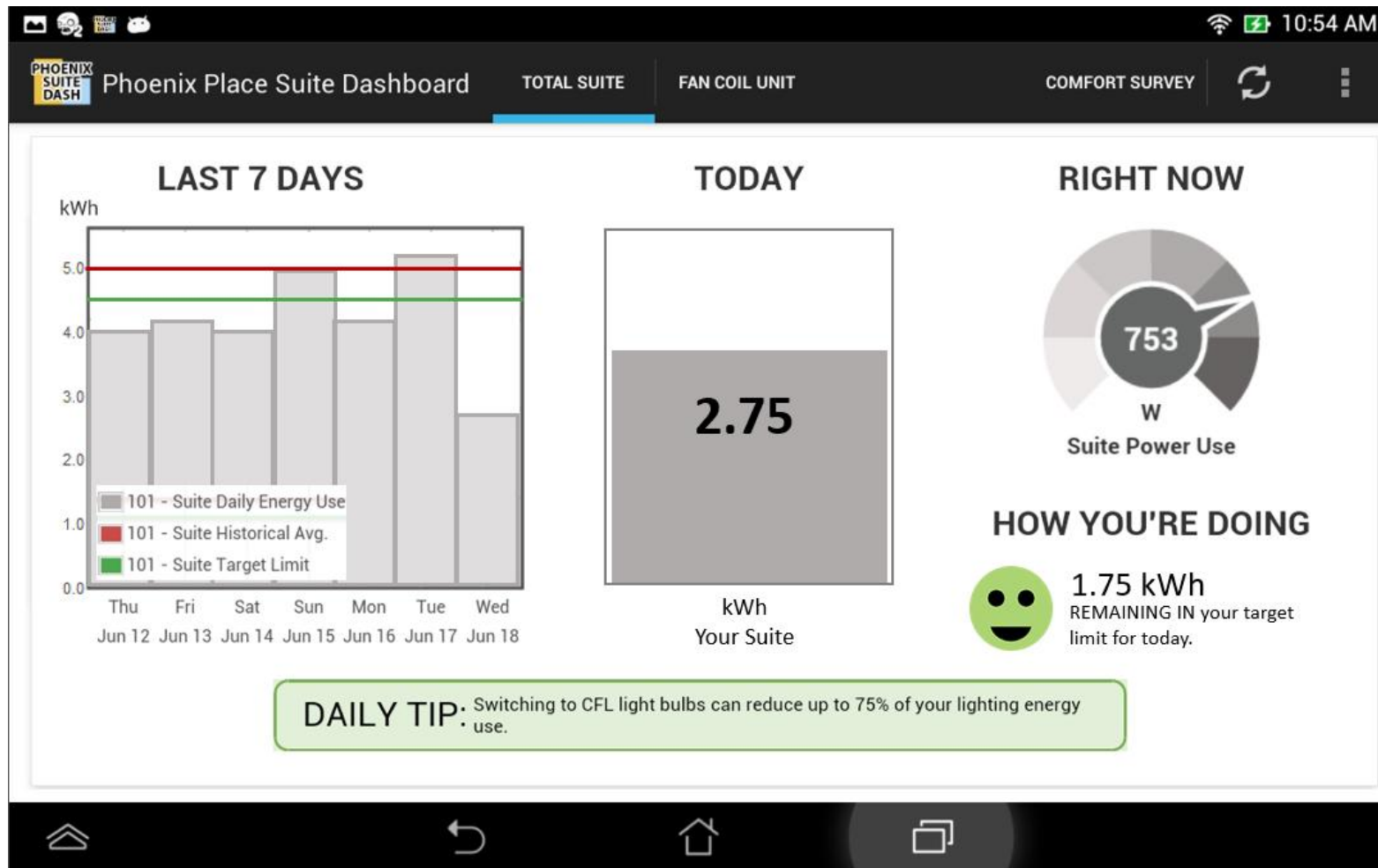


- web analytics

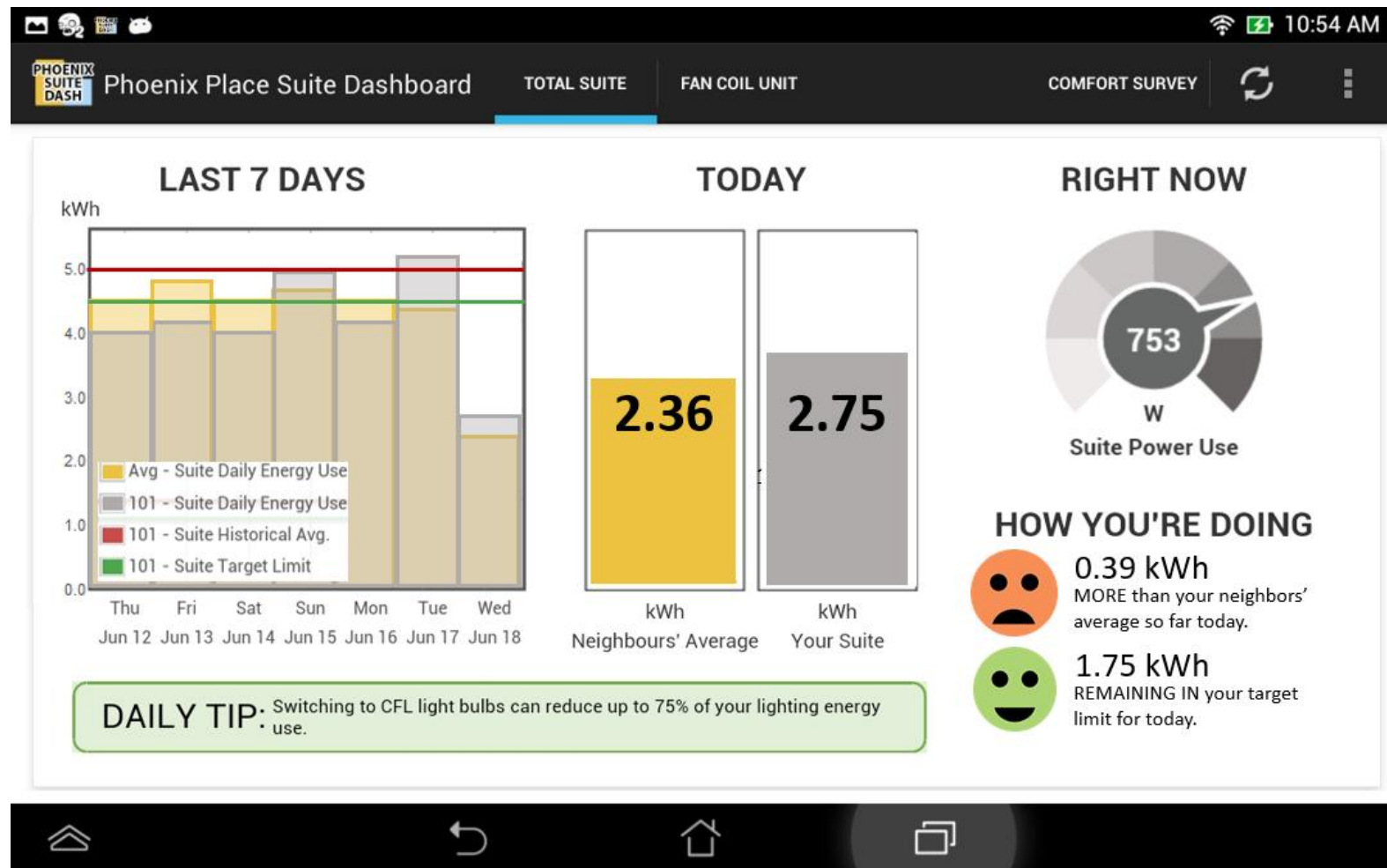
Platform Field Study Configuration



Basic Feedback Design



Basic Feedback + Social Comparisons



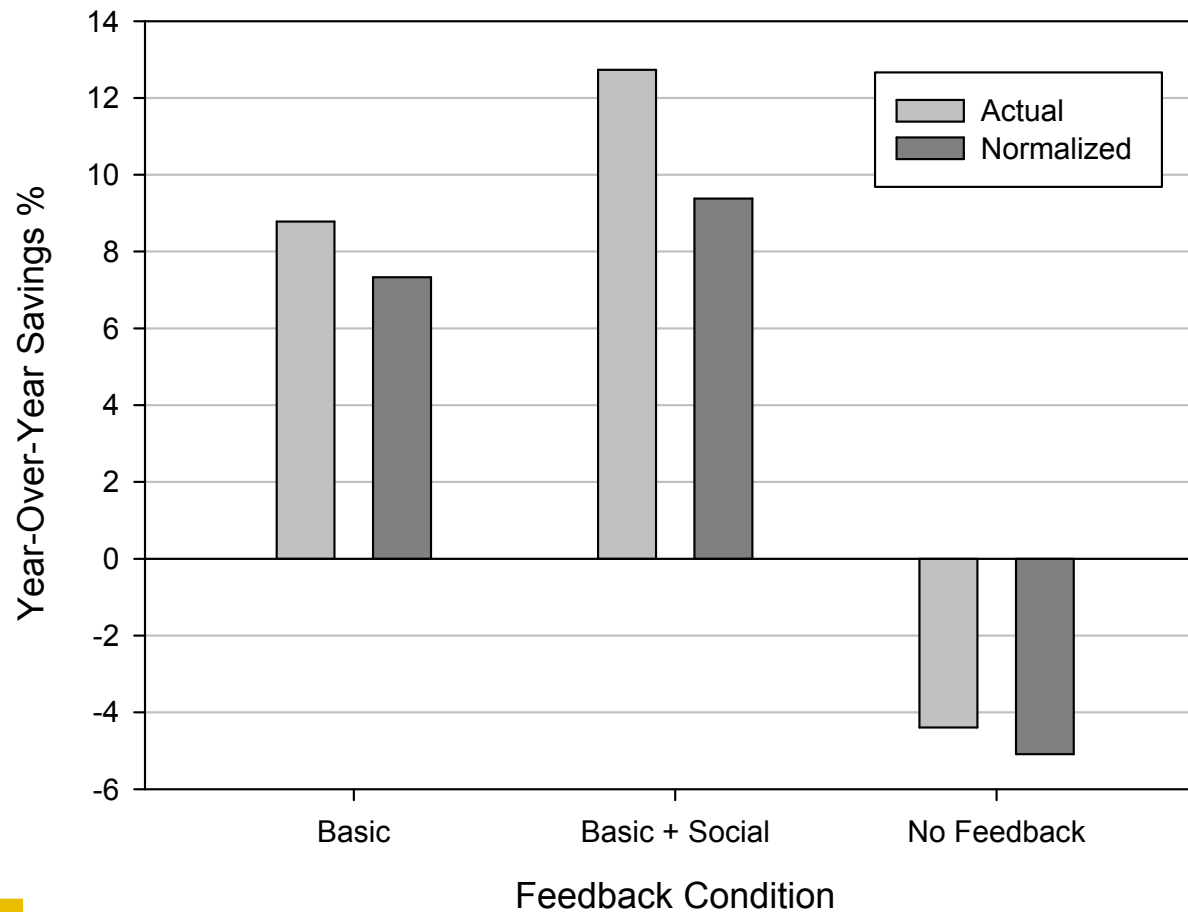
Field Study Design

- Intervention: A conservation program consisting of:
 - An information campaign with savings tips
 - Personal pledges to reduce energy use by 10%
 - Energy audit of electrical appliances
 - Real-time feedback for an entire year (completed Sept. 2015)
- Between-subjects factor: Feedback Type
 - Non-active participation (control, n = 106)
 - Basic feedback (n = 12*)
 - Basic feedback + social comparisons (n = 12*)
- Dependent variable:
 - year-over-year energy savings %

* 2 participants did not meet inclusion criteria

Results:

Did we meet our 10% savings target?



Conclusions

- Demonstrated a feedback research platform
 - Re-configurable, scalable, and freely available!
 - 11% savings with real-time feedback
 - Potential value of real-time social comparisons
- Future Work:
 - Improving system reliability
 - Persistence of savings
 - Investigating the case for real-time social comparisons

Thank You

- Supervisors:

- Dr. Alan Fung
- Dr. Vera Straka

- Collaborators:

- Dr. Sara Alsaadani

- Assistants:

- Danilo Yu
- Gabriel Leong
- Edward Vuong

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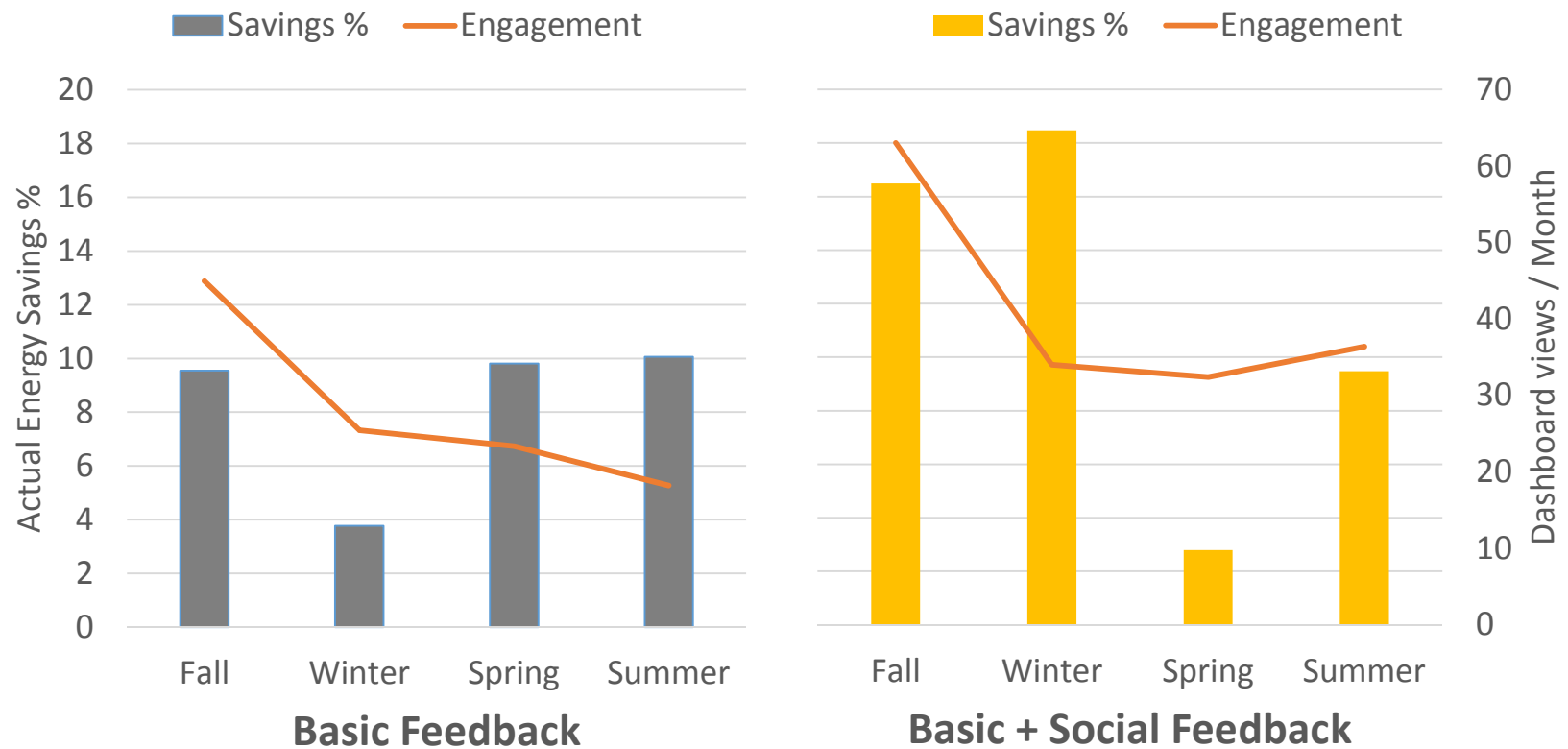


Extra slides

(for Q&A session)

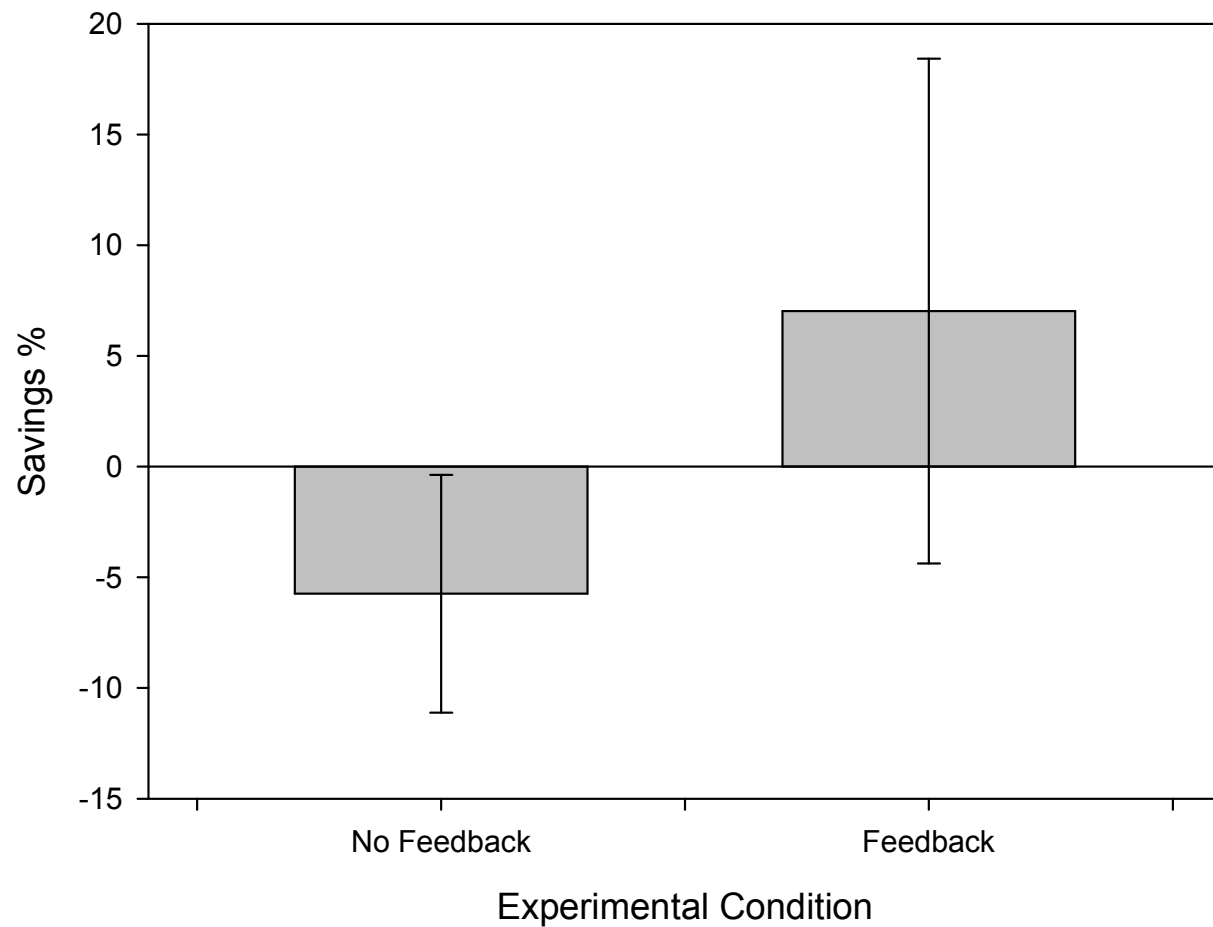
Results:

Savings and Engagement by Quarter



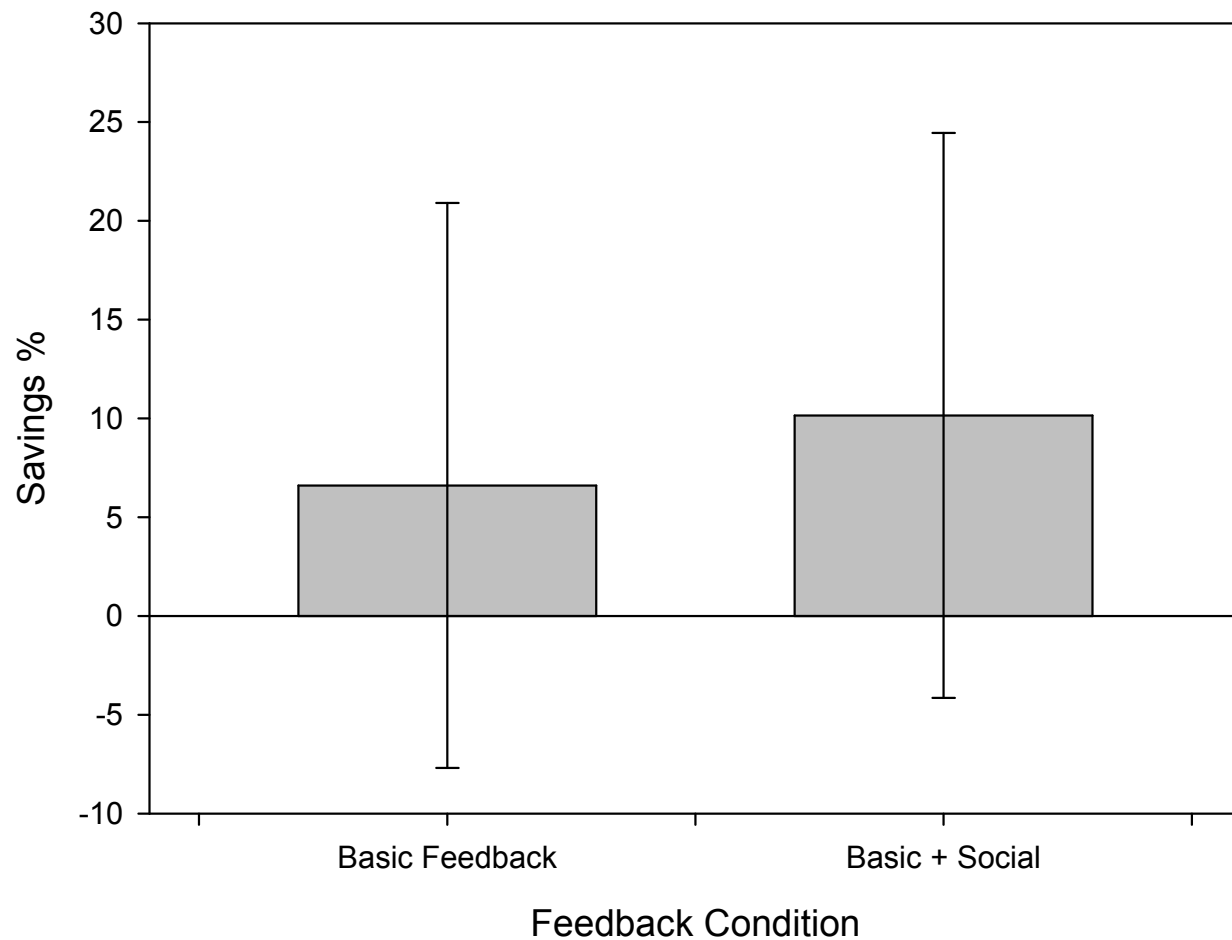
Results:

Effect of taking part in the conservation program

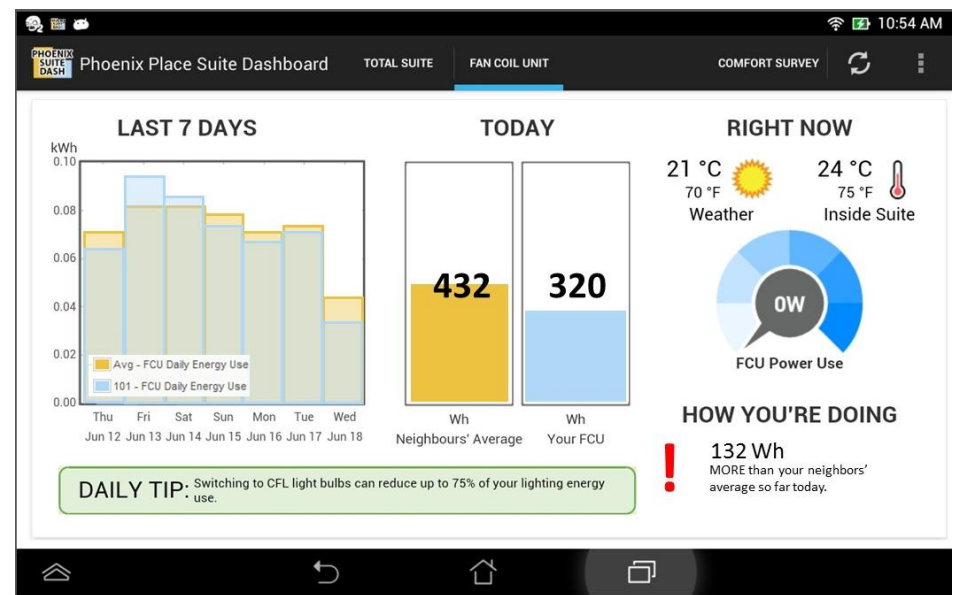
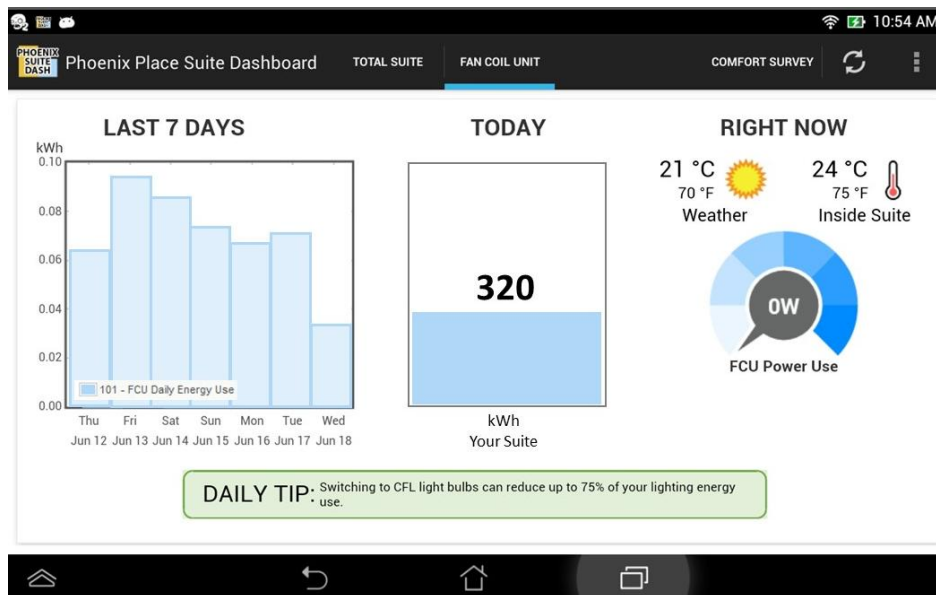


Results:

The effect of social comparison data



Feedback on FCU Usage



Thermal Comfort Survey

The image displays four overlapping screenshots of the ODK Collect application interface for a Thermal Comfort Survey. The screenshots show different pages of the survey, with the rightmost one being the most prominent.

Page 2 of 8: "Please rate your thermal comfort." Options: Cold, Cool, Slightly, **Comfortable** (selected), Slightly Warm, Warm, Hot. A progress bar at the bottom shows the current position.

Page 3 of 8: "Select the thermal sensation of your torso and head." Two human figures are shown for selection. A progress bar at the bottom shows the current position.

Page 4 of 8: "How much do you feel the effects of the thermal sensation?" Options: 50, 51, 52, 69, 70, 71, 88, 89, 90. A progress bar at the bottom shows the current position.

Page 5 of 8: "Since you last completed this survey, have you adjusted or controlled any of the following to get comfortable?"
List of items with checkboxes:
☒ Window (Opening and Closing)
☐ Blinds or Curtains
☒ Door to Hallway
☐ Portable Heater
☒ Portable Fan
☐ Humidifier
☐ Dehumidifier
Navigation arrows (back and forward) are visible at the bottom.