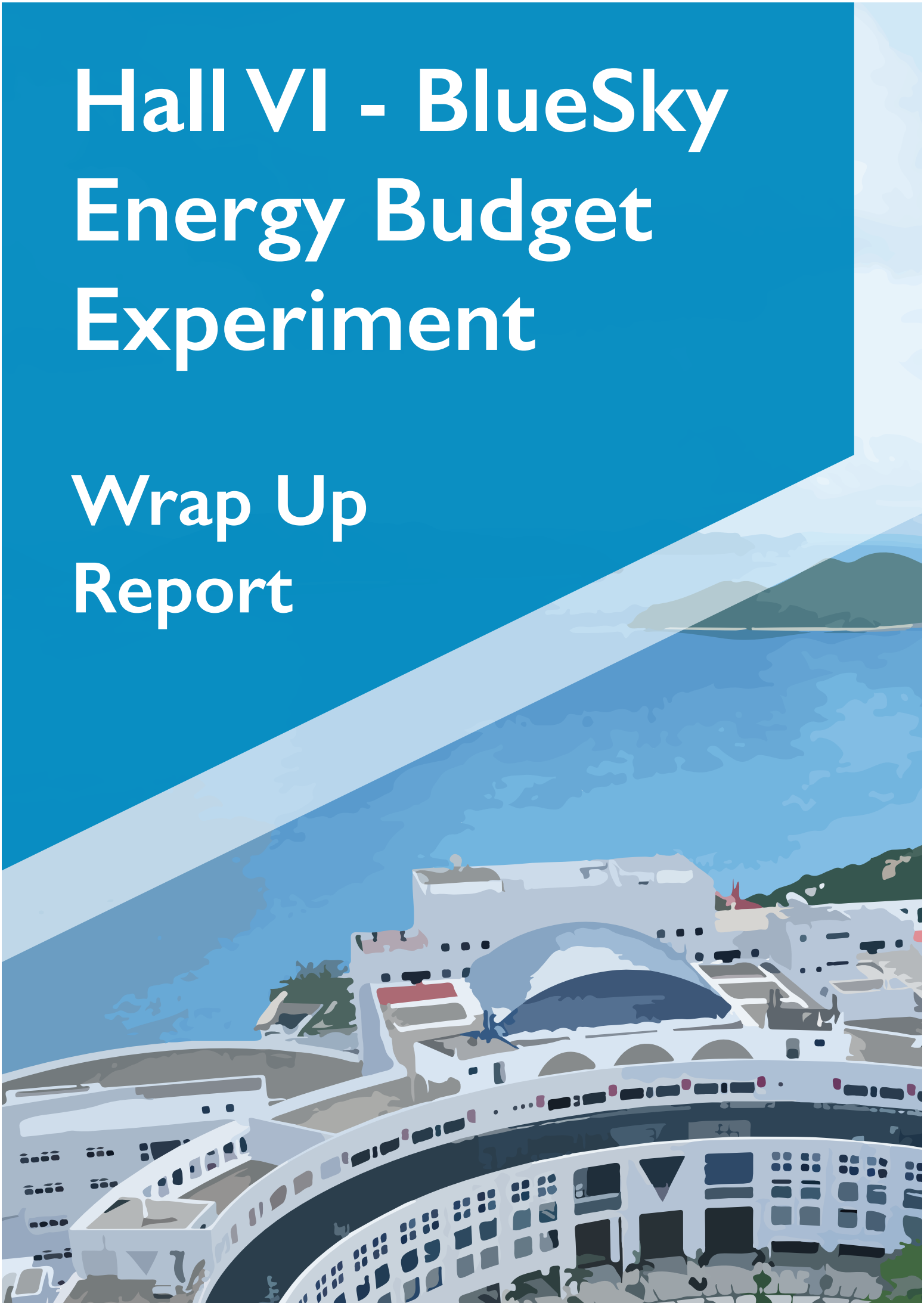
Hall VI - BlueSky Energy Budget Experiment

Wrap Up Report

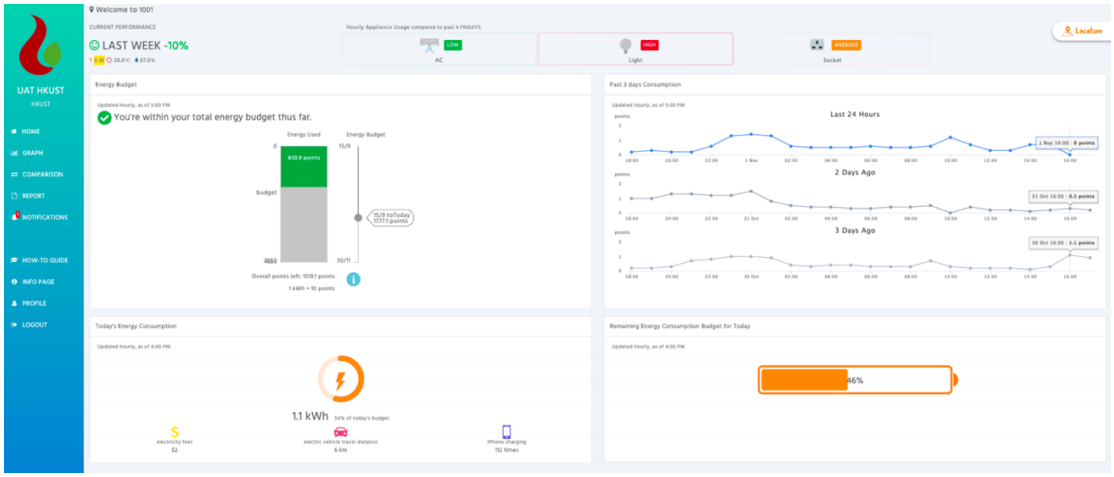


BlueSky Energy Budget Experiment -- Wrap Up Report

Goals of the Scheme

The Hall VI energy budget scheme was created with the aim of reducing energy consumption through testing an experimental system of electricity charging under the "living lab" model of the Sustainable Smart Campus. In other HKUST undergraduate student residences, students are charged only for air conditioning usage by hour. Under this scheme, all electricity usage in a room was included in an energy "budget", and students would only be charged for exceeding it. By changing electricity charging method, the scheme aims to change the energy usage patterns of students and promote more sustainable living habits.

Details of the Scheme



A dashboard from BlueSky used in the scheme.

The energy budget scheme was planned to run during September 15th to November 30th in UG Hall VI. Energy meters had been installed previously for pairs of rooms on floors 3, 6, 8, 9, and 10. Floors 3 and 6 were chosen as control floors with no intervention, while residents in double rooms on floors 8. 9 and 10 were automatically opted into the scheme as participants when it began. Triple and single rooms were excluded from the scheme.

Each room in the scheme was given an energy "point budget" based on past average energy consumption trends in rooms used in the scheme. The "point budget" was presented as 10 points for every kWh for a total of 2350 points. Participants of the scheme were able to view their current consumption and future budget via a dashboard provided by BlueSky. Electricity usage for plug loads, lighting and sockets was calculated using the energy meters installed for every two rooms, while air conditioning usage was metered on a room by room basis.

Rooms which were included in the scheme were able to turn on and use their air conditioning for free, provided that they remained within the cumulative energy budget

provided for the semester. If rooms exceeded the energy budget, their air conditioning returned to normal and they were charged for the equivalent of the original cost. Residents that chose to opt their room out of the scheme would return to the normal air conditioning charging methods.

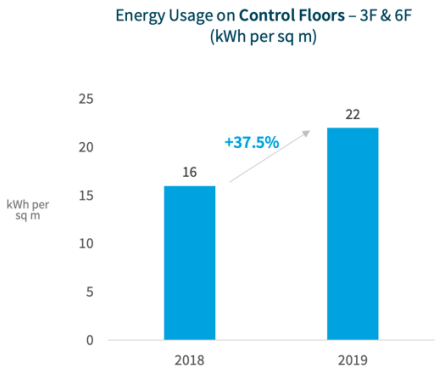
Rewards were offered for residents whose rooms did not exceed the budget by the end of the semester, with better rewards for rooms with lower energy usage. Rewards included things such as solar powered gadgets, fans, and water bottles.

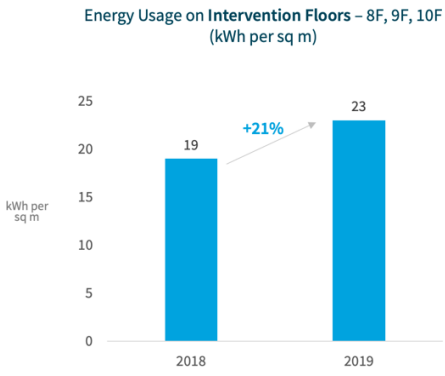
A total of 41 double rooms were a part of the scheme, while 3 rooms contacted us to opt out of the scheme before it began. There were 54 rooms in the control floors on floors 3 and 6. Unfortunately, due to extenuating circumstances, the scheme was ended prematurely on November 7th.

Results and Lessons Learned

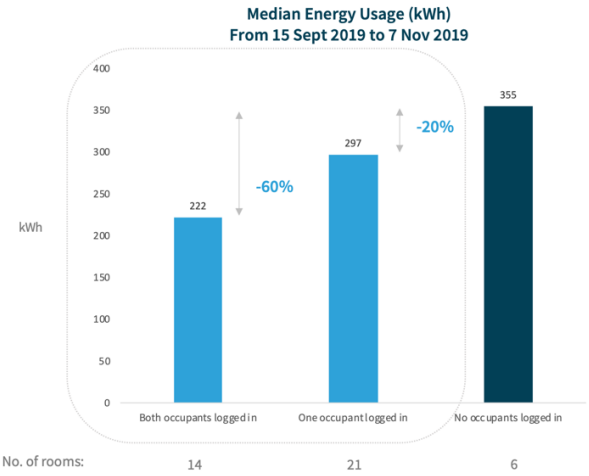
Overall, the scheme was somewhat successful in reducing energy usage in participating rooms when at least one occupant of the room logged in. However, a number of major issues were encountered during the scheme.

The first issue was that a 78% of rooms exceeded the term's budget, which was expected to be the average energy consumption. This was likely due to the record-breaking number of hot nights experienced this year, when compared with past years. Energy consumption per square meter increased by 37.5% and 21% for control and intervention floors respectively. Even though the energy consumption for rooms under the scheme increased less than outside the scheme, the presence of the energy budget did not offset the energy use caused by temperature. As a result, the energy budget appeared to be inadequate for most rooms, and future energy budgets may need to take changing weather into account in order to be fair for users at the potential cost of increased energy usage. This could be incorporated as a form of "buffer" of extra budget to be added in case the weather is hotter than usual.





Another issue was that 6 rooms (~15% of participating rooms) did not have a single resident logging into the dashboard used for the scheme, while some students were not aware of the scheme and thought there was free air-conditioning for the whole semester. This may have been due to inadequate promotion; during this scheme, students were informed of the scheme by posters in the lobbies and leaflets in their mailboxes, while dashboard login details were sent to them manually via email. Rooms where both occupants logged into the system used (on average) 60% less energy than room where neither occupant logged in, while rooms with one occupant logging in used 20% less, showing a correlation between dashboard login and energy savings. However, this correlation may have been exacerbated by the lack of limitations on AC usage while under the budget, or increased likelihood to login for residents who were already more aware of their energy habits. Hence, better promotion of the scheme, or integration of scheme information with regular residents' information packs is vital to ensuring effectiveness of the scheme.



On the administrative side, the lack of information integration between housing, BlueSky, and the scheme in general made it inefficient to manage rooms who wished to opt-out of the scheme (which required action from multiple parties), rooms that had already exceeded the budget (requiring action from housing), provision of access to dashboard login, and change of residents during room swap. This also resulted in some confusion for participants, possibly contributing to lack of awareness or understanding about the scheme. In future, the flow of information about changes in residency and room status will be necessary to prevent problems arising from lack of information transparency.

Despite these issues, residents interviewed in a focus group at the end of the scheme reflected changes in their lifestyles in order to save energy because of the scheme. Floors with the scheme did not use less energy per square meter than control floors; however, this was already true the year before the scheme began. There was a clear difference in energy use for rooms where residents logged in to the dashboard and rooms where they did not, which indicated the presence of a dashboard or awareness of the scheme may help contribute to reducing energy usage. There may have been some unintended consequences as a result of the lifestyle changes, such as moving electricity usage from rooms to common areas (such as the library), but adding load in these shared areas likely have lower energy footprint than energy consumption from within the rooms themselves. In addition, residents were often not aware of energy saving features (such as AC settings) or felt that energy tips provided were too general, and improved energy saving guides can help improve energy usage habits.

In summary, future energy budget schemes should make efforts to take into account changing conditions through budget "buffers", enhance scheme promotion to residents, and increase information transparency. This experimental scheme has shown that the

energy budget model does have the potential to reduce energy usage and change the habits of residents towards a more sustainable lifestyle, though repeated studies will be needed to evaluate its efficacy under different conditions or over longer periods of time.