Automating and Improving HBS' Energy Use Reporting

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Overview of Project Purpose

Our project aimed to streamline the reporting process for HBS building energy usage along three prongs:

- Simplifying the data input and review process for HBS and Operations staff
- Facilitating greater access and visibility to energy usage KPIs across the broader Harvard organization
- Creating a foundation for subsequent external-facing reporting needs

Current Process & Pain Points

Before we began revamping the reporting process, we worked HBS stakeholders to understand challenges with the current state. Rachel Huxhold, the Manager of Energy and Commissioning, was invaluable in her support throughout the project and helped us to identify key areas needing improvement.

Data Collection and Aggregation

- Data sources contain a broad variety of formats and data granularity
- Hosted in a variety of locations
- Data is then manually aggregated to create results, highly error-prone and undocumented, hard to scale

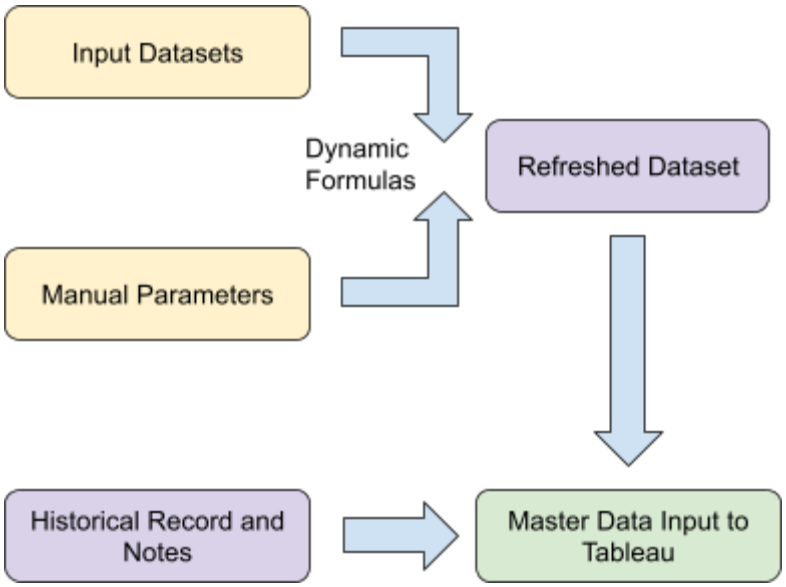
Reporting

- Hard to manipulate or get extra detail on a result
- No automated result flagging
- Limited to one building and utility type at a time

The existing process was labor-intensive and any insights were cumbersome to generate. Moving forward, specific solutions would be needed for each of the categories above in order to effectively address the challenges presented by each.

Our Solution: Data Preparation

The root of the problems with the old process was the initial steps required to gather data, combine it into a table, and refresh Excel graphs referencing it. We created an Excel data manipulation tool to automate this process and reduce the time required to refresh it. The tool generates an update using formulas that reference input datasets before merging with existing notes and data, as visible in the process flow below:



The tool was designed to be as future-proof as possible and easy for the Operations team to make edits to. It was delivered alongside comprehensive documentation on how to run it in order to ease its adoption. It is manipulated using the basic control panel you see to the right.

The input datasets were also heavily modified to support this project. Many needed reformatting in order to be referenceable by other formulas. Thanks to the support of Mark Deviney, we were able to replace the core dataset of energy bill information with an automated report that Operations will receive monthly, dramatically speeding up that process.

The data tool provides a single source of truth for future reference and is a direct input to the updated data visualization process.

Refresh will include both months below

Data Refresh Start Date	1/31/23
Override	
Default	2/15/23
Data Refresh End Date	1/31/24
Override	
Default	1/22/24

Extend Formulas

Data Checks	Confirmed
EnergyCAP	Confirmed
Weather	Confirmed
Solect	Confirmed
Water Meters	Confirmed

Generate Data

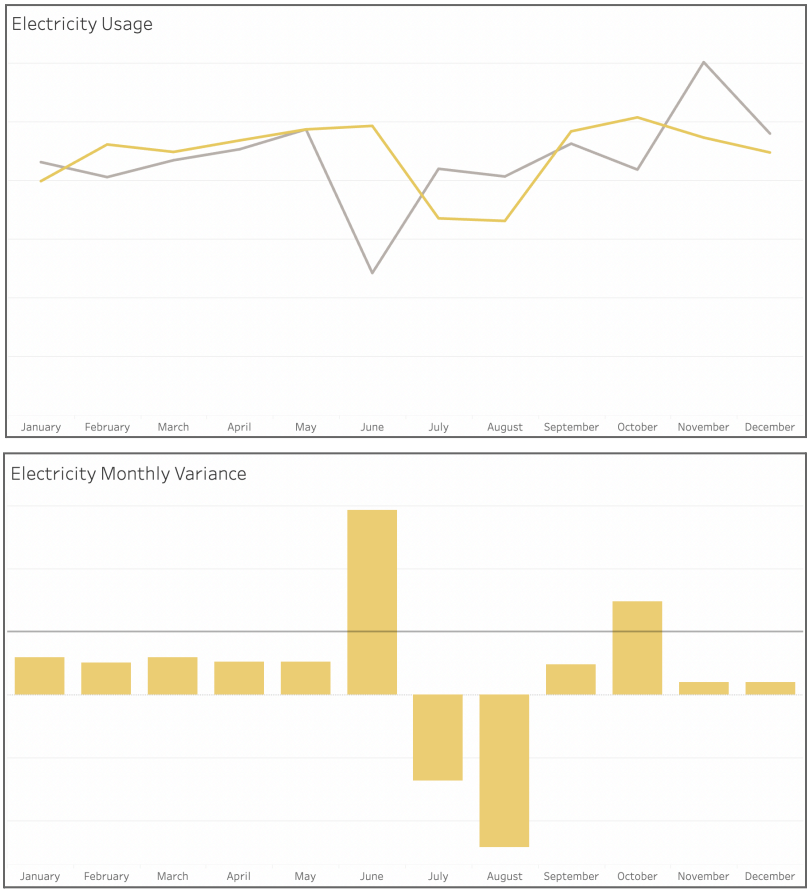
Merge Historicals

Our Solution: Data Visualization

In order to visualize the energy data, we built a series of views in a Tableau dashboard. Tableau was selected as a platform because:

- HBS Operations has existing licenses
- It is generally a user-friendly and intuitive tool
- Uploading data and integrating with future data sources can be streamlined more vs. in other tools

Note: Charts are for illustrative purposes only



The first view is an **Energy Usage Report,** which shows monthly energy usage and variance by energy type (electricity, steam, natural gas, water) and building. It also compares energy usage for a given year to a selected reference, which may either be (1) a manually selected reference

year, or (2) a computation of a weather-adjusted usage figure. The key differences in the Tableau report vs. the former Excel solution are:

1. A dynamic filter which allows users to filter by building and energy source
2. A dynamic parameter which allows users to select their reference input, as described above
3. A summary of the data at the building level, which allows users to easily identify any buildings above the 10% variance threshold

The second view is an **Energy Use Intensity (EUI) Report,** which measures energy use per square footage by energy type and building. The visualization also indicates the following targets, which can be toggled on and off:

- CBECS: Target based on survey of commercial buildings across the US, filtered for Northeast subset to account for climate
- Harvard: Target based on the rest of the university; Engineering & Utilities compiles average EUIs across the university by building use type
- SUNY: Target based on SUNY Construction Fund, Directive 1B-2. SUNY is the State Universities of New York— a system of the public colleges in New York. The Construction Fund that supports this network put forth this directive defines the goals for all new construction and major renovations to align with SUNY's energy and carbon reduction goals as well as the CLCPA – Climate Leadership and Community Protection Act (from NY state). Under this directive, all new construction must be NetZero Carbon capable, by meeting the specified EUIs. Major renovations must achieve their Deep Energy Retrofit guidance, by meeting EUIs that are slightly more forgiving but still ultra efficient

Overall, the Tableau dashboard enables greater automation, integration, and ease of use vs. the previous Excel solution. We believe this will be an impactful project not just for the end user (i.e., Energy & Commissioning Manager), but also for the broader Harvard community and external community.

Further Analyses

While this project focused primarily on automating the existing Excel solution and making incremental improvements to the reporting, there are a number of additional analyses that future projects could explore, such as:

1. Including additional data to further explain year vs. year variance (e.g., occupancy data)
2. The integration of data from new data sources (e.g., chilled water data once smart meters are installed)
3. More automated alerts to highlight outliers and further reduce burden on the user
4. Expanding data coverage to apply to other Harvard groups outside of HBS