Visualisation Narrative

My web application emerged from a challenge confronting nearly every modern building: how to achieve sustainability and cost-effectiveness without sacrificing occupant comfort. This complex question became the driving force behind my design, targeting facility managers and sustainability experts who navigate these tradeoffs. For them, the application's core promise is to unlock deeper, actionable insights into HVAC effectiveness and illuminate the patterns governing indoor environments.

The strength of the visualization is granularity. I engineered an HVAC usage score by combining the difference between air and radiant temperatures with normalized CO_2 (from 2019 SAMBA data) to quantify system effort. Alongside this, Predicted Mean Vote scores provided a standard measure of thermal comfort. By cross-referencing these metrics in a double-axis line chart, I aimed for users to consistently discover four pivotal insights: identifying Peak Performance Zones, uncovering Hidden Cost Centers, gaining Occupancy Intelligence, and discerning crucial Time-Based Patterns. To effectively leverage the 5-minute interval data, I developed two visualizations: a macro Year View for annual trends and a granular Day View for hourly breakdowns, allowing users to drill down from broad patterns to precise moments of intervention. My initial data preparation involved meticulous cleaning (handling missing data, combining files) and aggregation (5-minute data to hourly and daily averages) to support multiple scales.

My concept underwent significant refinement after the A1 presentation.One key realization was that my expert audience didn't need me to *presume* their insights; instead, my application should function as a versatile tool for their own discoveries. This shifted my focus profoundly: rather than highlighting "optimal" periods, I developed a comprehensive system categorizing all data into four distinct performance scenarios (Optimal, Inefficient Energy, Thermal Overdrive, Thermal Neglect), providing a more nuanced and objective framework. What began as a mere "seasonal toggle" evolved into a core element, as I understood that time granularity—from work/break cycles to hourly, daily, monthly, and seasonal —was fundamental to truly understanding building behavior. Ultimately, the most significant conceptual adjustment was positioning the dashboard as a thesis on the visualization itself, emphasizing its power to customize views and facilitate discovery, rather than attempting to prove a specific point from the data. The application's purpose pivoted from drawing fixed conclusions to empowering user-driven insights, reinforced by precise naming conventions with PMV as" thermal comfort" from HVAC as a "Energy usage score" for broader implications.

AI assistance played a supportive, rather than generative, role in developing the web application. While my core narrative and the functional vision for the graphs remained my own, and largely unchanged from the A1 pitch, AI provided valuable assistance in refining the narrative's writing, helping me achieve a more compelling and concise voice. Aesthetically, it offered suggestions for color palettes and html visuals, which I then adapted and refined to align with my desired outcome.

Usability Testing

My primary objective was to confirm an easy understanding of the fundamental idea—the interplay between energy usage and thermal comfort. I also assessed if my four defined performance scenarios resonated clearly. Beyond comprehension, I observed if users effortlessly navigate between the "Year View" and "Day View" and if interactivity genuinely helped uncover meaningful insights.

To achieve these goals, I designed open-ended tasks that encouraged exploration. I invited 9 university-educated, inquisitive individuals (housemates, friends, classmates) to engage with the prototype. Their tasks prompted qualitative insights: to identify success stories and areas for improvement in the Year View, and to analyze a random day's rhythm in the Day View.

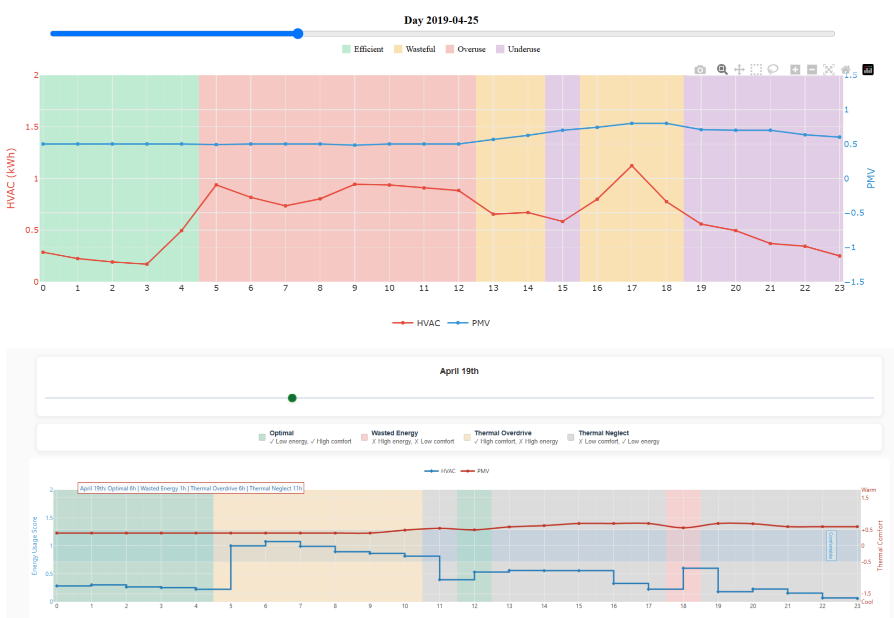
Testing immediately confirmed a major success: users quickly grasped the core energy vs. comfort relationship. This was a direct win, stemming from A1 feedback that advised bringing project goals upfront, effectively anchoring user exploration.

However, the tests also pointed out the need for interaction design improvements.Information overload with dropdown and checkboxes emerged: while users understood individual functions, they struggled to combine filters effectively without a clear goal. A striking lack of date context also proved problematic as the day's data was reported as "random and the same" in the Year View. Furthermore, the two-dimensional nature of PMV (optimal near zero, discomfort at extremes) consistently proved challenging to interpret. Beyond these, specific qualitative feedbacks highlighted confusing X-axis date formats, a need for clearer PMV hover info (e.g., "too warm/cold/comfortable"), and a desire for day-of-the-week labels. The original color palette was also deemed either too stimulating or blended , hindering legibility.

Responding directly to these user insights, I implemented significant design changes to enhance clarity, guidance, and user experience. A Tutorial Booklet was the most impactful change.This booklet features four simple demo walkthroughs with custom annotations, providing guided interactions that effectively familiarize users and make complex insights more accessible from the outset. Addressing the pastel palette, I enhanced color clarity, increasing opacity for traces and adding subtle borders to legends, which improved visual distinction and reduced ambiguity. To provide crucial temporal context, I refined time format and context: mid-month dates replaced end-of-month X-axis labels, day-of-the-week labels were added, and seasonal markers integrated. These changes empowered users to draw meaningful connections between performance and calendar patterns. Finally, for PMV comprehension, I introduced a visible "comfortable threshold" (a distinct zone around the PMV = 0 line) directly on charts. This visual cue immediately clarified optimal comfort falls within this range, making the metric intuitively understandable. Users now readily grasped deviation in either direction from zero indicated discomfort, greatly improving thermal comfort data interpretation.

These iterative, user-driven adjustments fundamentally transformed the prototype into a more intuitive, informative, and compelling application, directly allowing users to derive actionable insights, ultimately contributing to more sustainable and comfortable building environments.

Year view's past versions



Day view's past versions

References

- This is not in chronological order

Chatgpt 1

https://chatgpt.com/share/6837bd72-47b0-8002-89cc-ab1890ebc363

https://chatgpt.com/share/6837bda6-fc80-8002-910b-fd3cc3ac8dad

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Chatgpt 2

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Chatgpt 3

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