Interaction Design Coursework (COMP2213)

November 2, 2025

Contents

1 Introduction

2 Literature Review

Inefficient energy usage in the household

One underlying issue that is viewed within households is the inefficient usage of electricity and the waste of electricity due to human behavioural patterns causing mistakes such as leaving lights on. [1] suggests the solution of payment decoupling, which attempts to alter people's behavioural patterns when using household appliances. The authors outline the idea that if bills were to be given to consumers in smaller samples and paid more often, consumers would become conscious of their electricity spending rather than only receiving a bill once a month.

Similarly, in [2], The authors also focus on consumption and its dependence on the individual. However, the solution defined is a formative feedback system that relays electrical usage information to the consumer. This differs from payment decoupling as households are not compelled to pay after receiving the feedback. From these outlined solutions, you could argue that household consumption and energy loss increase based on the awareness and mindset of the homeowner.

The authors in [4] also rely on this argument and expand on the idea of creating routines to optimise electrical appliance usage further. However, unlike [1,2], the authors' design displays the money saved and environmental benefits which can motivate the homeowner to continue saving.

Authors in [5] also use an interface similar to [4], which still requires some homeowner dependence. Furthermore, the results from [4,5] show that the design increased motivation to save energy within the households. However, the design in [5] evaluates the optimal time to use electricity based on how cheap, green or quantity of excess electricity is available and does not consider the user's comfort, which is made a factor in [3,6].

A mathematical approach to energy saving

Diverging from the use of cognitive influence to save energy, a mathematical approach has been implemented in many designs. Authors in [3] provide an algorithm for a Home Energy Management System (HEMS) That considers homeowner comfort and appliance priority to mitigate energy output. This differs from the proposed solutions in [1,2] as it releases the dependence on the homeowner. Furthermore, it removes almost any behavioural effects from the solution. This contrasts the idea in [2] that suggests consumption is highly dependent on the individual. In further contrast to the solution from [3], authors in [4] use an algorithm that only displays calculations and does not act upon those results, which leaves more human dependency, thus potentially wasting more energy.

Scheduling and Management of Household Appliances

A possible scenario could be that the homeowner is wasting no electricity at their own fault. However, this does not mean there are no ways of cutting their electricity costs by increasing efficiency. The authors in [7] conclude that using sensors to detect activity in rooms for lighting and heating will reduce costs, and the idea of scheduling energy usage is seen in designs [3, 5].

A unique solution is proposed by [8], which will calculate scheduling and track bills built on a network of users. It uses big Data and a central server to store data on their customer's energy usage to make recommendations based on other households. Unlike other designs such as [6], this design is not limited to the household. However, it proposes a significant security risk when using its central server to hold information compared to [6,5,4,2], which is something to consider in the final prototype.

In a similar fashion to the design in [3], authors in [9] suggest a priority for appliances in the household which uphold an optimal schedule every day to get the best prices on electrical usage. You could argue that the authors in [9] produced an improved solution to authors in [3] as the proposal can be expanded onto other forms of energy, such as solar panels. The solution in [3] is mainly operable based on a central grid to reduce blackouts.

Conclusion

From exploring and comparing the existing designs and research in the problem space, we can consolidate the ideas that have been successful to aid in our design process. Considering the evidence reviewed, the designs mostly follow a similar focus path of automation or cognition. It is clear that designs focused on the behavioural patterns of humans and their effects on energy usage are less prevalent in the problem space. This can suggest that focusing our design in this area will result in a unique solution to the problem.

3 Interview Analysis

3.1 Thematic Analysis

Theme	Sub-theme	Quote
Convenience	Extra work	"it means extra steps when I want to use anything"
	Annoying	"my roommates found it a bit annoying to deal with"
Comfort	Have to schedule around power saving	"we might schedule some energy-intensive tasks when the battery is at its peak"
	Less work is better	"Something that fits into our lives without feeling like a chore"
Cost	Saving energy saves money	"It's been a pleasant surprise to see our energy bills drop significantly"
Scheduling	Controls when you can do activities	"it's inconvenient if I have to wait till some specific time to do laundry"
Cognitive Behaviour	Struggle to remember to save energy	"remembering to adjust appliance settings isn't always at the top of everyone's minds"
	One more thing on their mind	"spending so much time thinking about electricity"
Environmental	Cares for the planet	"I truly believe in taking care of our planet, and these technologies align with my values"

Convenience - Many participants were upset based on using up their time and taking effort. Reducing the effort and time it takes to save energy in their household will improve the design.

Comfort - Some participants were more concerned about their well-being than saving energy. Therefore, in the design process, the effect on comfort should be considered.

Cost - Many participants related their experiences to money. People were very centred around the idea of saving their money and labelled energy saving as strictly a financial benefit.

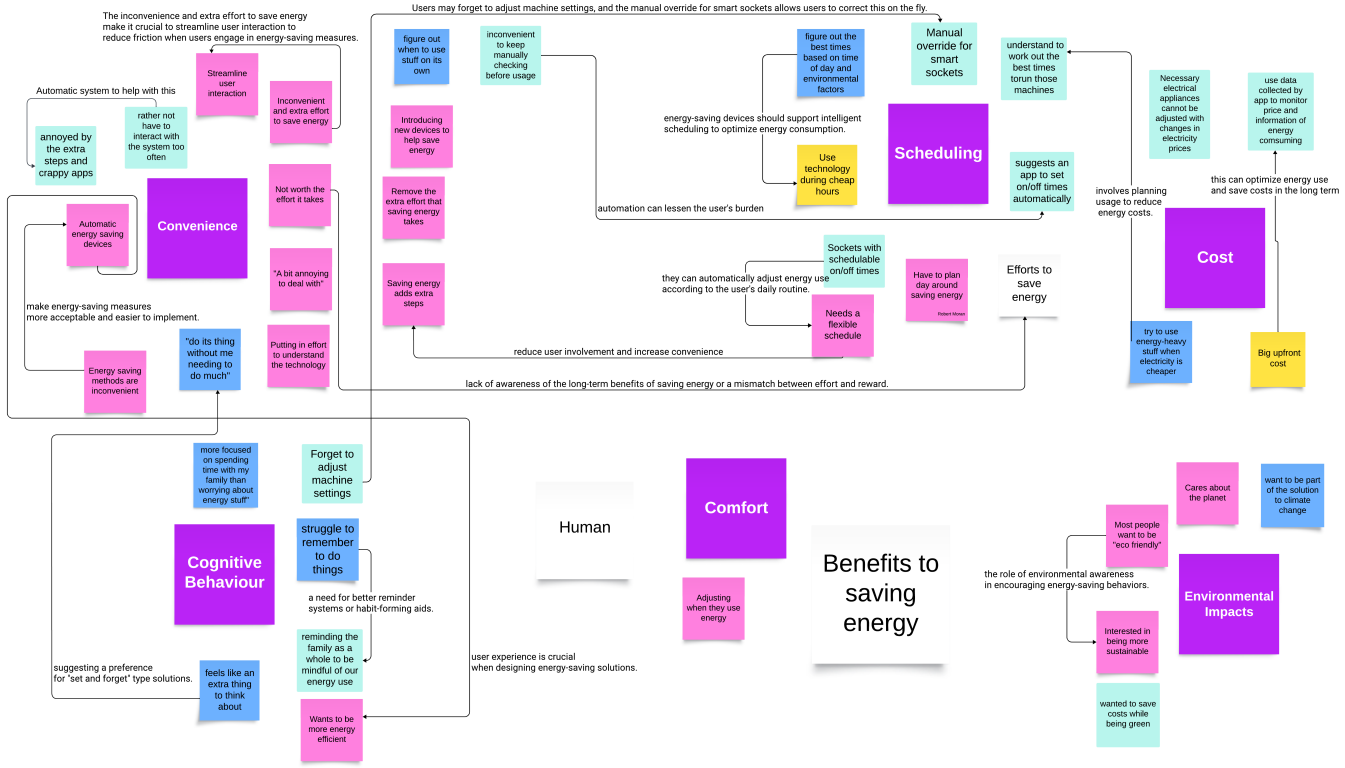
Scheduling - Some participants highlighted the importance of having control of their own energy usage and energy-saving practices. This directly contrasts designs from [1,2,3], which attempt to use automation to control the homeowner's energy usage.

Cognitive impacts - A general occurrence among many participants related to the effects on their minds. For example, creating a routine for some participants was a challenge.

Impacts on the environment - Another reoccurring theme within some participants was their views on environmental sustainability and saving energy to save the planet. This theme does not directly relate to saving energy in the household. However it can be used as a motivational point for some participants.

3.2 Affinity Diagram

During thematic analysis, we discovered a range of themes and sub-themes that are shown in union with the sets of interviews inside of our affinity diagram. The diagram outlines the generic themes (highlighted in white) and links together multiple interview quotes and ideas within related sub-themes (highlighted in purple).



4 Problem Statement

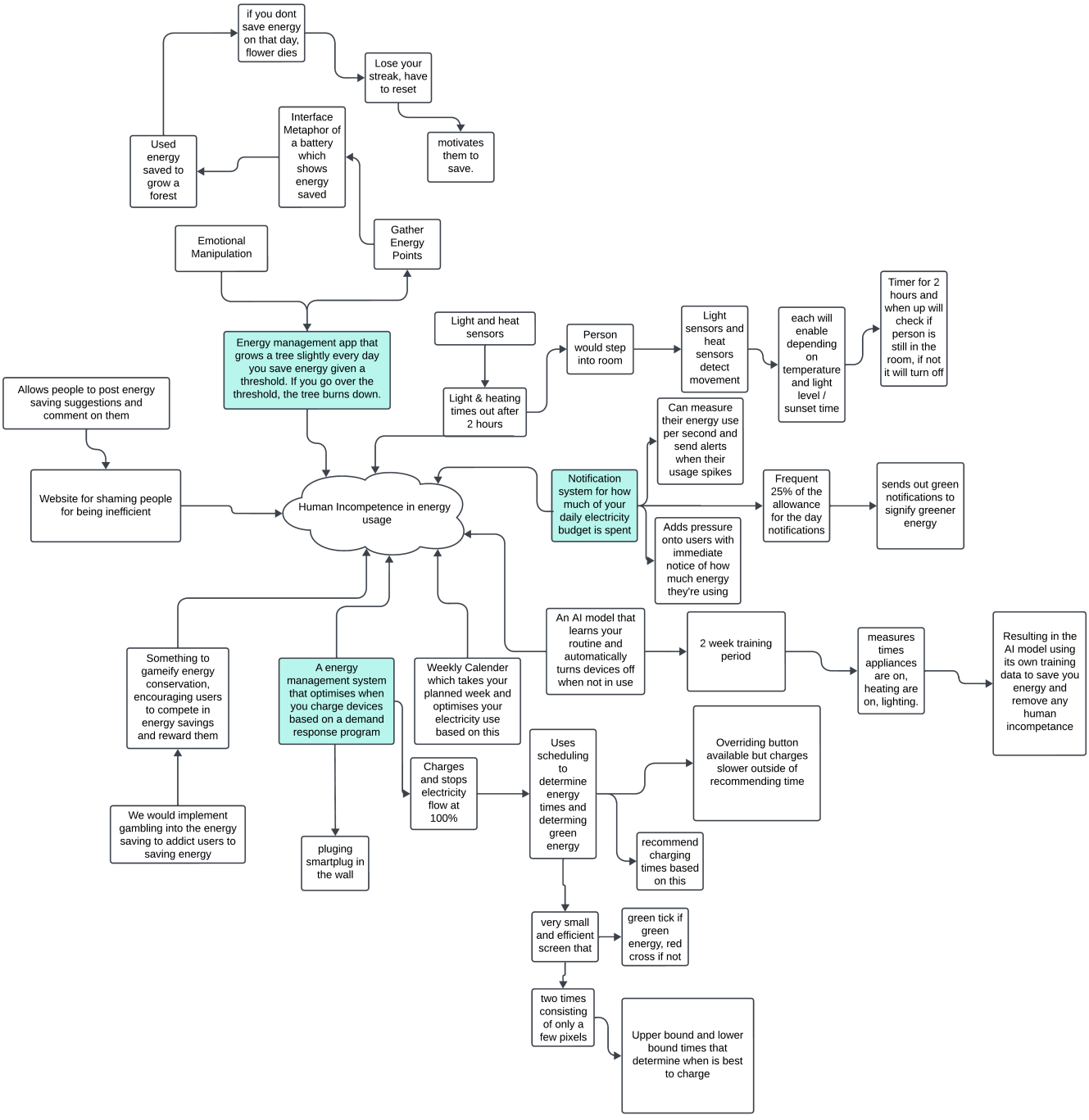
Through literature research and interview analysis, it is clear that within the problem space, there is an outstanding theme of changing behavioural patterns, which is not addressed effectively. For example, a participant from P8 stated that they have "got this fan ... but sometimes I forget to turn it off". This illustrates the mistakes people continue to make when attempting to save electricity, regardless of current design solutions.

The design solutions in [3, 4] both use algorithms to aid the homeowner in saving energy. Many

energy-saving tools within households appear to rely on the use of automation, which can reduce the control that people have over their usage. A participant in the interviews suggested that the "Less work, the better". Therefore, our design should keep the user in control over their energy usage but make saving electricity easier with less work.

As a result, the problem this design will address in the problem space will be to correct human behavioural patterns to increase energy usage efficiency.

5 Design Concepts



5.1 Design one: Energy Saving Game

An application that will allow the user to grow a forest based on their electricity savings. User will save electricity in their household every day, which will gain them a streak. All the energy they save under a threshold will be stored in a "power bank", which can be exchanged for seeds, water and compost from the in-game shop to grow their plants or trees in their forest. The forest will burn down if the user does not save energy in one day, and their streak is lost. By gamifying energy saving users will be motivated to change their behaviours over time to save more and more energy to maintain their streak and create larger forests.

5.2 Design two: Smart Chargers

The intelligent charger design will consist of a modern charger with a minimal pixel and an efficient screen. The screen will indicate two times which bound a recommended period during which the user should charge their devices based on cost. The screen will also allocate a few pixels for a tick or cross, which indicates whether the energy usage is greener than a certain threshold or not. Electrical usage will be halted at 100 percent battery charge to save energy further. There will be an overriding feature that allows the user to change at any time of the day. However, the appliance will use electricity at a lower rate expense of using this feature. By automatically charging devices at times when energy is "greener" users will have to think less about their energy saving and won't need to change any of their behaviour to save some energy.

5.3 Design three: Notification Software System

The notification system is a software system that will notify users at 25 per cent intervals based on their spending. The intervals are set by the user on how much they want to spend per day. The software will communicate with the household electricity meter to determine if notifications need to be sent to the user's device. If the user has high usage and is almost hitting the threshold, then a message will be presented on their device. The software also considers green energy with green notifications given to the user when the electricity on the grid is greener. By giving users real time feedback of their energy usage they'll be likely to pay significantly more attention to their usage, which over time is likely to enforce new energy saving behaviours as they'll see immediate feedback.

6 Developed Design Concept

6.1 Selection

Between the three design concepts the group has thought through, the stand-out idea was developing innovative technology that acted as an energy-saving game.

Assumptions

- Users will have a modern (past five years) mobile phone or tablet.
- Users will not want to burn down the their forests that they spent a large amount of time creating by saving on energy.
- People will use the app as a motivation tool to reduce their daily energy usage and become more aware of wasted usage.
- The software application will be able to connect to the user's energy meter and, take readings and calculate savings.
- The intended consumer will leave appliances on by "mistake", wasting electricity.
- The consumer has not considered reducing energy usage before using the app.

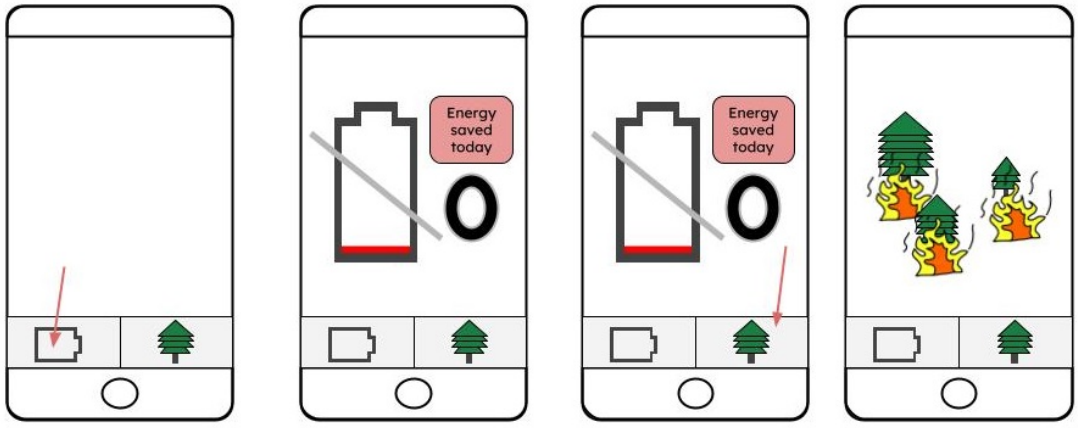
6.2 Development

6.2.1 Streaks

Built-in streaks build a sense of urgency for the people using the app. This urgency is caused by the fact that if their streak is lost, all of their progress will be lost. The streak mechanic is the core mechanic that will keep the user motivated. The effectiveness of streaks is shown in multiple popular apps, such as Duolingo, Snapchat and Wordle.The daily aspect of streaks will create a routine within the user's lives, which can, over time, become a permanent behavioural habit.

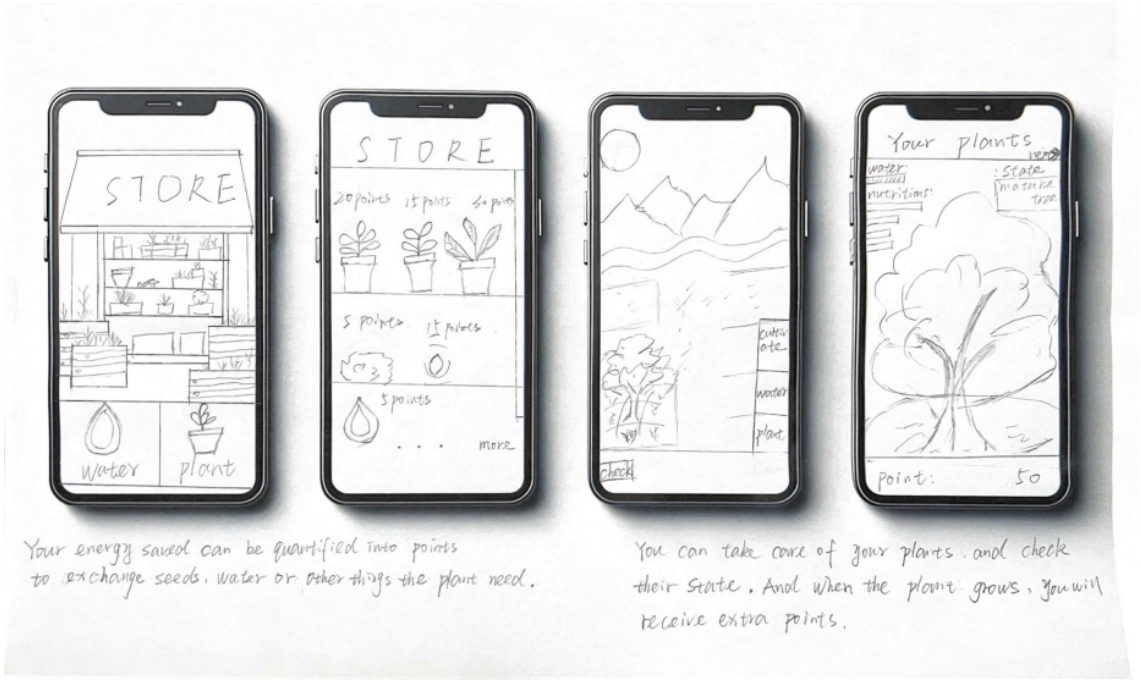
6.2.2 Forest

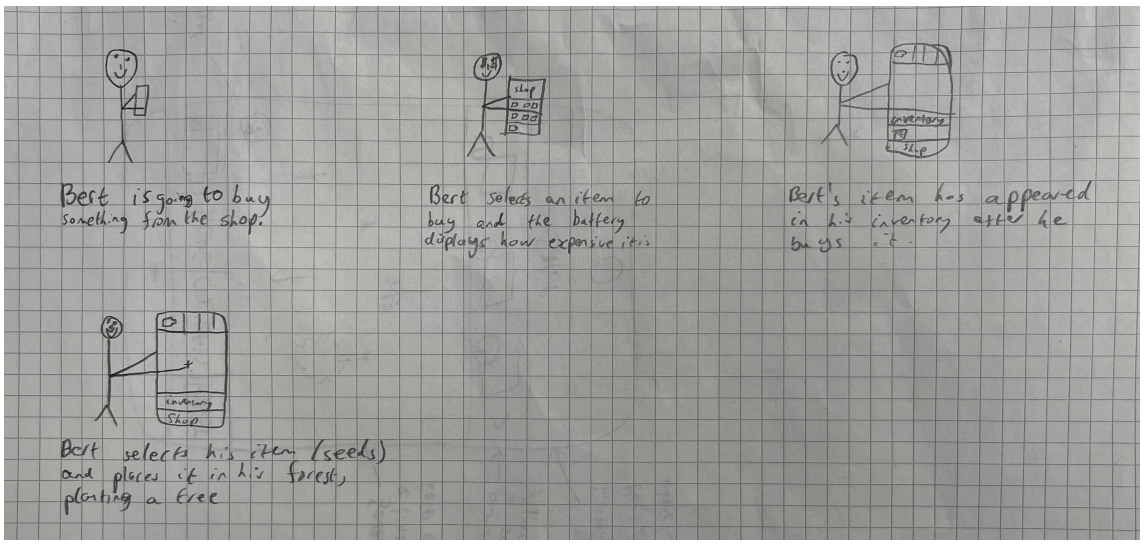
The homeowner will have their own hand-built forest that they will grow over time. This mechanic adds the idea of time, which can bring a sense of value to the game. This idea can then be used to motivate people further to save energy and grow their forest. If the user does not save energy on a certain day, the user's forest will burn down, and all progress will be lost. The forest is designed to give user a visual presentation of how much impact energy saving can make, to motivate users to continue with energy saving.



6.2.3 Battery

Keeping up a streak will fill a "battery", an "in-game currency" that can be spent on seeds to plant new trees, fertiliser, water, etc. The battery is an interface metaphor that illustrates the user saving real energy and storing it in a virtual battery. The battery is designed to give users a visual representation of them saving energy. As a result, this changes their behaviour by seeing saved energy as a reward which will make the energy saving process more enjoyable.


STORE
water
plant
STORE
20 points
15 points
5 points
5 points
15 points
5 points
. . .
more
Your plants
water
nutritions:
State
Point:
50
Your energy saved can be quantified into points to exchange seeds, water or other things the plant need.
You can take care of your plants and check their state. And when the plant grows, you will receive extra points.

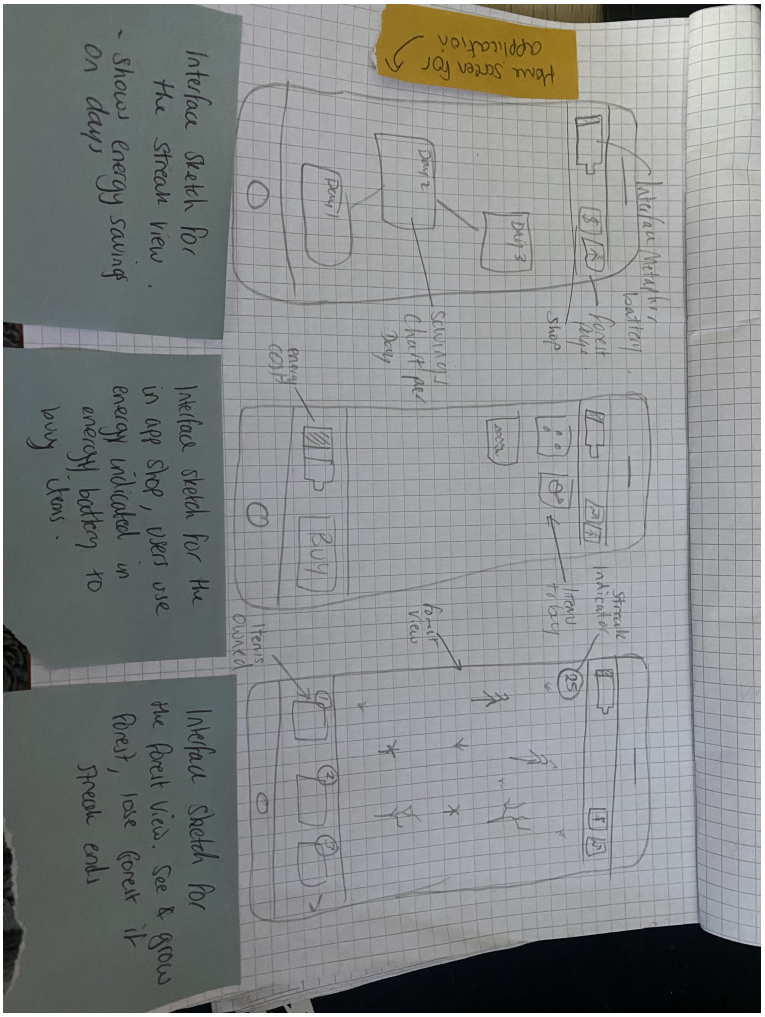

Bert is going to buy something from the shop.
Bert selects an item to buy and the battery displays how expensive it is
Bert's item has appeared in his inventory after he buys it.
Bert selects his item (seeds) and places it in his forest, planting a tree

7 Prototype

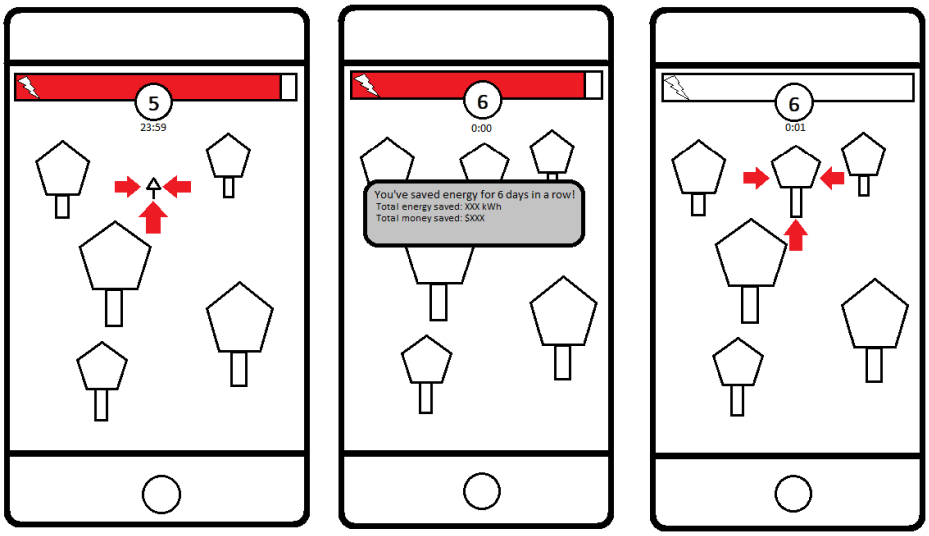
7.1 Iteration 1

7.1.1 Initial Sketches

The initial sketches for the application design included the fundamental components of the software. The app is split into three subsections in the first prototype image: a home screen, a shop screen and forest screen.



This sketch shows the streak counter increasing from 5 to 6 as the time changes from 23:59 to 00:00. The tree shown by red arrows also grows a little.



7.2 Iteration 2

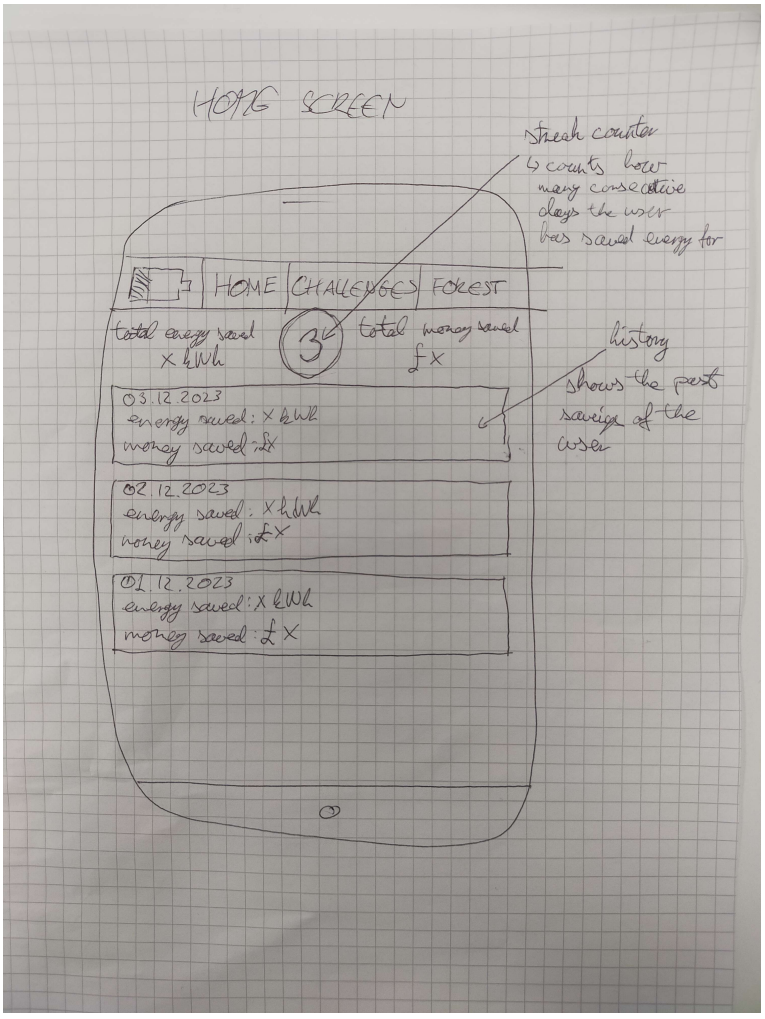
After completing the first iteration of sketches, we decided to create another iteration of sketches in order to improve upon the shortcomings of the initial iteration.

7.2.1 Initial Sketches

All of the screens contain the same navigation menu at the top of the screen, along with the battery in the top left. This design choice was made in order to maintain consistency between screens, making it easier to navigate the application, as well as being able to use the battery at all times.

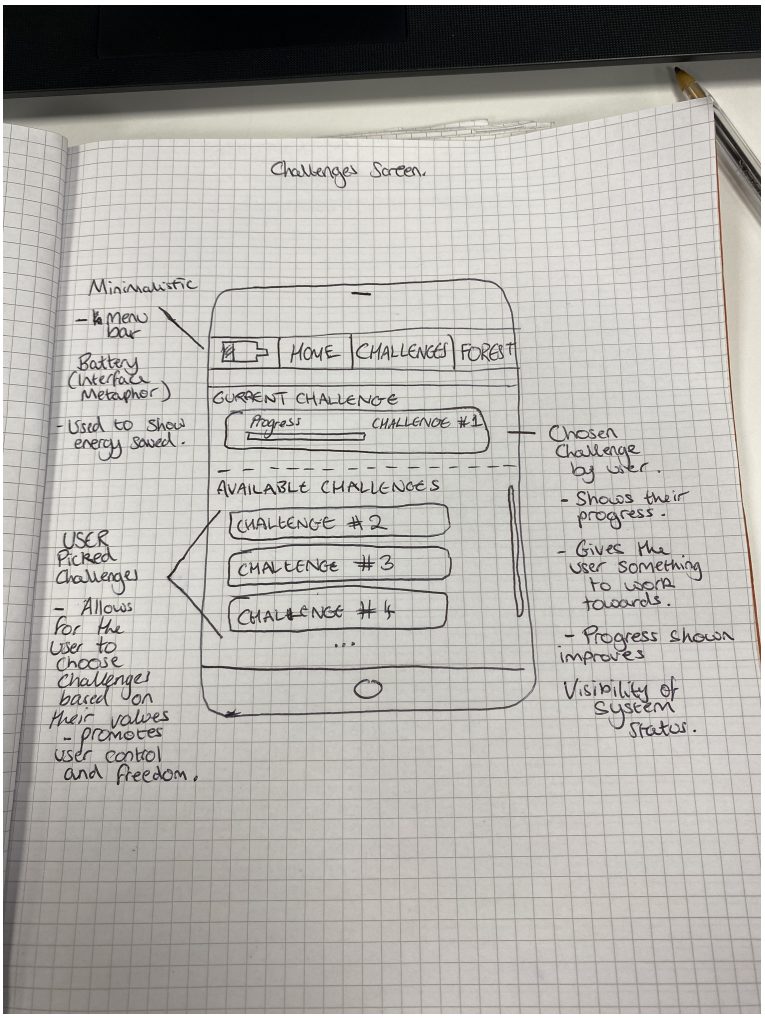
Home Screen

The home screen displays data about the user's previous energy usage. It also shows your current streak, along with how much energy and money you've saved in total.



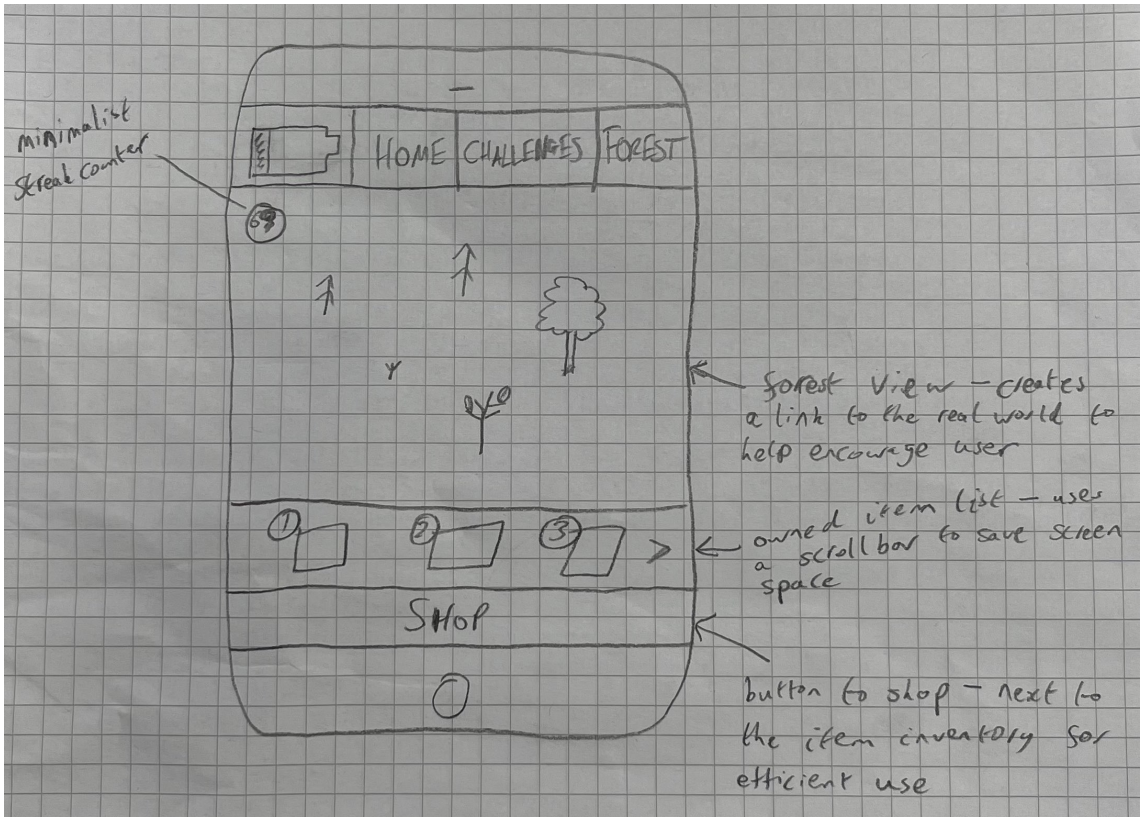
Challenges Screen

This screen is for viewing current progress on challenges and selecting new challenges.



Forest Screen

The forest screen shows the forest, along with a small streak counter. Furthermore, there is a shop button at the bottom, below an inventory menu showing the items you own.



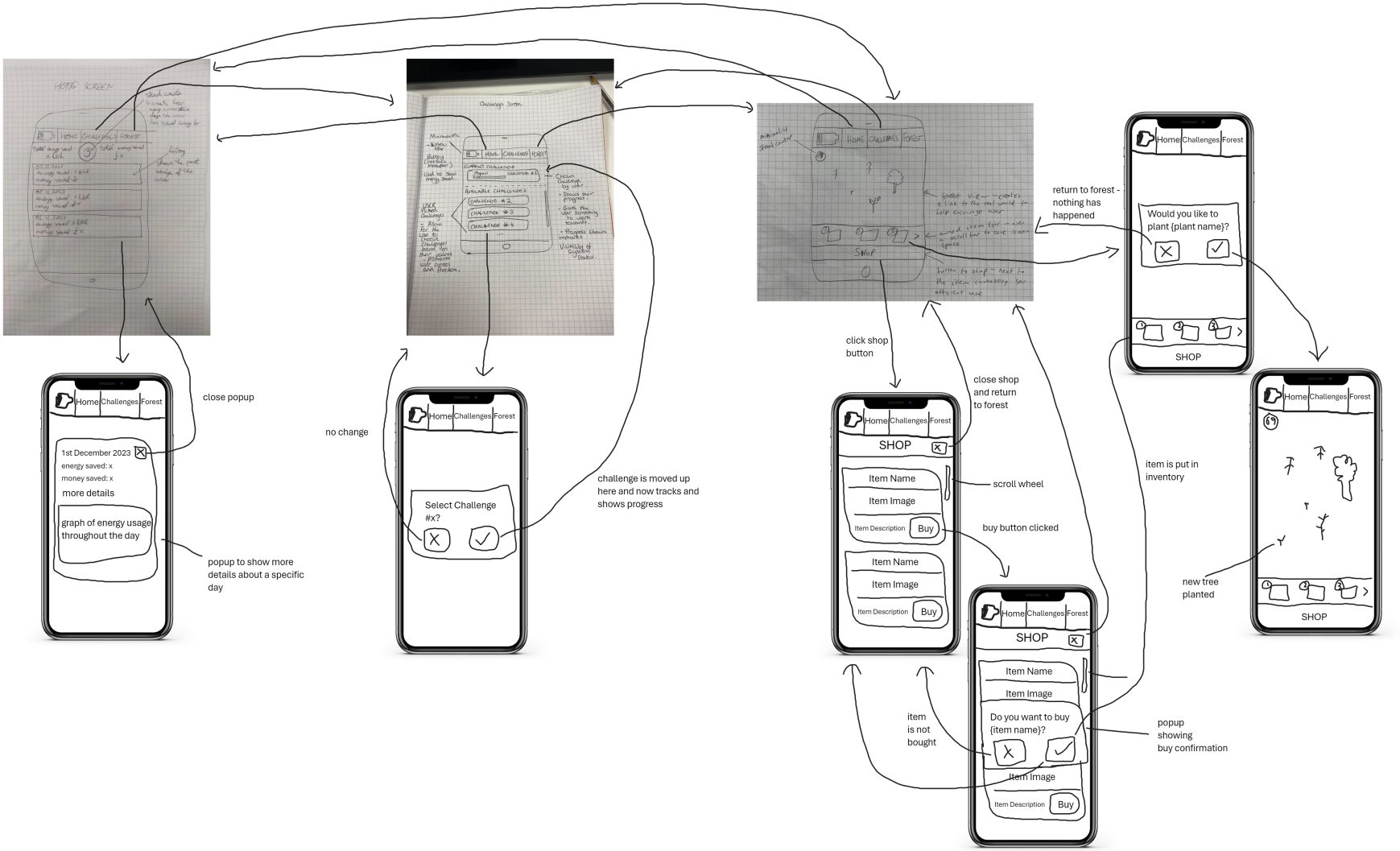
7.2.2 Advanced Sketch

This sketch improves upon the previous three sketches by showing navigation throughout the app and showing the shop and more menus.

The first sketch shows more details being displayed when you click on a specific day on the home screen, including a graph showing energy throughout the day.

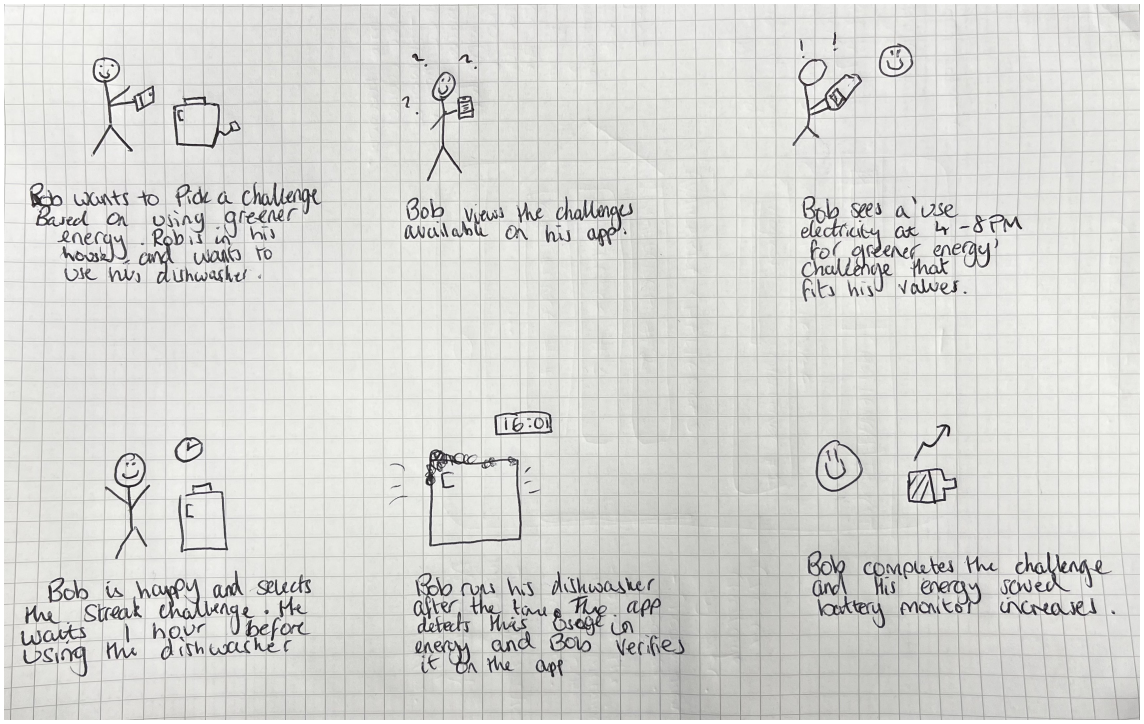
The sketch for the challenges screen shows a popup appearing for confirmation upon trying to select a challenge. Confirmation popups are used throughout the design to ensure the user doesn't do anything accidentally, such as purchase something from the shop.

The forest screen has the most complex navigation because it is also the gateway to the shop menu.

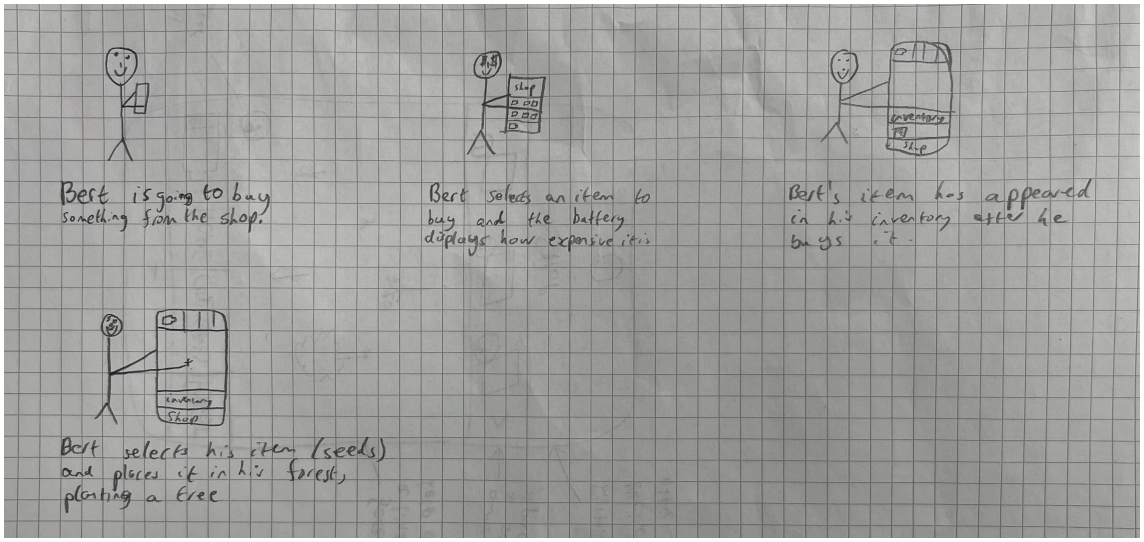

HOME SCREEN
Challenges Screen
Home Challenges Forest
1st December 2023
energy saved: x
money saved: x
more details
graph of energy usage throughout the day
close popup
popup to show more details about a specific day
Select Challenge #x?
no change
challenge is moved up here and now tracks and shows progress
click shop button
SHOP
Item Name
Item Image
Item Description
Buy
close shop and return to forest
scroll wheel
buy button clicked
item is not bought
Do you want to buy {item name}?
popup showing buy confirmation
item is put in inventory
return to forest - nothing has happened
Would you like to plant {plant name}?
new tree planted

7.2.3 Storyboards

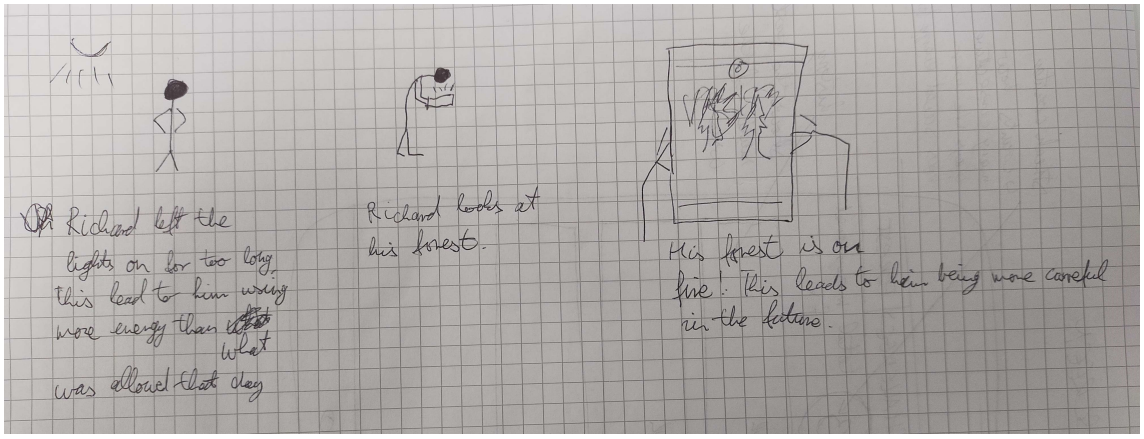
This storyboard shows a user choosing a challenge, doing the challenge and then claiming his reward for completing the challenge.



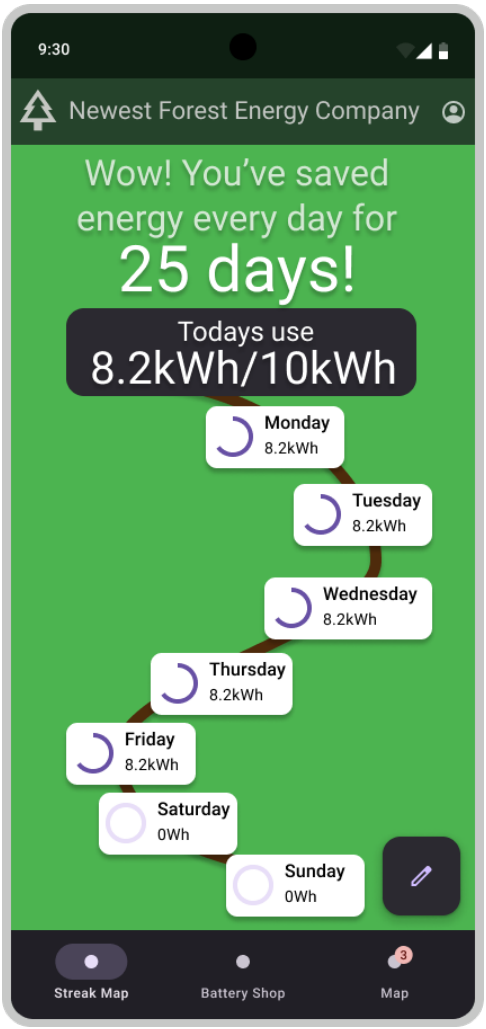
This storyboard shows a user buying an item from the shop and then using it.

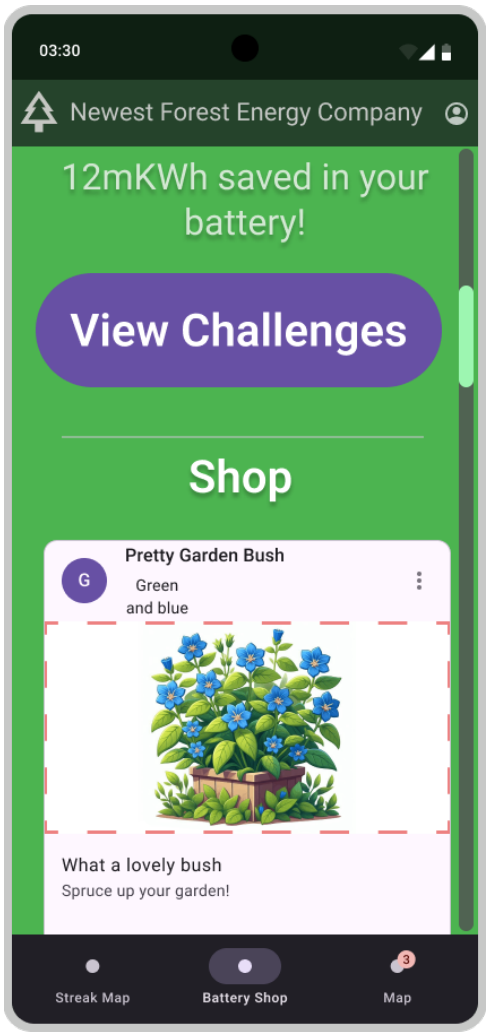


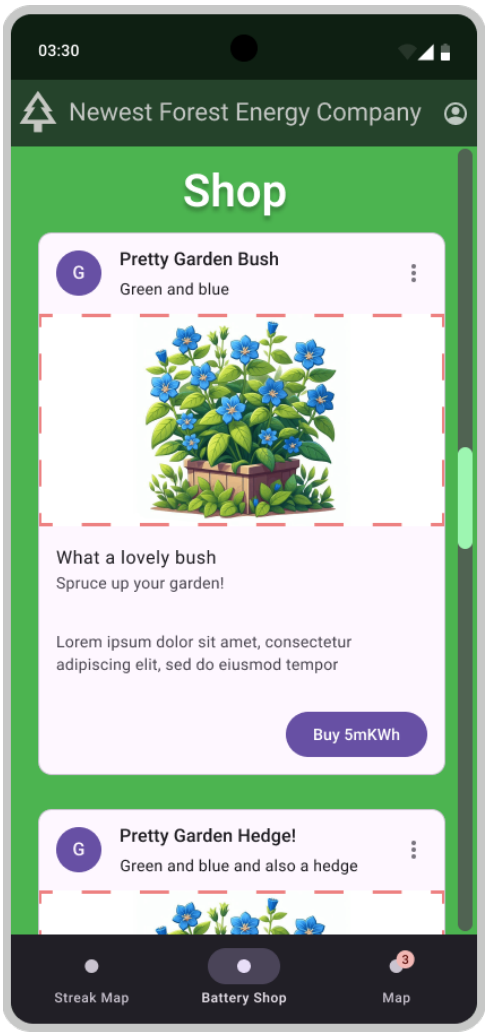
This storyboard shows a user's forest burning down due to them losing their streak.

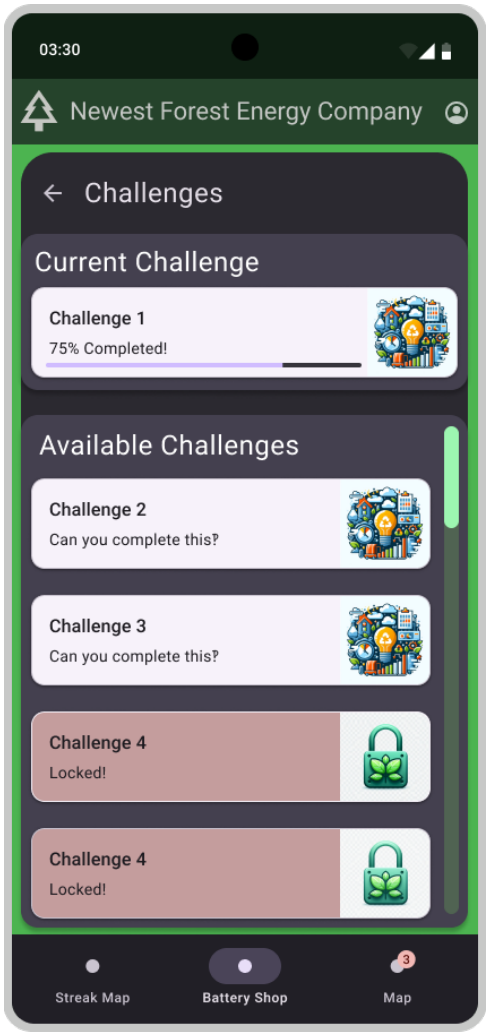


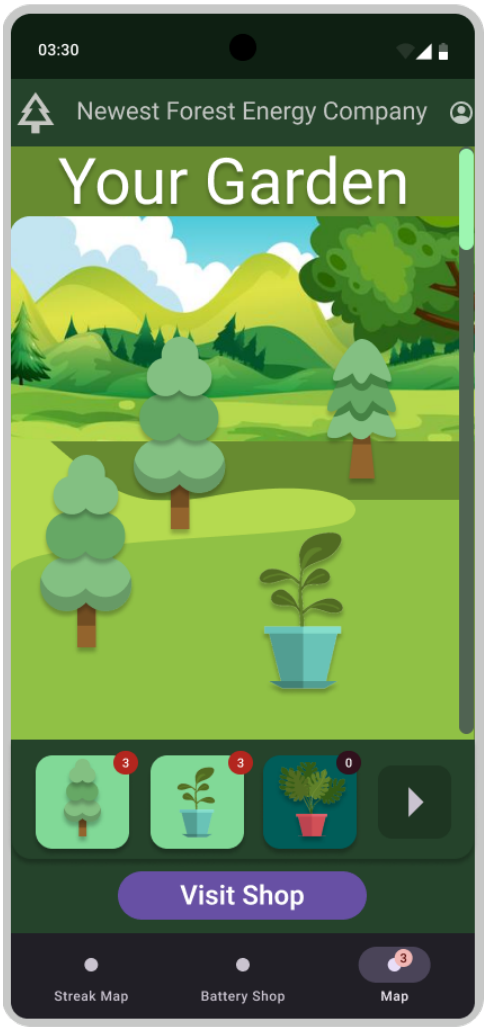
7.3 Figma Prototype




03:30
Newest Forest Energy Company
12mKWh saved in your battery!
View Challenges
Shop
G
Pretty Garden Bush
Green and blue
What a lovely bush
Spruce up your garden!
Streak Map
Battery Shop
Map
3


03:30
Newest Forest Energy Company
Shop
G
Pretty Garden Bush
Green and blue
What a lovely bush
Spruce up your garden!
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor
Buy 5mKWh
G
Pretty Garden Hedge!
Green and blue and also a hedge
Streak Map
Battery Shop
Map
3





In our Figma prototype, we used the Material Design 3 toolkit from Google. This allowed us to create a prototype that would be very similar to an actual Android app. We also used their dynamic colour plugin to create a coherent theme across the design.

7.4 Video Link

https://www.youtube.com/watch?v=YUogXUaVN74

8 Evaluation

For the evaluation of our first iteration, we set up a focus group containing other group members. The aim of the focus group was to present the product and display the product's functionality and design. Within the focus group, we gave each participant an anonymous questionnaire (See appendix A.2). The group decided to use this as it resulted in fewer biased answers due to each participant being allowed to express how they felt anonymously. This gave the group authentic qualitative and quantitative data to review within the evaluation.

Summary of qualitative feedback:

Question – What are your initial thoughts after learning about the product?

Initially, most members of the group believed the idea of the forest to be a motivating idea. Some participants mentioned that they "like the sound of the shop" therefore portraying the app as interactive and fun.

Question – What is the first thing you would change about the app?

A few participants within the group suggested their concerns with security within the app. They believed that to secure the app, an account creation page may be needed in the next prototype iteration. They further suggested that users with other devices would be able to view data from just being connected to the Wi-Fi network. Another recommendation a participant made was to add a "streak freeze" which would give the homeowner a day to go over the threshold without losing their forest. According to some of the participants, using this method would greatly reduce stress when using the app and would increase usability.

Question – What are the first words that come to mind when you see the product?

One participant in response to this question mentioned that it was a "smart way to get people engaged into saving electricity". This response suggests that the application is changing how the member perceives energy saving. Instead of viewing it as a chore, they believe it is engaging. To further prove this, another contestant responded with "Motivating, fun, accessible, simple".

Question – What challenges could you perhaps face when using the app?

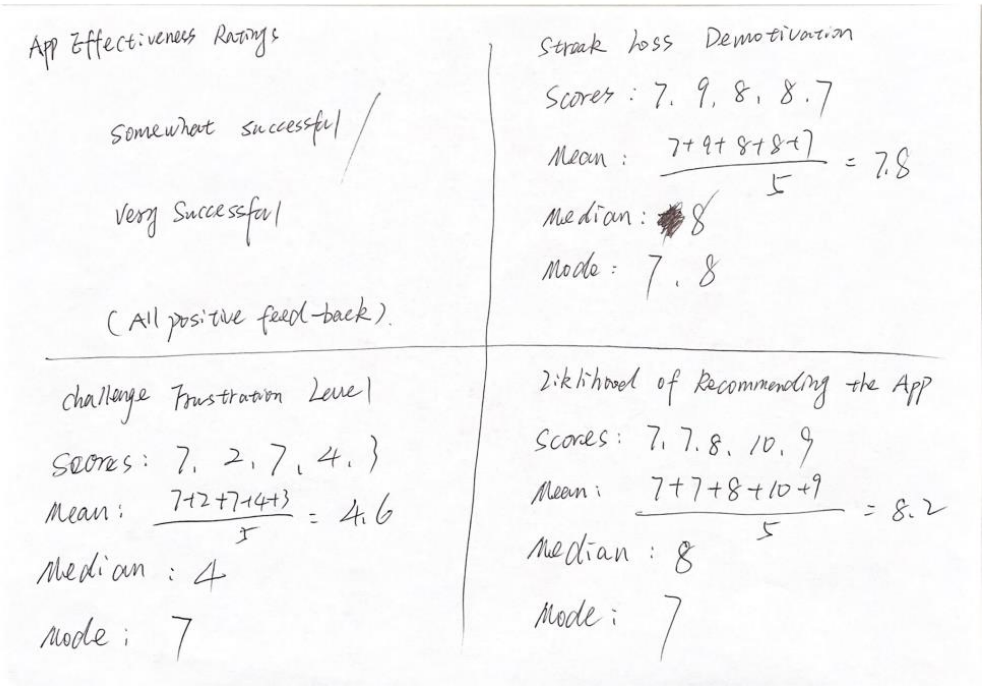
One participant for this question suggested that they felt like it would be "too much trouble" to have to "go to another room to shut off the lights" in some cases. This result could suggest that the application wasn't as engaging for them as we would have hoped. As a result, in the next iteration, we could increase the complexity of the challenges to which smaller tasks such as turning off lights in other rooms would feel like a big accomplishment and worth a user's time.

Another response to this question was that if there was no "social" aspect such as getting the family involved in 1 forest, they may be more likely to "lose motivation". Therefore, in the second iteration of the design, having a social aspect such as multi-user forests may be needed. Furthermore, we received a recommendation from a participant to have a "code" which can be shared around the household to join a forest. This could be a unique way of implementing this.

Summary of quantitative feedback:

Quantitative Data Analysis: Descriptive Statistics

To analyse the quantitative data, we calculated the ratings and responses using basic statistics like mean, median, and mode:



From our calculation, here are some of our discoveries:

- Idea of losing a streak is fairly demotivating for users, suggests a need for a more forgiving streak system.
- Moderate level of frustration with the challenges presented in the app, suggest that while some users find aspects of the app challenging, it's not overwhelmingly so.
- High likelihood that users would recommend the app to others, suggest it's overall appealing to people.

Based on the feedback we received, the focus should be on these key areas in the next design iteration:

1. Improve the streak system and security features.
2. Make the app more user-friendly by simplifying navigation and adding tutorials for easier understanding.
3. Add features like leaderboards and social sharing
4. Continuously update the prototype, using new rounds of user feedback to guide improvements.
5. Work closely between design and development teams to ensure changes are both desirable for users and technically feasible.

A Appendix

A.1 Interview Coding

A.1.1 P3-P4

Code Dictionairy for P3-P4

Type of energy use in home and how

Why this type of energy

How long have been using the type of energy and any tariff

Patterns of change in electricity price

Result of using this type of energy

Any effects on daily routines

Ways(potential ways) to help with using this type of energy

Additional comments

P3

Gender	Man
Age	42

Interviewer Today we are going to talk about your home energy use. Could you start by just telling me about the types of energy that you use in your home?

Participant Sure thing! Well, you see, at home, we mainly use electricity for everything. We've got these solar panels on the roof that soak up the sun and make electricity, which is pretty neat. Oh, and don't forget about our electric car, gotta charge it up too. What's interesting is that our electricity cost changes during the day because of the fancy tariff. So, I guess we're trying to work out how to use electricity when it's cheaper, or when the solar panels are generating most. It can be a bit tricky! Family isn't always on the same page about when solar is generating, or when the electricity price is lowest, and some equipment just does its own thing, not caring about schedules. It's a bit of a juggle!

Interviewer That's really interesting. Could you tell me some of the reasons that motivated you to get solar panels?

Participant I think one big reason was to try and be more eco-friendly. You know, do our bit for the planet. And, with a growing family, our energy bills were starting to climb, and solar panels seemed like a good way to cut down on those bills overall. Plus we liked the idea of generating our own electricity from the sun. It's like having a little power plant on your roof. Getting an electric car, it made sense to tap into solar energy for that too, free driving! So, yeah, a mix of saving money, being green, and just embracing some fun technology drove us to go solar.

Interviewer And how long have you had the solar panels?

Participant We've had the solar panels for about five years now. We got them installed when our youngest was just little. It's been quite an interesting journey, learning how they work and seeing how they impact our energy use. I'd say it's been a good investment overall, but it does come with its own set of challenges.

Interviewer And have you had the variable tariff for five years too?

Participant Oh, not quite. We switched to the variable tariff about two years ago. It was actually after we got the solar panels. We thought, "Hey, if we're making our own electricity, why not make the most of it?" So, we moved onto this tariff where the price of electricity changes through the day. It's been a bit of a learning curve, figuring out when electricity is cheaper or more expensive isn't always easy, especially when life gets busy. But it's all part of the adventure, I guess.

Interviewer Interesting. Have you noticed any patterns about when electricity is cheaper or more expensive?

Participant Definitely. There are some general trends we've picked up on. Usually, electricity tends to be cheaper during the daytime when the sun is shining and solar panels are doing their thing. Makes sense! Then, it tends to spike a bit in the early evening when people are getting home from work and school, cooking dinner and stuff. That's when we see higher prices. But later at night, it tends to settle down again. There are some days when things don't quite follow the pattern. But having a rough idea helps us make some smarter choices about when to use electricity-hungry devices.

Interviewer How have you found shifting your electricity consumption to cheaper periods? Would you say you are successful in doing so?

Participant Ah, shifting our electricity use, that's been a bit of a mixed bag, I'd say. On one hand, when we manage to time things right, like running the

dishwasher or doing laundry during the sunny hours, it feels pretty great. It's like a little victory, knowing we're using cheap solar electricity. But, not always so easy. Sometimes life gets hectic, we forget to adjust our routines and there are those appliances that just don't play with schedules, no matter how hard we try. So, I'd say we have our successful days and our not-so-successful days. It's a work in progress, and the family's awareness about electricity costs is something we're still trying to improve. It's a team effort, after all.

Interviewer You say that some appliances don't play nicely with schedules, what are some problems that you have noticed?

Participant Well some appliances just like doing their own thing, no matter what schedule we have in mind. Take the fridge, for instance, it doesn't care if it's daytime or nighttime, it just keeps things cold all the time. The TV and game consoles, the kids can fire those up whenever they want, and they often forget about the whole electricity price thing. So, it's a bit of a challenge, trying to get these gadgets on board with our money-saving plans. It's like herding cats sometimes.

Interviewer Do you have home energy storage, like a battery?

Participant Oh, not yet. We've thought about getting a home battery to store that excess solar energy, but we haven't committed yet. It's definitely on our radar, though. Having a battery could be be helpful, letting us store up extra solar power during the day and using it when the sun's not shining or when electricity prices are higher. But it's one of those decisions that needs some careful thinking, it's a big upfront cost; when we had the panels installed it wasn't offered, but I think it's pretty standard to get both at once now. We're keeping an eye out for good deals and will see how it goes.

Interviewer Are there any appliances that you feel you are relatively successful at load shifting?

Participant Oh, definitely! Some appliances have been more cooperative! Our washing machine and dishwasher are the best. We've can set them up to start during the sunniest parts of the day. And honestly, it's pretty satisfying to see those machines chugging away while the sun is out. It's like they're in sync with the universe or something. So, yeah, those two have been the winners in our household.

Interviewer That's great, how did you set that load shifting up?

Participant Oh, it wasn't too complicated, actually; you just have to remember to do it! Both have delay start options. So, we just delay the start

until the time we think electricity will be cheapest, or the sun will be sunniest. It's a bit like setting an alarm clock, but for appliances. Once we got the hang of it, it became part of our routine. Now, it's just second nature to check the forecast, see when the sun's putting in an appearance, and program the machines accordingly. It's kind of fun, like a little energy puzzle we're solving each day.

Interviewer And do you find that all members of the household are able to do that, or does it tend to fall to the same person?

Participant Well, I'll be honest, it's mostly fallen to me to handle the load shifting duties. The family's on board with the whole idea of saving money and using solar power, but remembering to adjust appliance settings isn't always at the top of everyone's minds. It's become a bit of my thing, you know? I've taken the time to understand how it works and to work out the best times to run those machines. That being said, we've had some family discussions about it, and the kids are slowly starting to get the hang of it. They're becoming more aware of when it's a good time to run things, which is pretty cool to see. But for now, it's mostly me doing the load shifting dance.

Interviewer What about your partner, how do they get involved in the load shifting?

Participant Ah, good question. My partner is supportive of the whole load shifting ided, but his involvement is a bit more indirect. He's not as hands-on with adjusting appliance settings or checking electricity prices. Instead, he's been more focused on helping the kids understand why we do this and why it matters. He's also been great at reminding the family as a whole to be mindful of our energy use. It's more about creating that awareness and making load shifting a household conversation. So, while they might not be the ones setting timers on machines, they're definitely part of the team effort to make it all work.

Interviewer What are some reasons that they are less hands-on with the load shifting?

Participant Well, it's a mix of factors, really. For one, my partner's schedule is quite busy with work and other responsibilities, so diving into the detail of the electricity system isn't always his priority. He's supportive of the concept, but the day-to-day management of it just doesn't fit naturally into his routine. So even when he remembers he's had less practice than me, and it maybe takes more thought and effort for him. It's not that he's disinterested, he's definitely on board with the bigger goal of like saving money and using clean

energy, it's just that his involvement takes a different form, focusing more on overall awareness and encouragement within the family.

Interviewer Have there been any times where trying to shift your energy usage was inconvenient or had a negative effect?

Participant Oh, yes! There have been a few instances where it didn't quite go as planned and ended up causing some inconvenience. One memorable time was when we had a load of laundry that really needed to be done, but the sun was hiding behind clouds all day, so our solar power was minimal. We had planned to run the washer during the sunny hours, but we had to make a choice, either run it on the grid at a higher cost or wait for sunnier days. We ended up running it later, and it probably cost us more overall; and some of the stuff was still damp the next day. There have also been times when we've forgotten to set appliances on delay start or didn't account for changes in our schedules. For example, we'd plan to run the dishwasher during the day, but then we'd have an unexpected family event or errand that threw off the timing. So, it's not always seamless, and sometimes the effort can clash with our daily lives. But it's all part of the learning process. We see these moments as opportunities to fine-tune our approach!

Interviewer You mention checking the energy cost when setting up your load shifting each day, what are some tools or sources of information that you have found useful?

Participant When it comes to checking energy costs and planning our load shifting, a couple of tools have been quite helpful for us. Our utility company provides a mobile app that shows us the current electricity prices. It's a quick way to check whether it's a good time to run energy-intensive appliances. And we use weather apps to track when the sun will be shining.

Interviewer How do you access your smart meter data?

Participant Accessing our smart meter data is relatively simple. Our utility company has set up an online portal, we can navigate to the section that displays our energy usage information. It gives us historic data on our electricity consumption, including graphs and charts that show usage patterns throughout the day, and includes details about the electricity costs at the time, which helps us gauge when it's more cost-effective to use energy-intensive appliances. The data is only refreshed once every 24 hours, though, so it's not live which is a shame.

Interviewer And what are some ways that your smart meter data helps you with load shifting?

Participant Smart meter data has been pretty useful when it comes to load shifting. One of the key ways it helps is by giving us real-time data on our electricity usage. We can see how much energy we're consuming and if we need to turn something off! It's common for our peak usage to be higher than the power provided from the solar. By spreading our usage out a bit, we can make better use of the solar power.

Interviewer Can you give an example of a some other load shifting?

Participant One example of load shifting for us involves adjusting our weekly routines based on trends in our usage. We noticed that energy usage tends to be higher on weekday evenings when everyone is home and using various devices and appliances, also the time when electricity prices are often higher. So we shifted some of our energy-intensive activities to other times of the day. For instance, we've started doing more cooking and baking during the daytime on weekends when electricity prices are lower and our solar panels are generating power. It saves some money and uses more solar. We've also encouraged the family to engage in activities that don't require as much electricity during those peak evening hours. Maybe spending more time outdoors or engaging in low-energy-consumption hobbies. By making these adjustments, we're able to smooth out our energy usage patterns over the week and take advantage of favorable conditions for load shifting.

Interviewer How have the kids responded to being told to spend time outside instead of playing on their computers?!

Participant Oh, you know how it goes with kids and screens. It's been a bit of a transition! At first, there were some protests and grumbles about having to spend more time outside instead of on their computers or game consoles. They're at that age where digital entertainment is a big part of their lives. But we framed it as a fun adventure, exploring the garden, playing games, and doing some outdoor projects. We tried to find a balance by designating specific times for digital activities and others for outdoor play. Over time, they've started to get used to it, especially when they see that spending time outside can be just as much fun!

Interviewer Thanks for your time, it's been really useful and interesting! Is there anything else you'd like to tell me about your load shifting or energy use?

Participant You're welcome! I'm glad I could share my experiences. Just a final note, load shifting and managing our energy use has definitely been a learning process. There's a real sense of accomplishment in getting the hang of managing our energy consumption. I guess one thing I tihnk is important is

that it's some important to work togther as a family, to share what we're trying to achieve and help one another understand. But this was fun, thanks!

P4

Gender	Man
Age	38
Notes	Husband of P3

Interviewer Good morning. Thank you for taking the time to talk about your home energy use today. Could you start by telling me about the types of energy that you use in your home?

Participant Good morning. Sure thing. Well, in our home, we primarily use electricity. We've got solar panels on the roof, which help generate electricity from the sun. We don't have many gas appliances left; just the central heating. And there's our electric car too, so no petrol! We've switched to a variable electricity tariff that changes throughout the day, which has been interesting.

Interviewer It sounds like you have quite a dynamic energy setup with solar panels and the electric car. Could you tell me a bit more about how these different components work together?

Participant Absolutely. The solar panels are great for generating electricity during sunny hours, and they can even help charge up our electric car. The variable tariff we're on means that electricity prices change during the day. So, we're trying to be clever about when we use power, aligning it with cheaper times or when the sun's out.

Interviewer What motivated you to get solar panels for your home?

Participant Oh, that's an interesting story. It was a combination of factors, really. We wanted to be more environmentally conscious, plus with a growing family, our energy bills were climbing. The idea of generating our own power and saving money in the long run was quite appealing. And, of course, charging up the electric car with clean energy made a lot of sense.

Interviewer It's great that you're thinking about both environmental impact and cost savings. How did the introduction of solar panels change your daily routines or habits?

Participant Well, it made us more conscious of when we use electricity. We started looking for ways to align our usage with when the sun was shining or when the tariff was lower. It's definitely changed how we approach things like laundry, cooking, and even charging our devices.

Interviewer How long have you had the solar panels installed?

Participant We've had the solar panels for about five years now. The time has flown by! It's been quite a journey, learning how they work and adapting our routines.

Interviewer Five years is a substantial amount of time. Have you noticed any changes in your electricity bills or energy habits since you got the solar panels?

Participant Oh, absolutely. Our electricity bills have definitely gone down, especially during sunnier months. We've become more aware of our energy consumption patterns and how to make the most of the solar-generated power.

Interviewer You mentioned being on a variable electricity tariff. Could you explain how that works and how it has influenced your energy use?

Participant Of course. The variable tariff means that electricity prices change throughout the day. They tend to be cheaper when there's lots of renewable energy like wind, and they can be higher in the evenings when people are using more power. It's prompted us to try and shift our usage to those cheaper times and align it with our own solar production.

Interviewer Shifting your energy usage to cheaper times sounds interesting. How has this impacted your daily routines and how easy or challenging has it been to coordinate this with your family members?

Participant It's been a bit of a mixed bag. Some things are easier to shift than others. For instance, running the dishwasher during the day when the sun's out and electricity's cheaper is pretty doable. But coordinating everyone's activities and getting appliances like the fridge on board with schedules can be a challenge. We've been trying to communicate as a family about when to use different appliances or do different activities, and how to understand things like the tariff and how the solar panels work.

Interviewer You mentioned that you find programming the appliances for load shifting a bit tricky. Could you tell me more about that?

Participant Programming appliances to start at specific times involves navigating through menus and figuring out settings, and since I'm not usually the person doing it I find that I sometimes can't remember how! They all work differently, and you have work out when to schedule them for by yourself. It's quite a manual task, I'd rather there was something to do more of that thinking and programming for me. Plus, not all appliances have time delay or scheduling features, so you have to remember when to turn things on. Sometimes I set an alarm to help, other times I forget.

Interviewer It sounds like convenience and ease of use are important to you. If you could design an ideal system to manage your appliances and energy usage, how would it look?

Participant That's an interesting thought. I'd love a system that pulls more of the information and control together, where I could adjust appliance settings, track energy consumption, and even get real-time pricing updates all in one place. Something intuitive that doesn't require too much technical knowledge would be a game-changer for me.

Interviewer You also mentioned that cross-referencing data about electricity prices and predicting when it will be sunny can be a bit of a hassle. Could you share more about that?

Participant Oh, absolutely. It's like playing a guessing game sometimes. I find myself toggling between different sources to check electricity prices and then cross-referencing with weather forecasts to predict sunny periods. It's a bit of a pain in the arse, to be honest. Having all this information seamlessly available in one place would save a lot of time and frustration. I don't have the same sense for it as my partner; he seems to just know when to switch things on.

Interviewer It sounds like you're dealing with quite a bit of data juggling. How do you think having a more integrated and user-friendly system would impact your experience with load shifting?

Participant It would make a world of difference. I'd feel more in control of managing our energy use, and it would reduce the stress of coordinating everything. If I could easily see when electricity prices are low, when the sun's shining, and adjust appliances with a few simple taps, it would definitely make load shifting feel less like a chore.

Interviewer Thank you for sharing your thoughts with us today. Is there anything else you'd like to add about your load shifting or energy use?

Participant Just that, despite the challenges, I'm committed to making it work. It's important to my partner, and I understand the benefits of being mindful about energy consumption. I'd like to find simpler solutions that can make load shifting less daunting and more accessible for everyone in the family.

A.1.2 P5-6

P5

Attitudes towards saving Energy
Efforts To Save Energy
Negatives to current methods of Energy Saving
Improvements to current Solutions
Barriers to saving energy

Gender	Woman	Age	72

Interviewer Thank you for agreeing to talk to us. Could you please start by telling me about the types of energy you use in your home?

Participant Well Good day to you, my dear, it's my pleasure. I mainly use electricity in my home. I've been fortunate to have solar panels and battery storage, installed when my late husband was still with us. They have been a blessing, allowing me to generate my own energy and reduce my carbon footprint. I call the battery Bertie! It's a big old thing, screwed to the wall in the garage.

Interviewer It's wonderful to hear about your use of solar panels and battery storage. How has your interest in eco-friendly living influenced your daily routines and habits at home?

Participant Well, you see, I've always been what some might call an eco-warrior. I truly believe in taking care of our planet, and these technologies align with my values. Since my husband's passing, I've taken more time to understand how they work. I'm excited about the potential to reduce my carbon footprint by using energy when the grid's CO2 intensity is lowest. It's become a bit of a hobby, you might say.

Interviewer What are some ways that you can shift your eneergy use?

Participant Well I'm a baker you see! Baking my goodies requires a fair amount of electricity; some days I think I barely turn the oven off! That uses quite a lot of electricity, especially when it's a big event like a bake sale. I've been pondering the idea of shifting my baking times to align with off-peak electricity times. It's just that I'd need to plan my day around it, and that's where the challenge lies. You don't always know when the sun will be shining. Having the ability to know in advance when the best times are would make it much more feasible.

Interviewer It sounds like you're aiming to optimize your baking routine for the sake of the environment. How do you envision the ideal system that could help you plan your baking and other energy-intensive activities?

Participant Oh, well it would be wonderful if the system could lend me a hand. Perhaps an app or a device that could predict the best times for energy-intensive tasks like baking. That way, I could plan my day around it without the need to constantly check. The system could do the calculations and let me know when it's a good time to fire up the oven, perhaps using the weather forecast or something.

Interviewer It's clear that you're quite passionate about reducing your carbon footprint. How do you think having a more automated system for energy management would impact your daily life and your efforts to be environmentally friendly?

Participant Oh, it would be quite the blessing! You see, as I've grown older, my days have become a bit busier with other responsibilities. Grandchildren, clubs, seeing the ladies, doing the garden. Having a system that does more of the thinking for me would ease my mind. It would help me align my activities with the greenest energy times make the most of my solar panels and the battery. I think my friends think I'm a bit mad for spending so much time thinking about electricity. Perhaps they're right!

Interviewer It sounds like you value convenience and efficiency. If you could design the perfect energy management system for yourself, what features would it include to make your efforts smoother and more impactful?

Participant Ah, now that's a delightful thought. The system would need to be intuitive and user-friendly. I'd love to have an app or a device that gives me personalized insights about when to use things like my oven. It could consider how dirty the grid is, how sunny it is, and perhaps what I need do that day. The less manual work for me, the better, but I wouldn't mind having to put some things in to help it, I think being good to the planet is worth it.

Interviewer Thank you for sharing your thoughts with me today. Is there anything else you'd like to add that we haven't talked about?

Participant Only that it's heartwarming to see how technology can be harnessed for the greater good. As someone who's been advocating for the environment for years, I'm so thrilled to see greener living become easier. If there's one thing I'd wish for, it's that future generations embrace responsible energy use.

P6

Gender	Woman	Age	30

Interviewer Thank you for taking the time to chat with us today about your experiences with energy management. Could you start by telling me a bit about your living situation and the types of energy you use in your apartment?

Participant Hi there! Of course, happy to chat. So, I live in an apartment with two roommates. We're all pretty chill, but I'm definitely the one who's more into tech and sustainability. As for energy, we mostly use electricity for our daily needs. We don't have anything special like solar panels or even electric cars, but I'm definitely interested in finding ways to make our energy use more efficient.

Interviewer It's interesting to hear about your living situation and your interest in sustainability. How does your daily routine impact on your energy use?

Participant Well I work as a freelance web developer, so I have a pretty a flexible schedule. Working from home gives me the flexibility to manage my energy use differently than someone with a traditional 9-to-5 job. I can adjust when I use energy-intensive things like cooking or doing my washing. It's also why I'm keen on finding ways to make our apartment more eco-friendly, I have the time to explore it.

Interviewer You mentioned your interest in finding more eco-friendly solutions for your apartment. How do your roommates feel about your efforts?

Participant Oh, that's a good question. My roommates are nice, but they're not as gung-ho about it as I am. I've tried suggesting some changes, but it does cause a bit of friction. I totally get it, they're not against it, but they're just not that into it. If things were easier or more streamlined, I think they'd be more willing to engage.

Interviewer It sounds like you're trying to find a balance between your own sustainability goals and keeping things harmonious with your roommates. Can you give an example of a situation where you've tried to introduce an energy-saving measure that might not have gone as smoothly as you hoped?

Participant Oh, for sure. I once tried setting up a smart thermostat to better manage our heating and cooling. I thought it was a cool idea to optimize our energy use. But my roommates found it a bit annoying to deal with, adjusting the temperature with an app just felt like an extra step. They're more the "set it and forget it" type. It's a lesson learned that any kind of friction makes them annoyed.

Interviewer Your experiences with introducing energy-saving measures to your roommates highlight the importance of simplicity and ease of use. How do you envision an energy management system that would work well for you and your roommates, considering their preferences for convenience?

Participant That's the thing, right? It needs to be hassle-free. I'd love something that's easy to use, maybe even automatic. For example, if there was a system that learned our routines and adjusted things like temperature or lighting accordingly, without us needing to fiddle with apps or settings, that would be great. Something that fits into our lives without feeling like a chore.

Interviewer It's clear that convenience is a key factor for you and your roommates. How do you think having a more user-friendly energy management system would impact your efforts to live sustainably and reduce your carbon footprint?

Participant It would make a world of difference, honestly. If we had a system that did the heavy lifting, like adjusting settings and making smart choices, it would be so much easier for my roommates to get on board. I mean, even if they're not as gung-ho as I am, they still care about being eco-friendly. If it became a natural part of our routine without added effort, it would be fantastic.

Interviewer If you had the opportunity to design an energy management system that aligns with your roommates' convenience preferences, what features would you include to ensure that everyone can engage with it easily?

Participant Good question. I think it should be intuitive and learn from our behaviors over time. Maybe it could send us little reminders or suggestions when we're using energy at times when it's not that efficient. And if it could adapt to our preferences without us needing to tinker with settings, that would be a win. It's about striking that balance between eco-friendly choices and convenience.

Interviewer Thank you for sharing your insights and experiences. Is there anything else you'd like to add about your perspective on energy management or any hopes you have for the future in this regard?

Participant Just that finding that balance between sustainability and convenience is important. If we can make eco-friendly choices without feeling like we're sacrificing ease of use, that's the sweet spot. I think as technology evolves, there's a great opportunity to make energy management seamless for everyone, not just the tech-savvy folks like me. It's about making a positive impact while keeping things simple and harmonious.

A.1.3 P7-8

Current engagement with energy saving
Environment
Efficiency
Usage of application

P7

Gender	Man
Age	45

Interviewer Hello. Thank you for taking the time to chat with us about your experiences with energy use and management. Could you start by telling me a bit about the types of energy you use in your home?

Participant Hey there. Yeah, we just use regular electricity like most people, I guess. Nothing too fancy or complicated.

Interviewer I see. Given your busy lifestyle, how does energy use fit into your daily routines and priorities?

Participant To be honest, it's not really something I think about much. I've got a demanding job, and when I'm home, I'm more focused on spending time with my family than worrying about energy stuff.

Interviewer It sounds like you have a lot on your plate. How do you feel about energy management and sustainability in general?

Participant Yeah, I mean, I get that it's important, but I'm not really into it. It feels like an extra thing to think about, and I've got enough going on as it is.

Interviewer That's understandable. Have you ever tried any energy-saving measures or technologies in your home? If so, how did that go?

Participant Not really. We just use things the way they come, you know? I don't want to mess around with a bunch of new stuff or change how we do things. It's easier to keep it simple.

Interviewer You mentioned preferring to keep things simple. How do you think energy management systems or technologies could be made more appealing or user-friendly for someone with your perspective?

Participant Honestly, I don't know. Maybe if they were super easy to use and didn't require a lot of effort. Like, if it could just do its thing without me needing to do much, I might be more open to it.

Interviewer Simplifying the process seems important to you. If you were to imagine an energy management system that fits into your busy life without adding extra tasks, what features do you think it should have?

Participant Hmm, I guess if it could figure out when to use stuff on its own and I didn't have to mess with settings or schedules, that might be okay. But honestly, I'm not sure how that would even work.

Interviewer Thank you for sharing your perspective, Mark. Is there anything else you'd like to add about your thoughts on energy management or any hopes you have for the future in this area?

Participant Not really. Like I said, I've got other things on my mind. If they can make it simple and not something I have to actively think about, that would be fine. But for now, it's not something I'm spending much time on.

P8

Gender	Woman
Age	28

Interviewer Thank you for joining us to talk about your experiences with energy management. Could you start by telling me about the types of energy you use in your apartment?

Participant Absolutely, I'm all about using less energy to save the planet. I mostly use electricity in my apartment, lights, appliances, you name it. But I know we gotta be mindful of how we use it, you know?

Interviewer How does your commitment to saving energy align with your daily routines and activities?

Participant I'm always trying to be more eco-friendly in everything I do. But, um, I'll be honest, sometimes it's a bit overwhelming to juggle everything. I mean, there's so much to think about, like when to use stuff and when not to. But I'm determined to do my part.

Interviewer It sounds like you're really dedicated to making a positive impact. Can you share some of the energy-saving measures you've tried to implement in your apartment?

Participant Absolutely! I've switched to energy-efficient light bulbs, and I unplug things when I'm not using them. Oh, and I've got this fan that's supposed to be super energy-saving. But,

uh, sometimes I forget to turn it off when I leave the room. And I've tried to use my washing machine and stuff when electricity is cheaper, but I often mess up the timing.

Interviewer It's clear you're putting in effort to save energy. How do you handle the challenges of scheduling or planning ahead when it comes to optimizing your energy use?

Participant Oh, scheduling is tough for me. Like, I'm all about saving energy, but remembering when to do things? That's where I struggle. I've tried setting reminders on my phone, but then I forget to check them. It's like my passion is there, but my brain just doesn't cooperate sometimes.

Interviewer Your enthusiasm is evident, but it's understandable that scheduling might be challenging. How do you envision an energy management system that could help you, considering your commitment to the environment and your struggles with planning?

Participant That's a good question. I guess if there was some sort of magic button or app that could just tell me when to use things to save energy, that would be amazing. Like, it could figure out the best times based on, you know, the planet and stuff. It's a bit silly, but I just want to do my part without getting overwhelmed.

Interviewer Simplifying the process seems important to you. How do you think having a system that takes care of the details and provides guidance would impact your efforts to save energy?

Participant It would be such a relief! Seriously, if there was something that could just, like, guide me through it all, I'd feel more confident about making a difference. I mean, I care so much about the environment, but sometimes it's like my brain goes on vacation when I'm supposed to remember things.

Interviewer If you had the chance to design an energy management system that's user-friendly and accommodates your challenges, what features would you include to make it easier for you?

Participant Oh, I'd want it to be really simple, like a one-button thing. And maybe it could send me little messages or reminders, but not too many, I get overwhelmed easily. And if it could just know when to use stuff and tell me, that would be awesome. I want to help the planet without feeling like I'm failing at scheduling.

Interviewer Thank you for sharing your thoughts and experiences with us. Is there anything else you'd like to add about your passion for saving energy or your hopes for the future in this regard?

Participant Just that even though I struggle with the details, my heart is in the right place. I want to be part of the solution, even if I'm not the best at planning. I think if there was a way to make it easier for people like me, you know, passionate but a bit scatterbrained, that would be really helpful.

A.1.4 P9-P10

A.2 Evaluation Questionairre

New Forest Energy App Survey

7	05:23	Active
Responses	Average time to complete	Status

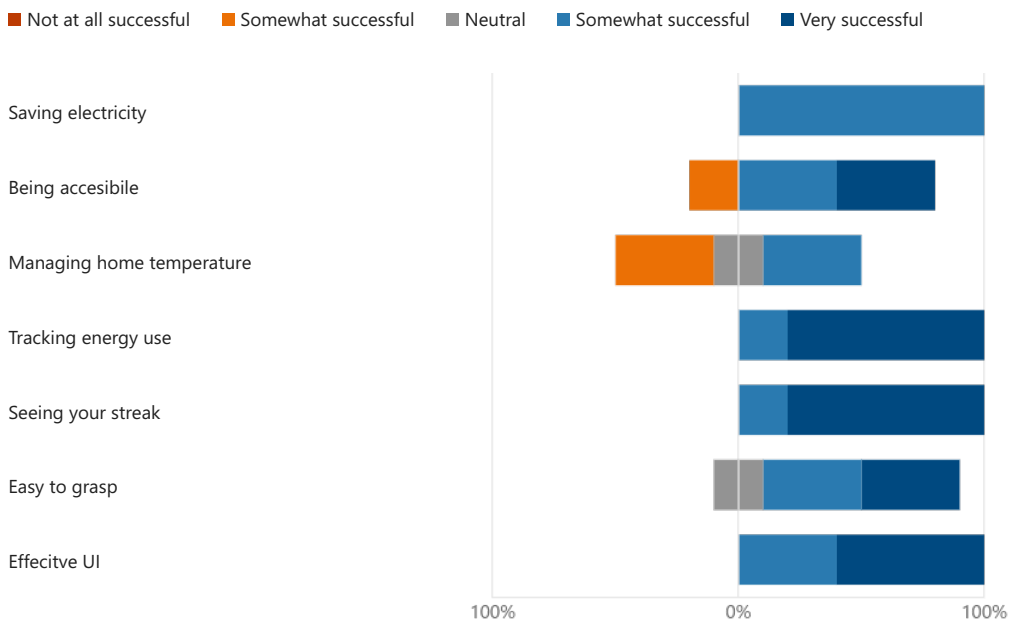
1. Do you consent to your data being stored

Yes	5
No	2

2. Have you used a smart home energy meter or smart thermostat in the past 12 months?

Yes	0
No	5
Maybe	0

3. How successful would you consider this product?



4. How well would this app provide a way to save energy for you?

Extremely well	0
Somewhat well	5
Neutral	0
Not very well	0
Not well at all	0

5. Do you own a smartphone?

Yes	5
No	0

6. What are the first words that come to mind when describing your feelings about this product?

4
Responses

Latest Responses

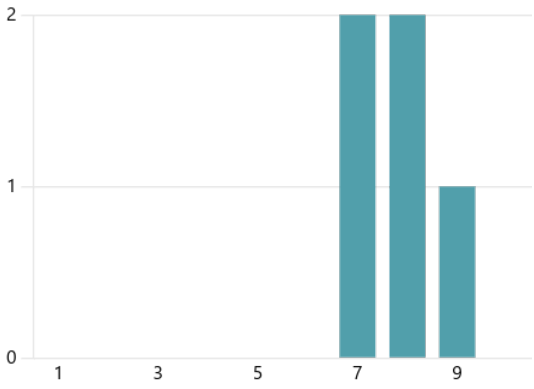
"Motivating, fun, accessible, simple"

"Creative idea to motivate people to save energy "

"Fun"

7. How motivating would the idea of losing your daily streak be?

7.80
Average Rating



8. What challenges could you perhaps face when using the app?

5
Responses

Latest Responses

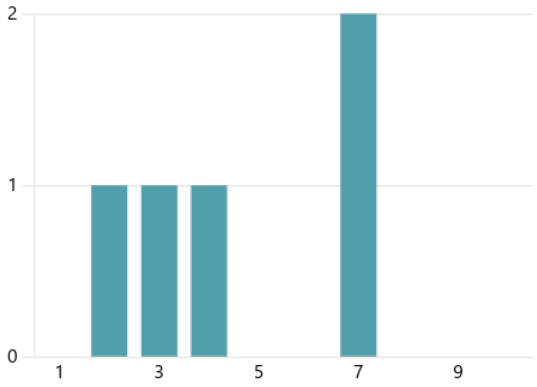
"If there wasn't any social function, or any way to get other people in the ho..."

"Just to understand how to use it in the firsts place "

"Hard to keep up with it every day, sometimes might forgot about it. Unless t..."

9. On a scale of 1 to 10, how frustrating are these challenges?

4.60
Average Rating



10. Would you be interested in competing with friends or family in challenges related to energy saving?

5
Responses

Latest Responses

"Yes, making it a social thing would provide a really strong incentive"

"Got to be honest no"

"Yes "

11. Any other thoughts or comments?

4
Responses

Latest Responses

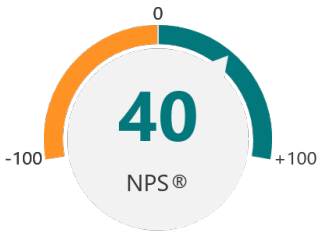
"Maybe adding a streak freeze which can be purchased from the store with p...

"Great idea "

"Can have rank for all friends and family, can view their forest"

12. How likely would you be recommend this app to a friend or family member?

Promoters	2
Passives	3
Detractors	0



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