

# **EkoHome**

Empowering Sustainable Living Through Accessible Energy Management

By

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This honors project report has been reviewed by the research advisor, engineering honors research advisor, and honors program director, and it has been found to be satisfactory.

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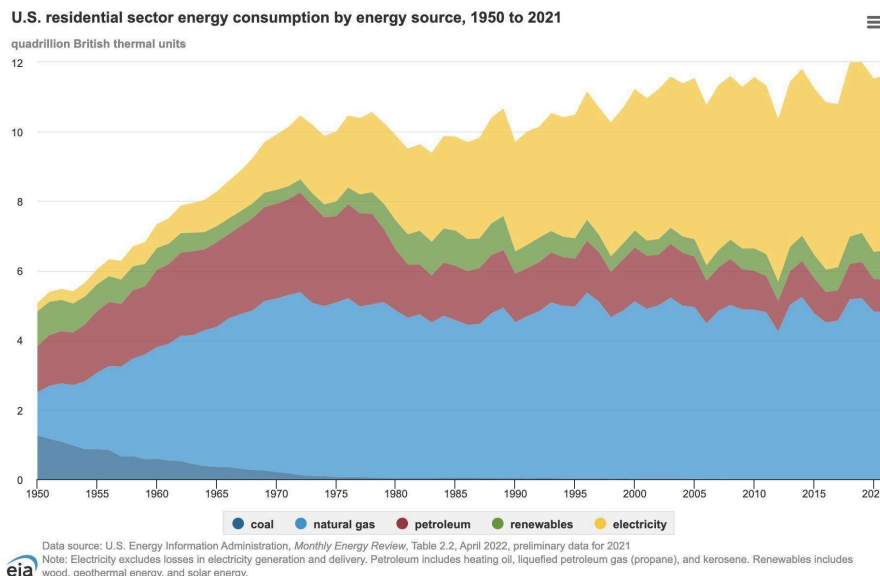
# Chapter 1. Introduction

## 1.1 Overview

*The overall commercial goal of this project is to introduce a solution for low-income California residents to manage utility bills, thereby contributing to both economic relief and environmental sustainability.*

## 1.2 Problem Area

Here's the environmental problem at hand; currently, there is unmet potential in lowering CO2 emission in the residential sector. The average American household emits 14,000 pounds of CO2 every year (EPA.gov), and the total energy consumed in residential and commercial structures is projected to increase to 139 quadrillion Btu by 2050 [23]. Alongside those projections, 35% of energy used by homes in the United States is wasted energy, making up 20% of the total U.S greenhouse gas emissions, and costing the 241.19 million US homes \$100 billion/year [10]. Clearly, households are drastically less energy efficient than they could be.



**Figure 1-1, U.S. Residential Sector Energy Consumption by Energy Source, 1950-2021 [14]**

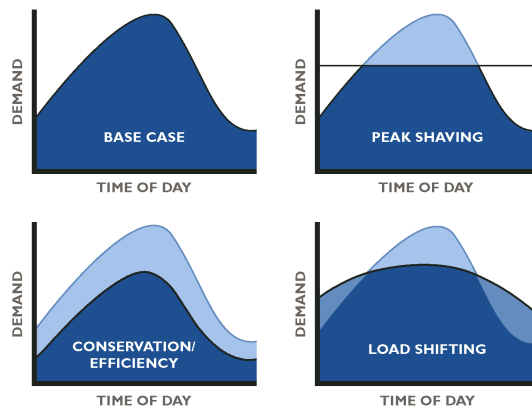
As residential trends show, there has been progress in reducing greenhouse gas emissions in U.S. households [26]; We've seen homes in various countries shift to a more active role in decarbonization, from mindful acts of energy conservation to the inclusion of renewable energy sources.

Enhancements in electricity efficiency have made energy more affordable and reliable by lowering the total and peak demands for energy. Total energy demand refers to the aggregate amount of energy required by a nation over a certain timeframe, while peak electricity demand represents the maximum level of electricity required at any single moment.

The capability of utilities to meet this peak demand is crucial. Without sufficient capacity, the inability to supply adequate electricity can lead to power shortages. The extent of peak electricity demand

determines the necessity for the construction and operation of power plants, as well as the requisite reserve power capacity. By reducing the peak demand, there's less need for extensive energy infrastructure and resources. [13]

The occurrence of peak demand periods is influenced by energy consumption patterns within a market. For instance, a simultaneous increase in energy use due to manufacturing activities and the cooling needs of commercial buildings in the afternoon can lead to a spike in demand. [13]



*Figure 1-2, Demand Side Management Strategies [13]*

Through demand-side management strategies, including energy efficiency initiatives, there has been an aim to decrease the overall and peak energy demands. While such programs have alleviated some of the pressing energy waste issues, there is still a gap between the greatest potential for conscious home-energy efficiency and the current lack of home-energy efficiency, known as the ‘Energy Efficiency Gap’. [32] The Energy Efficiency gap proves that the residential sector has not yet met its greatest potential for reducing emissions.

### ***The Psychology of Wasteful Behaviors***

Why does the ‘Energy Efficiency Gap’, a space where conscious consumers contribute to energy waste, exist? Well, the underlying causes of residential energy waste are complex and multi-faceted.

On one hand, optimizing energy consumption can be complicated; ratepayers interested in reducing energy waste have to make informed decisions about where energy inefficiencies exist, budget, choose from various tools and platforms, and then face solution learning curves in order to adopt said solutions. These complications may outweigh any benefits for some ratepayers.

So, although the market is saturated with smart-devices and government incentives aimed at reducing energy waste, “being environmentally aware and actively concerned about energy efficiency does not in itself lead to a stated desire, or even, intention to install energy-efficient technologies”, as the RETROFIT 2050 points out. [32]

Furthermore, financial constraints often overshadow environmental concerns among lower-income groups. The environmental aspect may not be a primary concern for most lower-class interviewees, primarily due to economic barriers and systemic issues in the availability of energy-efficient solutions. [b] While the intent to live sustainably may exist, practical constraints often take precedence.

Research from the Yale School of Environment suggests that while there are cost-effective energy efficiency opportunities globally that could save households in different sectors significant amounts on avoided energy expenditures, the adoption among lower-income households remains low due to various barriers. The study discusses the challenges faced by low-income neighborhoods in accessing energy-efficient technologies, such as LED bulbs. It was found that such items were less available in poorer neighborhoods, indicating a systemic issue with the distribution and accessibility of energy-saving technologies in these areas. This suggests that the lack of environmental action among lower-income individuals may also stem from a lack of access and availability, rather than a lack of concern or willingness. [a]

### ***The Cost of Sustainable Behaviors***

Cost barriers likely also contribute to the ‘Energy Efficiency Gap’, as many conscious consumers in the U.S. are from low-income households. “ In 2020, 34 million U.S. households, or 27 percent of all households, reported difficulty paying their energy bills or kept their homes at an unsafe temperature because of energy cost concerns, according to the Energy Information Administration” [22]. “Energy costs have traditionally been a bigger burden for low-income households, which typically spend a far larger percentage of their gross income on utility bills than higher-earning households, according to the Energy Department” [12]. Many also live in older, less efficient homes, which can lead to more expensive utility bills. [40]

Ideally, ratepayers interested in lowering their utility bills would have access to one of the best solutions for energy efficiency on the market: Smart-devices. These devices not only facilitate greater control over home appliances like lighting and heating but also enable advanced home automation. At the core of this technology, smart-devices can be synchronized to execute a series of actions, often referred to as ‘optimal sequencing’. [13] This process involves strategically timing energy-intensive tasks such as air conditioning and dishwashing to occur during off-peak hours, reducing strain on the grid and lowering energy costs. This optimal sequencing is part of a broader set of behavioral changes and energy management strategies enabled by smart home technology. Even without full optimization, these devices provide crucial data and insights that support timely adjustments to household energy consumption patterns. Currently, 60.4 million U.S. households benefit from these technologies [12], yet a significant portion still does not employ smart devices. For households without these intelligent systems, energy management requires considerably more manual effort and vigilance, often leading to missed savings opportunities due to human error and fatigue.

Additionally, barriers to adopting energy-efficient solutions are notably higher for low-income households. Challenges such as insufficient savings, lower credit scores, and difficulties in accessing and navigating federal and state subsidy programs hinder their ability to finance such projects. Furthermore, a significant number of these households are renters, limiting their capacity to make permanent upgrades that could reduce energy waste [34]

### ***Why Care?***

As ethical engineers and investors, you should care about this project succeeding because it can have a twofold positive impact on the world. By helping low-income ratepayers, who are in need of

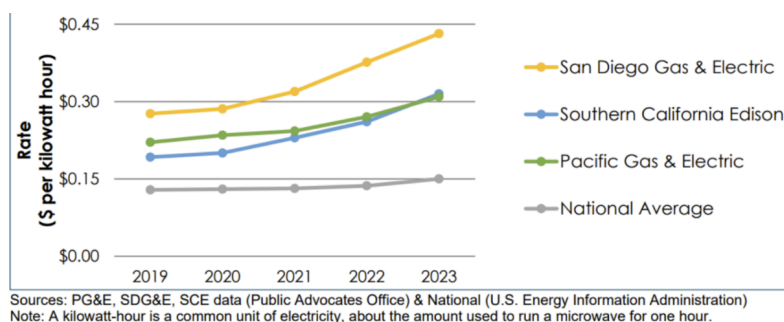
solutions to lower bills and whose energy waste makes up a large portion of the Energy Efficiency Gap, lower and afford their utility bills, this commercialization project will both reduce home-energy waste and make utilities more affordable for low-income ratepayers.

## Chapter 2. Customer Analysis

### *The Decision to Focus on LA County*

While residential utility waste is a problem across the United States, the commercialization has to begin with a first location to begin testing the demographics and eventual product.

The decision to focus on Los Angeles county was due to multiple factors; for one, I hypothesized that low and middle income residents of Los Angeles county would be interested in reducing energy waste because of rising utility costs in California, which are creating issues of affordability. California's electricity prices exceed the national average by 25%, with about a quarter of the largest utility customers falling behind on payments. [33] The utilities and regulators highlight that costs for power provision will escalate as the state tackles climate change challenges, including safeguarding and expanding the power grid to accommodate the energy needs for electric vehicles and cooling systems amidst extreme weather conditions.



**Figure 2-2, Average Year-End Electric Residential Rates by Utility (2019-2023) [15]**

To provide a rough estimate of energy waste in Los Angeles county, it is important to define what "waste" means in this context. Energy waste could include inefficiencies in home heating and cooling, appliances left in standby mode, inefficient lighting, and other lost energy not used for its intended purpose. However, without specific studies or audits, quantifying this waste directly is challenging. It is also important to clarify that energy usage, infrastructure, and efficiency programs can vary widely across different municipalities and regions within LA county. Los Angeles County, enveloping a multitude of municipalities beyond the city itself, presents a complex range of residential energy consumption patterns and efficiency potential.

When discussing energy consumption, rates, and potential savings, the data typically pertains to the jurisdiction of the Los Angeles Department of Water and Power (LADWP), which serves the city. However, it's important to note that some of the data sources, like those from the U.S. Bureau of Labor Statistics or EnergySage, often present broader regional data that encompasses the Los

Angeles-Long Beach-Anaheim metro area or even county-level data. While specific county-wide data for average household electricity consumption might not mirror the exact figures for the City of Los Angeles, it's reasonable to use city data, given the similar energy infrastructures and living standards across the county.

I relied on key data points: the typical electricity usage and costs for county residents, alongside an evaluation of the potential benefits stemming from energy efficiency measures. To estimate residential electricity consumption in Los Angeles for 2023, I also used available data on average electricity consumption and rates, although direct figures on waste are not provided. In 2023, Los Angeles residents, on average, paid about 24 cents per kilowatt-hour (kWh) for electricity, and about \$199 per month on electricity. [3] The typical household in Los Angeles consumes approximately 815 kWh per month, leading to an annual consumption of about 9,790 kWh and \$2,388 per year [3].

Estimating the rough impact that energy efficient behaviors have on LA County residents is challenging, as the county's varied economic and ecological environment suggests that the impact of energy savings through efficiency initiatives could slightly differ from those observed in the city alone.

Furthermore, as IEA explains, there are differing factors that explain variations in assessing behavioral impact, including:

- Analyzing methods: Assessing if a comparison is made between a control group and the group receiving the specific treatment, along with the metrics used for evaluation (e.g., households versus buildings). [8]
- Characteristics of the recipients of the interventions: Traits of those benefiting from the interventions, particularly the nature of their residence, their status as property owners or renters, and their prior energy usage levels, which are influenced by a variety of socio-economic factors. [8]
- Characteristics of the intervention: Such as its length and the timing of its assessment. [8]

Taking into account these elements, there are several insightful findings from past evaluations:

- Minor energy savings for each individual can accumulate, resulting in significant overall decreases in energy usage. [8]
- The exact origins of the savings differ across programs. For instance, home energy evaluations have demonstrated that savings occur as individuals decrease their air conditioning and heating use or turn off unused appliances and lighting. [8]

By assuming that energy efficiency measures could yield a 10% reduction in energy use, a cautious yet hopeful framework is established for assessing possible enhancements. For the average Los Angeles household, a 10% savings would equate to approximately 979 kWh annually (10% of 9,790 kWh). With over 3.5 million households in Los Angeles County, a collective 10% reduction could lead to savings exceeding 3.43 billion kWh annually across the county. This presents a significant opportunity for electricity savings.

For natural gas, water, and other utilities, precise county-wide consumption figures were harder to pinpoint. Applying similar efficiency gains, a 10% reduction in consumption across utilities, to the county's extensive household count suggests a significant reduction in total utility waste. These estimations, albeit rough, highlight the considerable scope for reducing utility waste through concerted energy efficiency and conservation initiatives across Los Angeles County.

## **2.1 Interviews**

### ***User Interviews***

Data on LA County residential energy waste presented a hypothetical need for some solution, but it had to be verified by actual people. So, interviews were conducted in order to truly understand the demographic's pain-points. The original hypothesis was that middle-aged, low and middle income ratepayers of LA County were frustrated by their current inability to reduce home energy bills and may have previously tried to make changes in order to save money or help the environment. To test this hypothesis I conducted over 15 interviews at Ralphs, a local grocery store known for savings and deals, and around South Central.

#### **Key Takeaways from the 1st Round of User Interviews:**

Lower-class & middle-class homeowners & renters wanted bill consistency, and have previously tried making behavioral changes to their energy consumption. At some point in time, they had been frustrated by rate-changes, bill spikes, or bill anomalies. They did not know when energy was cheapest to use and wanted to find out in the future, and also expressed confusion about what solutions existed and which solutions were best for their personal situations. They believed that there was a learning curve with certain energy solutions, and felt somewhat powerless to cutting bill costs due to uncertain rate-changes. They also expressed a preference for paper utility bills due to a lack of technological "savviness".

As hypothesized, many interviewees expressed frustrations that their bills were high, but contrary to the hypothesis, not all of them wanted to necessarily make any changes to their current situation. Financially comfortable interviewees did not express as much pain with their current system. Of those middle-bracket interviewees, some had smart-devices that largely solved their primary pain-point of experiencing energy inefficiency. Others explained that their finances are comfortable, so even if they were upset with or confused about high bills, they didn't necessarily feel the need to do anything about it; they could afford not to. The environmental aspect also was not a primary concern for most lower-class interviewees.

After the first round of interviews, low-income ratepayers appeared to be the likely target users for a solution, given their pain-points. To test this demographic hypothesis, I conducted a second round of interviews on predominantly lower-class ratepayers in LA County.

The second round of interviews was conducted around Ralphs and South Central again, but this time with a more selective process for interviewees. Just as hypothesized, low-income LA County residents in the next round of interviews expressed greater frustrations when it came to managing utility bills, and greater interest in finding solutions. On top of that, many interviewees had previously tried to find solutions to this problem, and were not satisfied with the results.

CS#, Role	WHAT WE THOUGHT	WHAT WE LEARNED	IMPACT New or supported hypothesis? Customer Discovery change in direction? Change to business model?
1, Jillian	We thought that wealthier individuals use auto-pay for bills and have high-tech devices to monitor/control energy.	Wealthier, older homeowners might not be actively trying to change their usage/bills, so some do not own efficient devices. They may still pay bills by hand/mail, partly because they are not tech savvy.	<u>Possible New Business Model</u> → Older individuals are less tech savvy, but would use text to see info/pay bills
2, Morgan	We thought that young, financially struggling parents would budget and try to manually cut energy consumption.	Young, financially struggling parents do budget and implement energy-efficient behaviors. Some do not have automatic bill payments because they have had errors with upcharges.	<u>Hypothesis Support</u> → Preference of knowing when energy is cheapest & having ability to track costs to budget, also wants to see rates change throughout the day to manually change behavior around rate spikes <u>New Hypothesis</u> → Prefers manual to autopay to catch issues <u>Possible New Business Model</u> → If autopay is part, we can include automatic alerts of energy spikes, Can also help renters
3, John	We thought that wealthier homeowners would use smart devices to automate energy for comfort and consistency	Wealthier homeowners are still conscious about energy spikes, but might not check their utility bills frequently (besides when paying)	<u>Hypothesis Support</u> → Thinks utility websites are NOT user friendly <u>New Hypothesis</u> → Wealthier homeowners care about energy spikes and inconsistencies
4, Shelly	We thought that lower-class homeowners would have less devices to track and automate home utilities	Lower-class, energy-conscious homeowners may use devices to schedule utility automations, and they may use apps to monitor their usage, but they feel powerless to rate changes	<u>Hypothesis Support</u> → Annoyance to deal with bill confusion (like extra charges) when utility doesn't provide clarity <u>New Hypothesis</u> → Rate spikes make homeowners feel powerless to cut costs
5, Jack	We thought that lower-class, energy-conscious homeowners were not consistently aware of rate changes, but would try to cut back on bills after bad months	Lower-class, energy-conscious homeowners believe that knowing rates & fixed prices will help them to adjust their habits. They think that personally monitoring rates is a headache.	<u>Hypothesis Support</u> → Knowing rates and fixed prices helps users to adjust their habits or even switch providers <u>New Hypothesis</u> → Highest motivation is predictable utility bills

*Table 2-1, Analysis of Key Interviews (Round 2)*

Two stories from the second round of interviews really stood out: The first story came from a young man living paycheck to paycheck in a 1 room apartment with his wife and two kids, and whose continuous efforts at manually changing his energy habits did not seem to be paying off as well as he would like. Jack expressed that there was no point in getting smart-devices for such a small living space, so he continues to manually try to reduce consumption where he can. He also mentioned that he checks every bill he gets for anomalies, because it's important to his financial stability that the bills are mostly consistent. The second story similarly highlights the importance of bill consistency. Nancy, a low-income wife and mother of a young baby, mentioned her frustrations in trying to sort out a bill anomaly caused by her utility company. Similarly to Jack, Nancy relied on relatively consistent bills, and only noticed the anomaly, at the end of the month, due to how high the cost was compared to previous bills. She spent a great deal of time trying to sort it out with multiple parties, and said that she wished she knew about the anomaly the minute it occurred in order to sort the deal out earlier.

### **Key Takeaways from the 2nd Round of Interviews:**

Lower-class homeowners & renters wanted bill consistency and predictability, have previously tried making behavioral changes to their energy consumption, have at some point in time been frustrated by rate-changes, bill spikes, and bill anomalies, did not know when energy is cheapest to use and wanted to find out in the future, expressed confusion about what solutions existed and which solutions were best for their personal situations, believed that there is a learning curve with certain energy solutions, knew about hourly rate changes but did not know how to access this data, and put time and effort into keeping bills low, or at the least, consistent.

*Overall, lower-class homeowners & renters of LA County wanted accessible, easily-digestible, and real-time knowledge about their utility consumption and what the best solutions were to their individualized waste problems.*

## **Industry Interviews**

### **Key Takeaways from an Interview with Ralph Kaiser of *Flume*:**

In my interview with Ralph Kaiser, Senior Director of Enterprise Sales at Flume, he detailed his experience since joining the company in November 2023. Ralph oversees two primary sales channels: direct-to-consumer and utilities/enterprise, which includes partnerships with insurance and technology companies that value residential water utility data. Flume collaborates closely with utilities to implement rebate programs that include services such as account verification, direct utility billing, and customer support. He explained that utilities are fully supported by Flume, receiving comprehensive backend support and customer data for service, planning, and forecasting, without the utility needing to manage these processes directly.

Ralph also shared insights on Flume's efficient customer acquisition process, noting that onboarding a utility could be completed in just a day or two. He highlighted Flume's involvement with CalWep, a non-profit organization that facilitates government benefits for utilities. Starting with three engineering majors from CalPolytech Institute, Flume rapidly established significant relationships during a period of historic drought, leading to early successes with major water companies like San Antonio Water Company in Texas and LADWP in California.

Addressing challenges, Ralph acknowledged the budgetary constraints different utilities face in adopting conservation technologies, which can affect their revenue. Despite these challenges, Flume has found particular success in water-drought states due to its ability to provide actionable insights into water usage, which has been especially effective in places like Goodyear, Arizona, where they documented a significant decline in water usage among users. Lastly, Ralph expressed Flume's interest in partnering with SoCalGas to expand their range of water-saving devices and services. SoCalGas currently provides free energy efficient devices, like low-flow showerheads, to their ratepayers. Flume is hoping that SoCalGas will provide ratepayers with their own product, further enhancing their value proposition and securing additional state, federal, and local support.

## **2.2 User Profile**

The interview process allowed for creation of an ideal user profile, and the generic journey which the user might make to try and lower their utility bills:

### **'Budget-Conscious Brenda'**

**Position/Title:** Homeowner or Renting Tenant

**Age/Sex:** Can vary widely, but often in the 25-70 age range, both male and female, with a slight skew towards females as primary household managers in certain demographics.

**Role:** Head of Household/Primary Decision Maker for household expenses and energy choices

**Discretionary Budget:** Limited. This customer typically has a tight monthly budget, with a significant portion allocated to fixed expenses, including rent/mortgage, utilities, and groceries. Discretionary spending is minimal, and any unexpected expenses can cause financial strain.

**Motivations:**

- **Financial Stability:** The primary motivation is to reduce monthly expenses to maintain or achieve financial stability.
- **Home Management Ease:** May or may not be tech savvy, and is looking for inexpensive solution to ease efforts of lowering bills

**Role Models:** Looks up to financially savvy individuals, often following budgeting and financial advice from personalities like Dave Ramsey, Suze Orman, or following platforms like "The Financial Diet" for tips on saving money and managing household expenses efficiently.

**Behavioral and Socioeconomic Insights:**

- **Energy Consumption Habits:** May lack knowledge about energy-efficient practices or be unable to invest in energy-saving measures (like upgrading to energy-efficient appliances) due to upfront costs.
- **Income Level:** Likely to be in the low to middle-income bracket, potentially qualifying for energy assistance programs but not always aware of them or how to access them.
- **Education and Awareness:** May have a basic to moderate level of education regarding energy conservation but lacks detailed knowledge or resources to implement significant changes.
- **Housing Situation:** Lives in older or less energy-efficient housing due to budget constraints, contributing to higher energy bills.

**User Journey: Lowering Utility Bills**

The mission of users is to understand how, when, and where their home has energy inefficiencies, and to reduce energy consumption by means of manually changing energy habits or using automations:

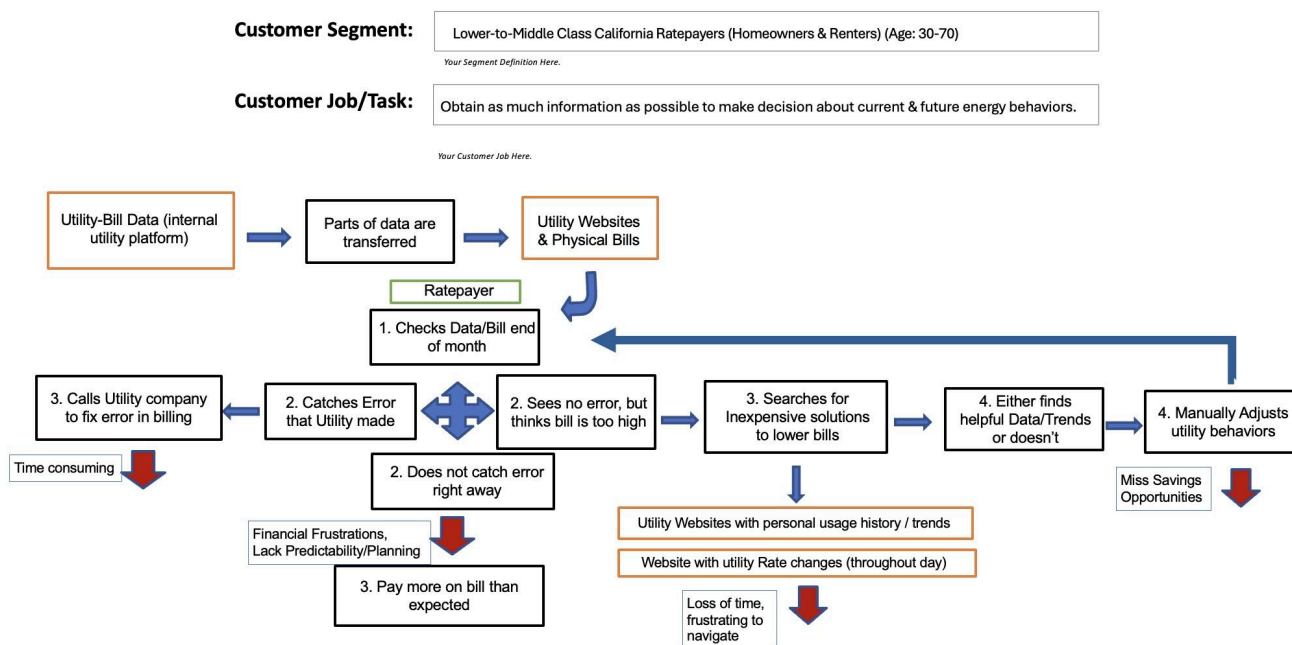


Figure 2-1, Typical User Journey for Lowering Utility Bills

While the aforementioned user profile is ideal for our users to act as beneficiaries, the true paying customer was yet to be identified; low-income users were not likely to invest money into a solution to reduce their bills, so I decided to expand the customer search into utilities and government entities. Both entities have programs to assist low-income individuals with bills, and both have also made commitments to reducing carbon emissions.

I initially hypothesized that utility companies would be the primary purchasers for our project, influenced by their substantial budget allocations for social and environmental initiatives. The idea was that our solution could offer a means for utility companies to further diminish carbon emissions, thereby assisting them in attaining energy efficiency targets mandated by government policies. This

compliance facilitates meeting the government's investment criteria, further enriched through collaborations spanning various industries. This is underscored by legislative frameworks, such as Assembly Bill 327, Senate Bill 1414, Senate Bill 801, and Senate Bill 350, all of which bolster demand-response programs. Utility companies engaged in showcasing environmental stewardship and social responsibility are not only aligning with governmental expectations but are also positioned to meet specific, government-defined targets, thus garnering benefits and favorable recognition from governmental entities.

Moreover, investing in our project could significantly enhance the reputations of utility companies, an increasingly crucial factor amidst growing calls for sustainable practices. A strong reputation is instrumental for public utilities in attracting bond investors, as these entities frequently resort to public bond sales. Through our project, we could offer an avenue for these companies to not only meet but exceed sustainability benchmarks, thereby enhancing their appeal to potential bond purchasers.

Considering utility companies like SoCalGas, which has committed to achieving net-zero greenhouse gas emissions by 2045 [2], alongside introducing innovative clean energy programs by 2025 and supporting its low-income ratepayers, it appeared our project would align well with their expenditure patterns. To test this feasibility, I interviewed with employees of SoCalGas.

As a previous employee of SoCalGas, I was able to connect with Joe Leiva of the Research, Development & Demonstration team. He mentioned that their budget was more focused on internal innovations, such as hydrogen innovations and other R&D programs on the '*Aspire 2045*' SoCalGas project. Leiva suggested that a customer-facing perspective might offer more insight into the feasibility of our project. The utility company has partnered with companies such as Google Nest, and donated 500 energy efficient smart thermostats with the All Peoples Community. [37] So, there seemed to be a possibility that our project would interest SoCalGas.

Yet, there were drawbacks to relying on utility companies as paying customers were heavily considered as well. Utilities, known for their risk-averse nature, operate under the close watch of their consumer base and regulatory bodies like the California Public Utilities Commission (CPUC). [39] Despite their monopolistic status, utilities must maintain a favorable public image to avoid negative outcomes such as bad press, public protests, or boycotts, all of which can detrimentally affect their reputation and financial standing. The relationship between utility companies and regulatory authorities is pivotal. Regulatory bodies not only set rates and ensure service quality but also oversee the utility's adherence to operational standards. A tarnished social reputation could invite stricter regulatory oversight. Moreover, securing financing for infrastructural ventures hinges on a utility's reputation; a strong standing facilitates easier and more cost-effective access to investors and government loans. The approval process for rate increases further illustrates the importance of a utility's image. Ratepayers are more inclined to support rate hikes if they trust in the utility's commitment to providing reliable and high-quality service. Additionally, a reputable utility is better positioned to foster trust within the communities it serves, a critical factor during emergencies or natural disasters when the public's reliance on utility services peaks. However, utilities often face a slow pace of change, particularly highlighted by their conflicted stance on conservation. While regulatory directives push for conservation of resources like gas, electricity, and water, utilities find their revenues decrease with lower consumption levels, creating an inherent conflict of interest.

Given the limitations associated with relying on utility companies as paying customers, it seemed logical to explore government entities as the next potential primary financial supporters of our project. This consideration is rooted in the understanding that the U.S. government, recognizing the importance of environmental and social responsibility, actively funds projects aimed at environmental sustainability.

To evaluate the feasibility of government entities as the main financial customers, it was crucial to understand the challenges they face, especially in managing utility usage spikes. Such spikes, particularly in electricity and water services, pose issues related to infrastructure stress, operational costs, environmental impact, energy security, grid reliability, public health, and social equity:

**Infrastructure Stress Due to Peak Demand:** High peak demand on utilities, particularly electricity and water, poses significant challenges to existing infrastructure. Utility systems, including power plants and water treatment facilities, are typically engineered to manage expected demand levels. However, during peak periods, when consumption significantly exceeds average levels, this can strain the system beyond its designed capacity. Such peak demand episodes can precipitate equipment failures, accelerate the degradation of infrastructure components, and necessitate costly, urgent upgrades or repairs to cope with these high loads.

**Increased Operational Costs:** With higher utility usage comes the need for additional resources to generate electricity, purify water, or increase gas supplies. This raises operational costs for utility providers, costs which are often passed down to governments and, ultimately, taxpayers or consumers. It can also necessitate the purchase of energy at higher market prices during peak demand, further escalating expenses.

**Environmental Impact:** Excessive consumption of utilities, particularly fossil fuel-based electricity, contributes significantly to environmental degradation. It increases greenhouse gas emissions, exacerbates climate change, and can lead to the depletion of natural resources. Governments are under increasing pressure both domestically and internationally to reduce emissions and commit to sustainable practices, making high utility usage problematic.

**Energy Security and Dependence:** Consistently high average consumption, rather than infrequent peak demand spikes, primarily exacerbates a country's dependence on imported fuels, affecting its energy security. For nations heavily reliant on imported oil, gas, or coal, such sustained high demand levels heighten vulnerability to global market fluctuations, political instability in supplier countries, and other geopolitical risks. While peak demands can strain energy systems temporarily, it is the ongoing high usage that drives greater dependence on foreign energy sources and exposes the economy to broader risks.

**Grid Reliability and Blackouts:** High demand, especially during peak times, can overwhelm the electrical grid, leading to blackouts or brownouts. These events not only inconvenience consumers but can also have serious economic repercussions by halting production in industries, affecting critical services, and compromising national security. Maintaining grid reliability requires significant investment in grid modernization and expansion, which is a substantial financial burden for governments.

**Public Health and Safety:** For utilities like water, excessive usage can strain supplies, leading to shortages that affect public health and safety. In extreme cases, water scarcity can compromise hygiene, lead to rationing, and increase wildfire risks in drought-prone areas.

Additionally, government entities face pressures to maintain low utility rates, balancing infrastructure needs with social equity. California's recurring droughts highlight the specific challenges of managing water consumption, further emphasizing the need for sustainable solutions.

In assessing the government's openness to funding similar projects, I engaged with several agencies and discovered a comprehensive array of grants, rebates, and initiatives aimed at bolstering energy and water efficiency and endorsing sustainable practices. Conversations with Environmental Protection Agency (EPA) representatives, specifically Dawn Oberg of the EPA's Environmental Information Center, highlighted numerous funding avenues such as the Inflation Reduction Act [9], People, Prosperity and the Planet (P3) Student Competition, and grants [16]. Recommendations also included exploring programs offered by the California Department of Community Services and Development (DCSD) [7], CPUC Low Income Energy Assistance Program [29], and California Energy Commission (CEC).

The Los Angeles county government, along with its agencies, actively promotes sustainability through programs designed to minimize energy and water usage. Initiatives by the Los Angeles Department of Water and Power (LADWP), such as the EZ-SAVE Program, Used Electric Vehicle Rebate Program, and Consumer Rebate Program, alongside the Los Angeles Department of Public Works' Custom Performance Program (CPP) and Commercial Lighting Incentive Program, underscore the region's commitment to efficiency and sustainable living by offering rebates for energy-saving measures in both residential and commercial sectors.

### ***Customer Journey: Funding Programs to Decrease Utility Loads***

The process by which a government entity searches for, selects, and funds rebate programs of external companies promoting residential energy efficiency involves several steps which can vary in time, depending on the scope of the program, funding availability, and specific governmental procedures.

*Below is a general overview of the timeline of projects to launch:*

#### **1. Needs Assessment and Planning (1-3 months)**

- **Identifying Goals:** The government entity identifies the need for promoting residential energy efficiency within its jurisdiction, setting specific goals based on community needs, environmental targets, and legal requirements.
- **Research and Planning:** This involves researching existing programs, potential impacts, and the best practices for implementing rebate programs.

#### **2. Call for Proposals or Partnerships (1-2 months)**

- **Developing Criteria:** The entity develops criteria for selecting external companies, focusing on factors like technological innovation, cost-effectiveness, and potential for impact.
- **Issuing a Request for Proposals (RFP):** An RFP is published, inviting external companies to submit proposals for rebate programs. This document outlines the project scope, submission guidelines, and evaluation criteria.

#### **3. Proposal Evaluation (1-3 months)**

- **Reviewing Submissions:** A committee reviews proposals based on the predefined criteria, assessing each company's ability to meet the program's goals.

- **Selection Process:** The best-suited proposals are selected for further negotiation. This phase may include presentations, discussions, and revisions to the proposed plans.

**4. Contract Negotiation and Finalization (1-2 months)**

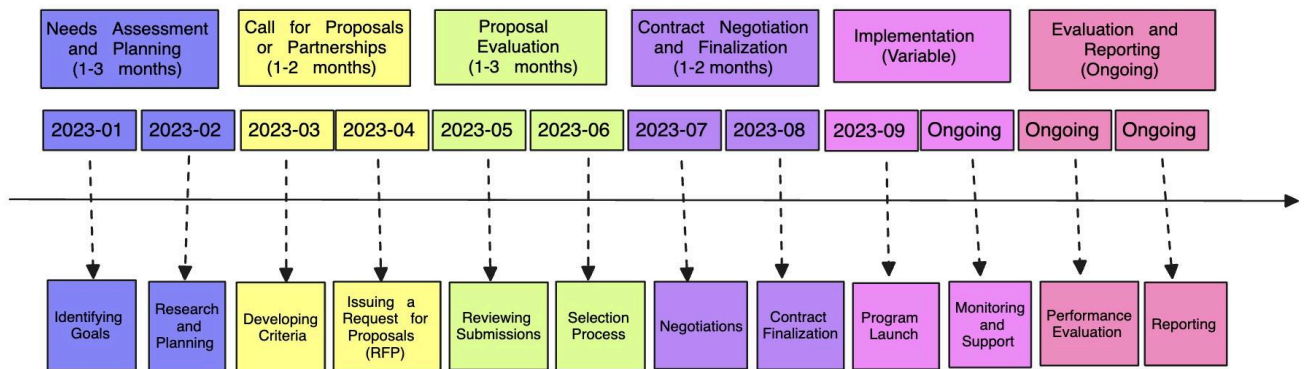
- **Negotiations:** The government entity and the selected companies negotiate terms, focusing on deliverables, timelines, and funding specifics.
- **Contract Finalization:** Contracts are finalized and signed, outlining responsibilities, funding amounts, and reporting requirements.

**5. Implementation (Variable)**

- **Program Launch:** The selected programs are officially launched, with marketing efforts to inform residents of the new rebate opportunities.
- **Monitoring and Support:** The government entity monitors the program's implementation, providing support as needed and ensuring that milestones are met.

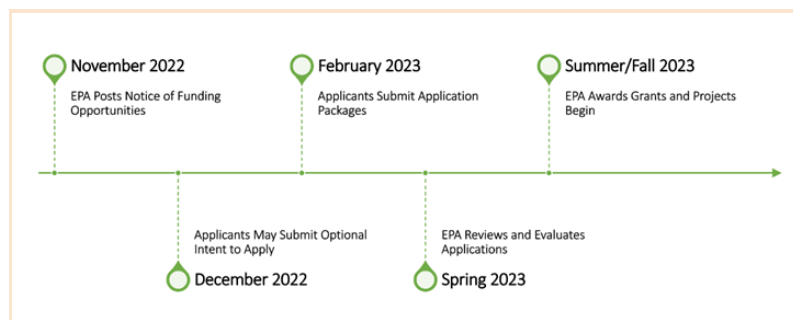
**6. Evaluation and Reporting (Ongoing)**

- **Performance Evaluation:** The effectiveness of the rebate programs is evaluated against the initial goals, including energy savings achieved and resident participation.
- **Reporting:** Findings are reported to relevant stakeholders, and the results inform future program planning.



*Figure 2-2, Energy Efficiency Rebate Program Development Timeline*

The overall timeline from needs assessment to program launch might range from 4 to 11 months or longer, not including the implementation phase, which can vary greatly depending on the program's duration. The evaluation and reporting phase is ongoing throughout the program lifecycle.



*Figure 2-3, Timeline for a specific grant opportunity from the EPA in 2022 and 2023 [38]*

**'Government Gale'**

**Position/Title:** Energy Efficiency Program Managers or equivalent positions within government agencies are responsible for orchestrating the development, execution, and oversight of initiatives designed to curb utility consumption and promote sustainable living practices among the populace.

**Age/Sex:** Not specified/Not applicable

**Role:** The individual oversees the development, implementation, and management of energy efficiency initiatives aimed at reducing utility demand, particularly during peak usage hours. This role involves coordinating with external companies to implement rebate programs that promote residential energy efficiency.

**Discretionary Budget:** The budget varies depending on the scale of the program and available federal, state, or local government funding, which can include grants, rebates, and initiatives supported by federal, state, or local government funds aimed at bolstering energy and water efficiency. Government entities typically have a structured but flexible budget for environmental sustainability projects, with funds allocated based on the year's priorities and available grants or legislative appropriations.

**Motivations:** Government Driven by a commitment to achieving environmental benchmarks, reducing utility consumption, ensuring energy security, and enhancing grid reliability. Furthermore, addressing socioeconomic disparities in utility access and promoting public health are paramount.

**Environmental Concerns:** Exhibits a high level of concern for environmental issues, with a strong commitment to reducing emissions, advocating for renewable energy sources, and implementing sustainable practices to combat climate change.

**Role Models:** Agencies and municipalities that have successfully implemented energy efficiency and sustainability programs, such as the Los Angeles Department of Water and Power and the Environmental Protection Agency.

**Behavioral and Socioeconomic Insights:** Seeks innovative, scalable solutions that balance the need for infrastructural improvement with considerations for social equity and affordability. Prefers technologies and programs that demonstrate tangible benefits in energy savings, reduced environmental impact, and enhanced community welfare.

**Energy Consumption Patterns:** Prioritizes initiatives that encourage both governmental and public sectors to minimize energy use through efficient practices, rebates, and incentives.

**Education and Awareness:** Possesses a deep understanding of environmental policies, energy-efficient technologies, and sustainability program management. Likely holds an advanced degree in a relevant field and engages in ongoing education to remain current with trends, technologies, and policy changes.

## **2.3 Solution Psychology**

BJ Fogg's Behavior Model shines a spotlight on the crucial elements needed to encourage a shift towards more sustainable behaviors. He identifies motivation, ability, and triggers as the three key components that must align for any behavior change to take place. [24] Motivation can come from personal goals or external rewards. For motivation to lead to action, individuals need to have the ability to perform the desired behavior. This means considering and removing potential barriers, like cost or accessibility, that might prevent someone from taking part. [24] Finally, there has to be a trigger, which is a prompt that makes the person act. Without this trigger, even the most motivated and capable individuals won't take the necessary steps towards change. [24]

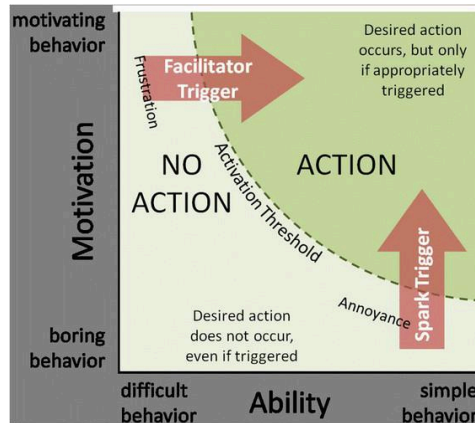
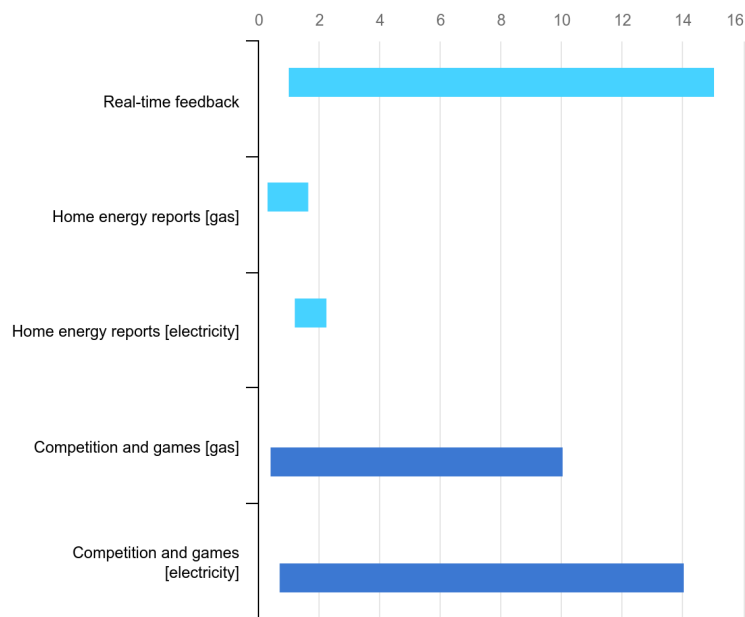


Figure 2-5, Fogg behavior model, adaptation of BJ Fogg's behavior [19]

In this context, mobile apps, specifically "Green Information Systems," play a critical role in helping to facilitate motivation and triggers. These systems are designed to use information technology to help achieve sustainability goals. With the widespread ownership of smartphones, even a small app can have a big impact by reaching a large number of users. This aligns perfectly with Fogg's model by providing information about tools (ability) and notifications (triggers) needed to make energy-efficient decisions. [24] For instance, an app that offers real-time feedback on energy usage empowers users to immediately see the benefits of their actions, acting as both a motivator and a trigger. This feedback loop is crucial because it directly shows the user the effect of their behavior change, without them having to wait for a physical bill to arrive.

The type of feedback and how it is presented can significantly influence its effectiveness. A meta-analysis of feedback programs found that feedback through detailed bills or home energy reports produced the least savings, while real-time feedback via in-home displays, and particularly digital platforms such as apps or websites, led to higher energy conservation. [8] The method of delivery matters, and digital platforms seem to offer the most promise in encouraging sustainable energy usage. [8] This finding underscores the importance of leveraging digital platforms for feedback delivery to maximize user engagement and energy-saving behaviors.

However, behavioral interventions, including those facilitated by digital feedback mechanisms, have been shown to yield more substantial reductions in electricity usage compared to natural gas consumption. [8] This distinction between the types of energy consumption highlights the different challenges and opportunities in influencing user behavior across various energy uses. Electricity, with its diverse applications such as lighting, air conditioning, and appliances, presents more opportunities for behavior modification than natural gas, which is mainly used for heating and hot water. This insight emphasizes the need for targeted interventions that account for the unique characteristics of different energy sources and their uses in households. [8]



**Figure 2-6, Energy savings across behavioral interventions implemented in the United States, where light blue represents High Evaluation Quality, and dark blue represents Medium Evaluation Quality [8]**

### **Customer's Coordinate System of Value**

*This system revolves around the tangible and intangible benefits the customer derives from the product or system. It's about the user experience, the direct outcomes they witness, and the overall value they perceive.*

#### **Tangible Benefits:**

- **Energy Savings:** Direct reduction in energy bills due to optimized consumption.
- **Environmental Impact:** The reduction in carbon footprint due to efficient energy usage.
- **Ease of Use:** The intuitiveness and user-friendliness of the system.

#### **Intangible Benefits:**

- **Peace of Mind:** Knowing that they are making environmentally conscious decisions.
- **Trust in Data:** Belief in the accuracy and reliability of the system's data and insights.

#### **Measurement Methods:**

- **Surveys and Feedback:** Feedback from users about their experience and perceived benefits.
- **Usage Metrics:** Tracking how often and how effectively users engage with the system.
- **Cost Savings Analysis:** Comparing energy bills before and after using the system.

### **Engineer's Coordinate System of Value:**

*This system is about the technical feasibility, efficiency, and reliability of the system. It's about ensuring that the system performs as intended, is scalable, and meets all technical requirements.*

#### **1. Efficiency and Reliability:**

- **System Uptime:** The reliability and availability of the system.
- **Scalability:** The system's ability to handle a growing number of users without performance degradation.

#### **2. Compliance and Security:**

- **Regulatory Adherence:** Ensuring the system meets local and international energy regulations.

- **Data Security:** Ensuring user data is encrypted and secure.

### **Requirements Specifications List**

- 1) **The system must provide real-time data on energy consumption.**
- 2) **The system must provide real-time notifications of utility spikes and potential anomalies.**
- 3) **The system must identify peak energy consumption times.**
- 4) **The system must offer actionable insights based on user consumption patterns.**
- 5) **The system must ensure data privacy and security.**
- 6) **The system must be scalable to accommodate a growing user base.**
- 7) **The system must provide accurate data analysis.**
- 8) **The system must have a user-friendly interface.**
- 9) **The system must comply with environmental and energy regulations.**
- 10) **The system must have a feedback mechanism for continuous improvement.**

### **Specification Tree**

**System Level (Emergent Behavior):** *Reduce overall home energy consumption.*

- **Sub-system Level 1: Data Collection and Analysis**
  - **Real-time energy consumption data:**
    - The system must provide instantaneous data updates.
    - The system should support multiple data sources (e.g., different utility providers).
  - **Peak energy consumption times:**
    - The system must identify and highlight times of day with the highest energy usage.
    - The system should provide historical data comparison for peak times.
  - **User consumption patterns:**
    - The system must analyze and categorize user energy habits (e.g., night owl, work-from-home).
    - The system should offer predictive analysis based on historical data.
- **Sub-system Level 2: User Interface and Experience**
  - **User-friendly interface:**
    - The system must be intuitive and easy to navigate.
    - The system should offer customization options for users.
  - **Actionable insights and recommendations:**
    - The system must provide tips based on user consumption patterns.
    - The system should allow users to set goals and track progress..
- **Sub-system Level 3: Security and Compliance**
  - **Data privacy and security:**
    - The system must encrypt user data both in transit and at rest.
    - The system should offer two-factor authentication for user accounts.
  - **Compliance with regulations:**
    - The system must adhere to local and international energy regulations.
    - The system should provide regular updates to comply with changing regulations.

## Chapter 3. Product and Technology

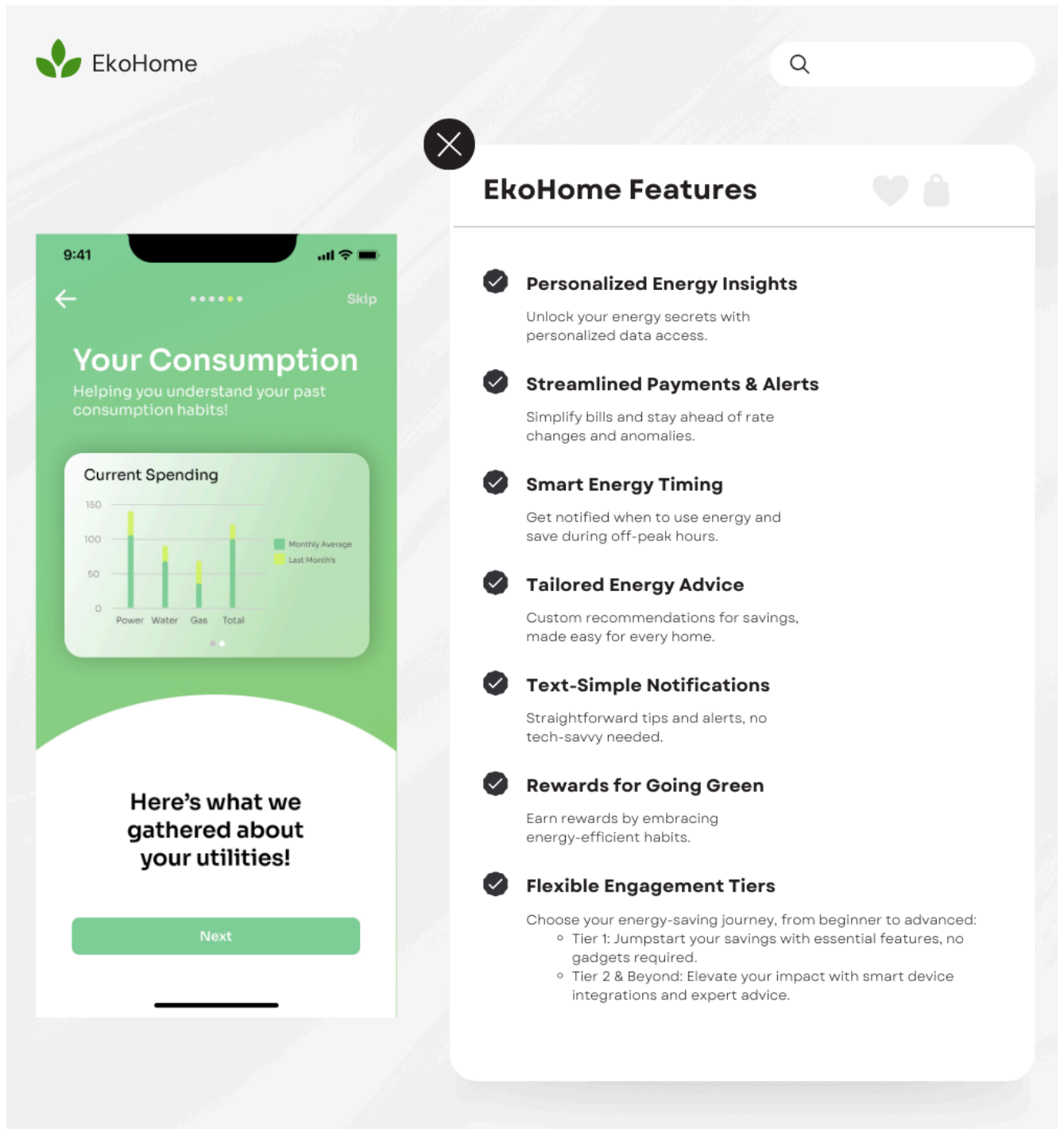


Figure 3-1, EkoHome MVP Insights

### **3.1 Main Product Features of EkoHome**

**1) Personalized Energy Consumption Data:** Users gain unparalleled access to their energy usage data, fostering a deep, personalized connection with their consumption patterns.

**2) Payment Portals and Notification Systems:** The app simplifies payments and alerts users to utility rate changes, bill anomalies, and spikes, ensuring financial transparency and predictability.

**3) Optimal Energy Use Timing:** Through intelligent notifications, EkoHome advises users on the best times to consume energy, helping avoid peak rate periods, thus contributing to the broader goal of reducing energy rates and the need for new generation capacity.

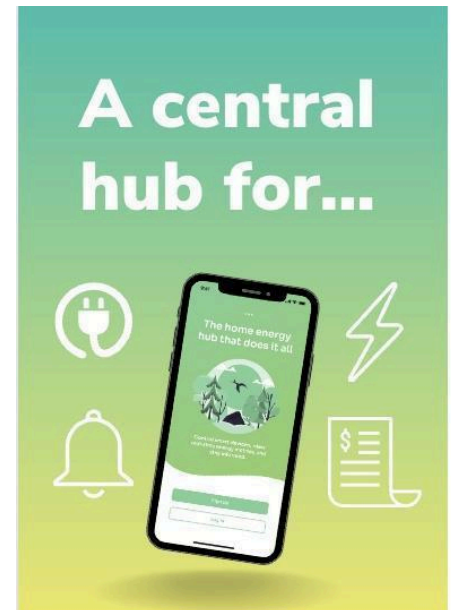
**4) Customized Recommendations:** Addressing the confusion among lower-income homeowners and renters regarding optimal energy solutions, EkoHome provides tailored advice on energy habits, rebates, government programs, and smart devices.

**5) Simplified Interaction for All:** Recognizing the diverse technological proficiency of its users, EkoHome delivers critical notifications and advice in simple terms directly via text, removing barriers to access and understanding.

**6) Incentives for Sustainable Behaviors:** The app incorporates a rewards system to encourage and incentivize energy-efficient behaviors, translating complex energy savings into tangible rewards.

**7) Enhanced Customization Through Product Tiers:** EkoHome introduces a tiered approach to user engagement, designed to match the unique needs and capabilities of each user:

- **Tier 1 - Basic Engagement:** For users just beginning their journey towards energy efficiency, this tier offers essential app functionalities without the need for automated devices. It provides a gentle introduction to energy savings, with straightforward recommendations tailored to users' current habits.
- **Tier 2 & Beyond - Advanced Integration:** As users become more comfortable and look to deepen their impact, EkoHome guides them through the seamless integration of smart devices and more sophisticated energy management strategies. This includes personalized advice on which smart devices to adopt first and incentives for making the switch, ensuring users feel supported and not overwhelmed.
- **Guided Progression & Incentivized Advancement:** EkoHome not only allows users to select the tier that best suits their current situation but also offers clear, incentive-driven guidance on how to progress to higher levels of energy efficiency. This approach includes specific suggestions tailored over time, such as optimal heating settings after a few months of app usage, fostering gradual but meaningful engagement with energy-saving practices.



### **3.2 Why EkoHome Works**

#### **Psychology Behind the Design**

*EkoHome's effectiveness is deeply rooted in its psychological design:*

- **Motivation through Customization and Rewards:** EkoHome taps into intrinsic and extrinsic motivators by offering rewards and making the financial impact of users' actions clear and tangible. This directly aligns with Fogg's emphasis on pleasure/pain and social

acceptance/rejection as key motivators. Cost is a key motivating factor for EkoHome's Users, so EkoHome harnesses the emerging time-of-use charges policies of utilities to align with users' motivations.

- **Enhancing Ability by Simplifying Actions:** By providing easy access to information and straightforward recommendations, EkoHome removes barriers to sustainable actions, ensuring that users have the tools they need to effect change.
- **Effective Triggers for Immediate Action:** Notifications serve as immediate triggers, prompting users to take energy-saving actions at the most opportune times. This ensures that motivation and ability are effectively translated into action.

### **Unique Value Proposition**

#### **Personalized Solutions for Diverse Needs:**

- EkoHome addresses confusion among lower-income homeowners and renters regarding energy-saving solutions by providing personalized recommendations. This includes advice on optimal energy habits, rebates, government programs, smart devices, and meter-readers tailored to individual situations.
- The app offers notifications for timing energy use to avoid peak periods, helping reduce electricity costs and contributing to the broader goal of energy sustainability.

#### **Simplifying Technology for All Users:**

- Recognizing that some users, especially the older demographic, may not be as technologically adept, EkoHome sends important notifications via text. This approach ensures that even those who prefer traditional methods of communication or find digital platforms challenging can still benefit from the app's features without the need to navigate through it.
- To overcome the learning curve associated with understanding energy-saving solutions, EkoHome explains complex information in simple terms. It ensures users do not need to be experts to make effective changes in their energy consumption.

#### **Incentivizing Sustainable Behaviors:**

- EkoHome motivates users towards energy-efficient behaviors with a system of rewards and transparent benefits, making the environmental and financial benefits of actions clear and accessible.
- The app makes the economic implications of high-usage tiers more transparent, showing users how rates can significantly vary. This information encourages more sustainable energy consumption patterns by highlighting the savings achievable through energy efficiency.

#### **Proactive Notifications for Immediate Action:**

- Users receive timely text notifications about scheduled power shut offs and other anomalies, ensuring they are always informed and can prepare accordingly. This feature is part of EkoHome's holistic approach to keep users engaged and proactive in managing their energy use, further contributing to the reduction of peak demand and supporting the grid's stability.

#### **Community and Government Engagement for Broader Impact:**

- EkoHome extends its influence beyond the individual level by forging strong partnerships with government energy efficiency programs and local community initiatives. This collaborative approach amplifies the benefits and incentives available to users, driving community-wide engagement and fostering a culture of sustainability.

#### **Empowering Educational Content for User Confidence:**

- EkoHome provides users with accessible educational content that demystifies the complexities of energy consumption and conservation. By enhancing understanding and

confidence, EkoHome enables users to make more informed decisions, fostering a sense of empowerment and ownership over their environmental impact.

### **SWOT Analysis**

- **Strengths:** Innovative approach, customization capabilities, and alignment with sustainability trends.
- **Weaknesses:** High initial development and marketing costs, consumer hesitance to adopt new technologies.
- **Opportunities:** Expansion of smart home market, increasing government incentives for energy efficiency, and growing consumer demand for sustainable living.
- **Threats:** Intense competition, rapid technological changes, and potential regulatory challenges.

## **3.3 Feasibility**

### ***Technological Developments***

#### **Interview Insights:**

- I engaged with key industry players like the COO and Co-founder of Arcadia (a utility API company) Kate Henningsen, highlighting the project's feasibility and securing platform access for thorough testing.
- I collaborated with Evan Birenbaum of Chai Energy, who provided insights into the technological viability of EkoHome and the instrumental developments produced from his work with the Green Button Initiative.

#### **Software Development:**

- EkoHome will prioritize iOS for initial software development, leveraging Arcadia's Utility API tokens for real-time energy data, payment processing, and rate change alerts. [1]
- EkoHome will explore alternative data sources beyond Arcadia because the Green Button Initiative has expanded access to energy data.

#### **Forecasting Utility Rates:**

- EkoHome's ability to access to real-time and forecasted utility rates is increasingly feasible, supported by:
  - Utility Providers and Grid Operators offering variable rate information.
  - Websites like the U.S. Energy Information Administration (EIA) and platforms such as OpenEI's Utility Rate Database providing broader data access.

#### **Key Technical Challenges:**

- Developing a user-friendly interface that simplifies complex energy data into actionable insights for users of all technological proficiencies.
- Maintaining data privacy and security, especially concerning users' energy usage patterns and payment information.
- Adapting the app's functionality to accommodate the diverse energy infrastructures and regulations across different regions.

## Chapter 4. Market Analysis

The commercialization of this project in 2024 and beyond is strategically positioned to capitalize on the evolving dynamics of the residential energy market. Amidst a growing global emphasis on sustainability, growing consumer preferences towards eco-friendly living, and supportive government policies, this project is positioned to offer innovative solutions that cater to the growing demand for energy efficiency and sustainable home management.

### 4.1 Market Trends

*Factors for potential success in the current and future market landscapes:*

- **Global Push for Sustainability:** Governments worldwide are intensifying efforts to combat climate change, as seen by regulations and incentives promoting energy efficiency. Initiatives such as rebates for energy-efficient appliances and tax credits for sustainable home renovations underscore this trend.
- **Technological Advancements:** The integration of IoT (Internet of Things) in residential settings, smart home technologies, and advancements in energy-efficient appliances are transforming how energy is consumed and managed in homes.
- **Consumer Awareness and Preferences:** A shift in consumer mindset is evident, with an increasing number of individuals prioritizing sustainability in their purchasing decisions. Consumers are seeking ways to reduce their carbon footprint and utility bills, driving demand for eco-friendly home solutions.

### 4.2 Market Size and Growth Potential

**Green Energy Market Value:** Valued at over \$856 billion [35], the green energy sector presents a lucrative opportunity for this project. By emphasizing energy waste reduction and CO2 emission minimization, this project is strategically positioned to capture market share. A unique aspect of this project's value proposition is its ability to not just conserve electricity but also to shift some usage away from peak periods. This capability is critical, as it not only helps in avoiding higher energy costs and potential brown-outs/black-outs but also reduces the need for new generation capacity, which is often dictated by peak demand. This approach to reducing peak demand represents a high-leverage strategy that could lead to lower utility rates by diminishing the necessity for extensive infrastructure build-out.

**Growing Market for Energy-Efficient Products:** The global market for energy-efficient technologies in residential areas is expected to witness significant growth. This is fueled by both technological advancements and consumer demand for products that offer cost savings and reduce environmental impact.

**Smart Home Adoption:** The smart home market is on a robust upward trajectory, expected to exceed \$150 billion globally by 2024. [36] this project, with its emphasis on energy efficiency and integration with smart home ecosystems, is well-positioned to tap into this expanding market.

**Potential for Partnerships:** Collaborating with smart-home energy applications and solutions within the green energy domain, this project could significantly penetrate the utility app market, currently valued at approximately \$4.7 billion [20]. The synergy between this project and advanced smart-home technologies can enhance its market positioning, offering integrated solutions that cater to the growing demand for sustainable and efficient energy management.

**Legislative Frameworks:** The energy efficiency landscape is further shaped by legislative initiatives such as California's Senate Bill 350, which ambitiously aims to double the state's energy efficiency savings by 2030 across various sectors. This underscores the critical role of energy efficiency in meeting broader energy and environmental objectives, providing a conducive environment for this project's integration and success in both utility and non-utility sectors.

**Vision for Global Impact:** EkoHome's mission aligns seamlessly with the global movement towards CO2 emission reduction, offering homeowners an unparalleled level of understanding and control over their energy usage. This vision resonates with the escalating consumer demand for products that not only offer personal benefits but also contribute to global sustainability efforts.

### **4.3 Target Market**

Further analysis is set for target users and customers in the Los Angeles county area, to gauge initial market sizing. It will focus on urban and suburban areas, which are regions with supportive energy-saving rebates and policies. This project's primary target market users and customers includes those that fit the profiles described below.

#### ***Target User ('Budget-Conscious Brenda')***

The target user represents homeowners or tenants in the LA county area, with ages ranging from 25-70, primarily focused on reducing monthly expenses and, to a lesser extent, reducing their carbon footprint. This group is not highly inclined to invest in energy-efficient solutions due to upfront costs and technological challenges, but is motivated by immediate bill savings and possibly environmental concerns.

#### **Average Income Levels for Target Users:**

- **Los Angeles County Median Family Income** as of May 15, 2023 is **\$98,20** [28]
  - Low-Income Levels: *Families incomes does not exceed 80% of median family income*
    - For a single person: **\$70,650** [28]
    - For a family of eight: **\$133,200** [28]
  - Very Low-Income Levels: *Families incomes does not exceed 50% of median family income*
    - For a single person: **\$44,150** [28]
    - For a family of eight: **\$83,250** [28]
  - Extremely Low-Income Levels: *Families incomes is significantly lower than low-income levels*
    - For a single person: **\$26,500** [28]
    - For a family of eight: **\$50,560** [28]

#### **Average Costs of Utility Bills for Target Users:**

- **Average Monthly Costs:**

- **Electricity Bill Cost:** The average monthly electricity consumption as of March 2024 for Los Angeles residents was about 815 kWh, with an average monthly bill of approximately **\$199** [11]
- **Water Bill Cost:** The average monthly water bill in 2021 for a household using a typical amount of water (6 hundred cubic feet) was **\$65.85** [6]
- **Natural Gas Bill Cost:** The estimated average monthly natural gas bill for Los Angeles County ratepayers in 2023, based on the cost of \$1.775 per therm and an assumed average consumption of 83 therms per month in the U.S. [3] , would be approximately **\$147.33**.
- **Estimated Yearly Utility Bill Cost:** Based on the above estimated average monthly utility costs, with 3-4 utilities on average, the estimated yearly utility cost is as follows:  
 $\$199 + \$65.85 + \$147.33 = \mathbf{\$412.18/month}$ . According to an average calculated by Borowitz & Clark, the average total essential utility bill—that includes electricity, gas, fuel, and water—in Los Angeles could be as low as **\$245.67/month**. [4]
- For Low income families, with an income of around \$70,650, spending **\$245.67 per month on utilities represents about 4.17% of their monthly income, and spending \$412.18 per month on utilities represents about 7.00% of their monthly income.**

#### **Number of Potential Users:**

There are currently **1.37M people** in Los Angeles County that live below the poverty line. [27] The LADWP offers a Low-Income Assistance Program, known as 'EZ-SAVE', which helps qualifying Los Angeles households reduce their monthly utility bills by offering discounts on electric, water, and specified sanitation services. Around **123,000 customers** are enrolled in this program in 2021. [25]

#### **User Expectations on Savings:**

Roger Colton suggests an energy affordability threshold at **6% of income**, drawing from studies suggesting 30% of income for housing and 20% of that for energy. [17] With utility expenses being a significant portion of shelter costs, EkoHome aims to align with this benchmark, making it a compelling offer for users looking for substantial bill reductions. Oracle Opower's findings indicate low-income individuals seek **savings of \$5-\$10 monthly** to be motivated. [31] While savings desires vary, achieving a **10-20% reduction** through energy management apps is seen as significantly beneficial for users.

#### **At what price will they buy?**

Understanding the financial constraints of low-income households is crucial for pricing our EkoHome service. For example, through a partnership with LADWP, Flume offered their water monitor at a significantly reduced cost to encourage adoption among ratepayers looking to lower their utility expenses. Flume devices normally retail for \$199, but through LADWP's pilot program, customers can purchase a device for \$49, receive a \$25 refundable deposit for installing the device, and pay only \$24 total in the end. This model demonstrates the importance of affordability and the potential for utility-backed programs to reduce costs for consumers. Given this context, and considering our users may lack smart devices, their willingness to invest could be even lower, highlighting the potential role of government programs in facilitating access to our service. A freemium model, supplemented by government subsidies or a nominal subscription fee in comparison to the savings potential, could optimize user uptake and retention.

#### **How many users will download?**

With utility expenses being a significant portion of shelter costs, EkoHome aims to align with this benchmark, making it a compelling offer for users looking for substantial bill reductions. Success in programs like LADWP's EZ-SAVE, which enrolled **123,000 users** [2], indicates a strong potential user base for EkoHome.

### User Cost-Benefit Analysis

To create a cost-benefit analysis, there must be some assumptions. The first is that users monitor their utility usage in real-time and adjust their habits accordingly, users respond to rate-change notifications but do not have smart-device automation, and behavioral interventions deliver larger cuts to electricity consumption than to other utilities. The analysis will also assume that there is a 10% savings on electricity and 5% savings on other utilities due to behavioral changes facilitated by the app.

- For an average monthly utility bill of \$412.18, users might save approximately **\$41.22** on electricity and **\$20.61** on other utilities per month. This amounts to around **\$493.86 saved per household per year**. For those utilizing the app primarily for real-time electricity monitoring and rate-change notifications, the annual savings would be approximately **\$238.80 per household per year**, based on the average electricity cost previously provided.
- Given the EkoHome app's potential savings from energy management and assuming an average monthly utility bill of \$412.18, below are the calculated savings for both unsubsidized and subsidized users:
- Calculated Savings:
  - **Unsubsidized User Calculation:**
    - **Monthly Fee:** \$10
    - **Annual Fee:** \$10 x 12 = \$120
    - **Estimated Savings:** Assuming a 10% reduction on electricity and a 5% reduction on other utilities, users might save about \$493.86 annually.
    - **Net Savings:** \$493.86 (savings) - \$120 (cost) = **\$373.86**
  - **Subsidized User Calculation:**
    - **Monthly Fee with Subsidy:** \$1
    - **Annual Fee with Subsidy:** \$1 x 12 = \$12
    - **Estimated Savings:** Same as above, \$493.86 annually.
    - **Net Savings with Subsidy:** \$493.86 (savings) - \$12 (cost) = **\$481.86**

### Would It Be Worth It for Users?

Unsubsidized Users will have a net savings of **\$373.86 annually** after the cost of the app, most users would find value, especially if they are focused on reducing monthly expenses. Subsidized Users will have a value that is significantly higher, with **net savings of \$481.86**, making it an attractive proposition for low-income families.

The following table simulates monthly utility bills for users and calculates potential savings with EkoHome based on theoretical customer bills fluctuating each month. We'll assume a baseline reduction of 10% on electricity and 5% on other utilities:

Month	Average Customer Bill (\$)	EkoHome Customer Bill (\$)	Savings (\$)	Savings (%)
January	412.18	370.96	41.22	10%
February	395.07	355.56	39.51	10%
March	377.00	339.30	37.70	10%
April	359.00	323.10	35.90	10%

<b>May</b>	341.00	306.90	34.10	10%
<b>June</b>	412.18	370.96	41.22	10%
<b>July</b>	433.29	389.96	43.33	10%
<b>August</b>	433.29	389.96	43.33	10%
<b>September</b>	412.18	370.96	41.22	10%
<b>October</b>	391.07	351.96	39.11	10%
<b>November</b>	370.00	333.00	37.00	10%
<b>December</b>	412.18	370.96	41.22	10%
<b>Totals</b>	<b>4,749.24</b>	<b>4,270.58</b>	<b>478.66</b>	<b>10%</b>

*Table 4-1, Ratepayers (EkoHome Users) Cost-Benefit Analysis Table*

### ***Target Customer (“Government Gale”)***

The target paying customer is Energy Efficiency Program Managers within government agencies focused on reducing utility demand spikes and promoting sustainable practices through initiatives like rebate programs.

#### **Number of Potential Customer Entities:**

In California, 26 utilities currently offer energy efficiency rebates to both homeowners and businesses. These include a total of 210 residential rebate programs and 122 commercial rebate programs. [14]

#### **How much of a change in energy consumption are they looking for?**

Government entities and utilities will look for demonstrable energy savings from EkoHome users to justify rebates. Specific targets vary, but a visible reduction in energy consumption that contributes to broader environmental goals is be a key metric. Utilities and regulatory bodies may set benchmarks based on the program's objectives, potentially in the range of 5-15% as aligned with sustainable energy policies.

#### **At what price will they buy?**

Government contracts for integrating EkoHome involve comprehensive services beyond software access, including system setup, training, and customization to meet specific needs, reflecting the extensive support and potential for bulk deployment across multiple facilities. A \$10,000 price point may serve as an initial investment by agencies, aimed at delivering a solution that encompasses data integration, security compliance, and ongoing support to ensure success in enhancing energy efficiency and supporting low-income households. This estimate is based on general principles of business-to-government (B2G) sales, where contracts typically include extensive support and customization.

#### **How many might buy EkoHome?**

The number of agencies with potential interest in EkoHome can be based on existing energy efficiency and low-income support programs. In LA County, this might include the LADWP, the California Energy Commission, and other local agencies focusing on sustainability.

#### **Customer Cost-Benefit Analysis**

The company Flume exemplifies a successful partnership between innovative solutions and government support, with its smart water monitors aiding in the reduction of water usage during

California's droughts. [20] Drawing parallels to Flume, my project aims to reduce utility demand, particularly during peak usage hours, by time-shifting consumption. While smart-monitor companies like Flume have helped alleviate water spikes, there is still a drought in California. My solution will not only help reduce water consumption during this dire time, but it will also help reduce consumption across all other utilities. Investing in my solution could alleviate various challenges associated with utility spikes, offering a compelling case for government investment in our solution, and now. Furthermore, my project also has the opportunity to offer data and consumer insights on utility trends, using algorithms

### ***Would it be worth it for the Target Customer to invest money into EkoHome?***

Previous success stories present a compelling case for government investment in EkoHome's solution, from historically similar investments that have been made in sustainable solutions and in low-income ratepayers, to what EkoHome can offer its paying customers.

*Below are some previous success stories:*

**Nest:** Through its partnership with LADWP, Nest incentivizes customers to allow remote adjustments to their thermostats during peak demand periods by offering a \$125 gift card per thermostat upon enrollment, and a \$60 gift card for each year of continued participation, up to two thermostats. This demand response program helps LADWP manage load and reduce strain on the grid during high-demand seasons. While the specific financial arrangements between companies like Nest and LADWP or online retailers are not detailed, these partnerships typically include promotional activities and may involve rebates, affecting profits depending on agreements between manufacturers and retailers.

**Flume:** Flume has similarly demonstrated its value through partnerships with major water utilities like San Antonio Water Company and LADWP, leveraging its technology during a historic drought to significantly reduce water usage. Their success, evidenced by a notable 14.6% decline in water usage in Goodyear, Arizona, showcases how EkoHome could similarly benefit from integrating with government programs to promote sustainable energy usage among low-income households.

## **4.4 Bottom-Up Market Analysis**

### **Brenda Segment:**

- **Total low-income Households in Los Angeles County:** There are approximately 1.37 million people living below the poverty line. [27]
- **Percentage of Target Market (Brenda):** Given the varied motivations and capacity to invest in energy savings, it could be estimated that the Brenda segment makes up about 30% of low-income households.
- **Price They're Willing to Pay:** \$1/month with government subsidy, aligning with the affordability threshold.
- **Realistic Reach:** 10% of targeted households = approximately 41,100 households (considering 30% of 1.37 million people living below the poverty line translates to around 411,000 households).
- **Conversion Rate:** 5% = 2,055 actual customers.

### Gale Segment:

- **Government Agencies (Gale):** Estimating conservatively, about 10 agencies might have interest in a partnership or implementation of EkoHome.
- **Price Point:** Given the complexity of government contracts and the potential for bulk deals, I estimated a starting point of \$10,000/agency for complete implementation.
- **Realistic Reach and Conversion:** Assuming 50% of interested agencies proceed = 5 agencies.

### Unsubsidized Ratepayer Revenue Calculations:

- **Subscription Fee:** \$10/month
- **Net After App Store Fees:** \$7/user/month
- **Number of Subscriptions:** 82,050
- **Annual Revenue:** 82,050 users \* \$7/user/month \* 12 months = **\$6,892,200**

### Subsidized Ratepayer Revenue Calculations:

- **Subscription Fee (User Pays):** \$1/month
- **Net After App Store Fees:** \$0.70/user/month
- **Number of Subscriptions:** 41,025 (50% of unsubsidized assuming half qualify for subsidy)
- **Annual Revenue:** 41,025 users \* \$0.70/user/month \* 12 months = **\$344,610**

### Government Subsidy Revenue Calculations:

- **Government Pays:** \$9/month per qualifying ratepayer
- **Number of Agencies:** Assuming a realistic interest from 5 agencies
- **Number of Subsidized Users:** 41,025 (assuming half qualify for subsidy)
- **Annual Revenue:** 5 agencies \* 41,025 users \* \$9/user/month \* 12 months = **\$2,216,125**

### ***Total Initial Market Size:***

- **Direct Ratepayer Revenue (Unsubsidized):** \$6,892,200
- **Direct Ratepayer Revenue (Subsidized):** \$344,610
- **Government Subsidy Revenue:** \$18,461,250
- **Total Revenue Before Expenses:** \$6,892,200 (Unsubsidized) + \$344,610 (Subsidized) + \$2,216,125 (Government Subsidy) = **\$9,452,935** before other expenses and cost deductions.

## **4.5 TAM, SAM, SOM**

### ***Total Addressable Market (TAM)***

- TAM represents the total market demand for EkoHome's service, assuming 100% market share without competition.
- Given EkoHome is targeting low-income households in Los Angeles County with an energy management solution, the TAM would be the total potential revenue from all households adopting EkoHome at the full price point.
- Considering the average monthly subscription fee is \$10 (unsubsidized rate), and that approximately 1.37 million people live below the poverty line in LA County (with an average of 3 people per household):
  - TAM = ((1,370,000 people) / (3 people/household)) \* 12 months \* \$10
  - **TAM = \$54,800,000 annually**

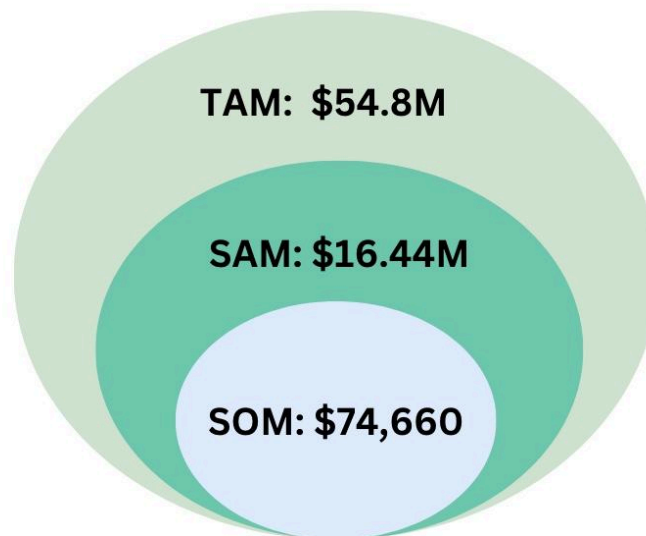
### ***Serviceable Addressable Market (SAM)***

- SAM is the portion of TAM targeted by EkoHome's services within practical reach, considering its service offerings.
- Assuming EkoHome captures about 30% of low-income households as its target market (Brenda segment), then:
  - $SAM = 30\% * \$54,800,000$
  - **SAM = \$16,440,000 annually**

### ***Serviceable Obtainable Market (SOM)***

- SOM is the portion of SAM that EkoHome realistically expects to capture, given its current business operations, marketing efforts, and competition.
- Assuming a realistic reach of 10% of the targeted households (Brenda segment) converting at a 5% rate, and considering both Brenda and Gale segments:
  - Brenda Segment SOM = 2,055 customers \* \$12 = **\$24,660 annual potential revenue**
  - Gale Segment SOM = 5 agencies \* \$10,000 = **\$50,000 annual potential revenue**
  - **Total Initial SOM = \$24,660 + \$50,000 = \$74,660**

*\*The SOM calculations (\$74,660) represent a small initial test market or a conservative first-year estimate rather than competing directly with the larger revenue figures (\$25,698,060) which might encompass a broader operational scope.*



*Figure 4-1, EkoHome's TAM, SAM, SOM*

## **4.6 Early Competitor Research**

### ***Competitive Analysis: EkoHome's Market Edge***

#### **Chai Energy:**

Chai Energy, an early 2000's innovator in the utility data space, leveraged the potential of the *Green Button* Initiative's data access [2] to provide users with actionable insights into their energy

consumption. While its features offered significant value, such as detailed energy consumption dashboards, baseload measurement, solar analysis, and incentives like Power Pay Days, Chai Energy ultimately did not sustain its market presence and the company went bankrupt. I interviewed Evan Birenbaum to hear his thoughts on Chai's downfall. Despite its innovative approach, he said that Chai faced challenges with user interface intuitiveness and broader market sustainability, leading to its downfall.

### **EkoHome Differentiators:**

**Personalized Energy Management:** EkoHome advances beyond Chai by providing personalized insights tailored to each user's specific energy patterns and home characteristics, coupled with a tiered engagement system for customized user journeys.

**Enhanced Community and Government Engagement:** EkoHome builds on Chai's incentives with stronger partnerships in community and government programs, promoting sustainability.

**Superior User Experience:** EkoHome addresses Chai's interface shortcomings with an intuitive platform that delivers direct notifications and simplifies energy data into actionable advice.

**Advanced Insights and Predictive Analytics:** Moving past Chai's predictive bill comparisons, EkoHome offers real-time notifications and dynamic energy use recommendations, based on current market rates and user behavior.

### **EkoHome vs. Open-Source APIs and Algorithms:**

- **Open-Source APIs** provide a DIY approach to energy management, granting users direct access to utility data, pricing information, and forecasts. However, they lack the personalization and integration that a comprehensive solution like EkoHome offers.
- **EkoHome's Strategic Use of Open-Source Data:**
  - **Integration and Actionable Insights:** EkoHome leverages the same open-source APIs but transforms raw data into personalized, actionable insights, bridging the gap between data access and user action.
  - **Beyond Data Display:** While open-source options offer data, EkoHome integrates this information with smart home technologies, providing a seamless energy management ecosystem.
  - **Community and User Engagement:** EkoHome enhances the raw data utility with community-driven incentives and educational resources, fostering a deeper commitment to energy efficiency.

EkoHome uniquely positions itself in the competitive landscape by not only addressing the limitations of predecessors like Chai Energy but also by harnessing and enhancing the capabilities of open-source APIs and algorithms. Through its personalized energy management experience, comprehensive device integration, and emphasis on community engagement and user-friendly interfaces, EkoHome transcends the traditional data-centric approach of its competitors. It delivers a sophisticated, intuitive solution that simplifies complex energy data, making sustainable energy management accessible and actionable for all users. This holistic approach, combined with strategic data utilization and community involvement, secures EkoHome's lead in the market, offering unparalleled value in promoting energy efficiency and sustainability.

# Chapter 5. Industry Analysis

## 5.1 Current Market Landscape

As the world moves towards more sustainable and efficient energy use, driven by consumer demands, regulatory changes, and technological advancements, the role of utility companies is evolving. These companies have attempted to support this transition, providing customers with information on energy use, trends, and rate changes via emails and websites. Yet, despite their efforts to clarify energy management practices, rate changes, rebates, and more, many people still find themselves lost in a maze of confusion. For instance, the complexities involved in understanding utility credits for home solar panel electricity generation leave the average user puzzled, especially when trying to calculate payback periods.

The challenge doesn't stop at complex utility credits. A significant portion of U.S. ratepayers feels blindsided by their utilities [5], fostering a sense of mistrust towards their utility providers. This disconnect stems from a lack of centralized data across utilities and insufficient communication, hindering efficient energy actions. These challenges underscore a broader issue within the energy sector: the overwhelming and fragmented nature of information provided to consumers.

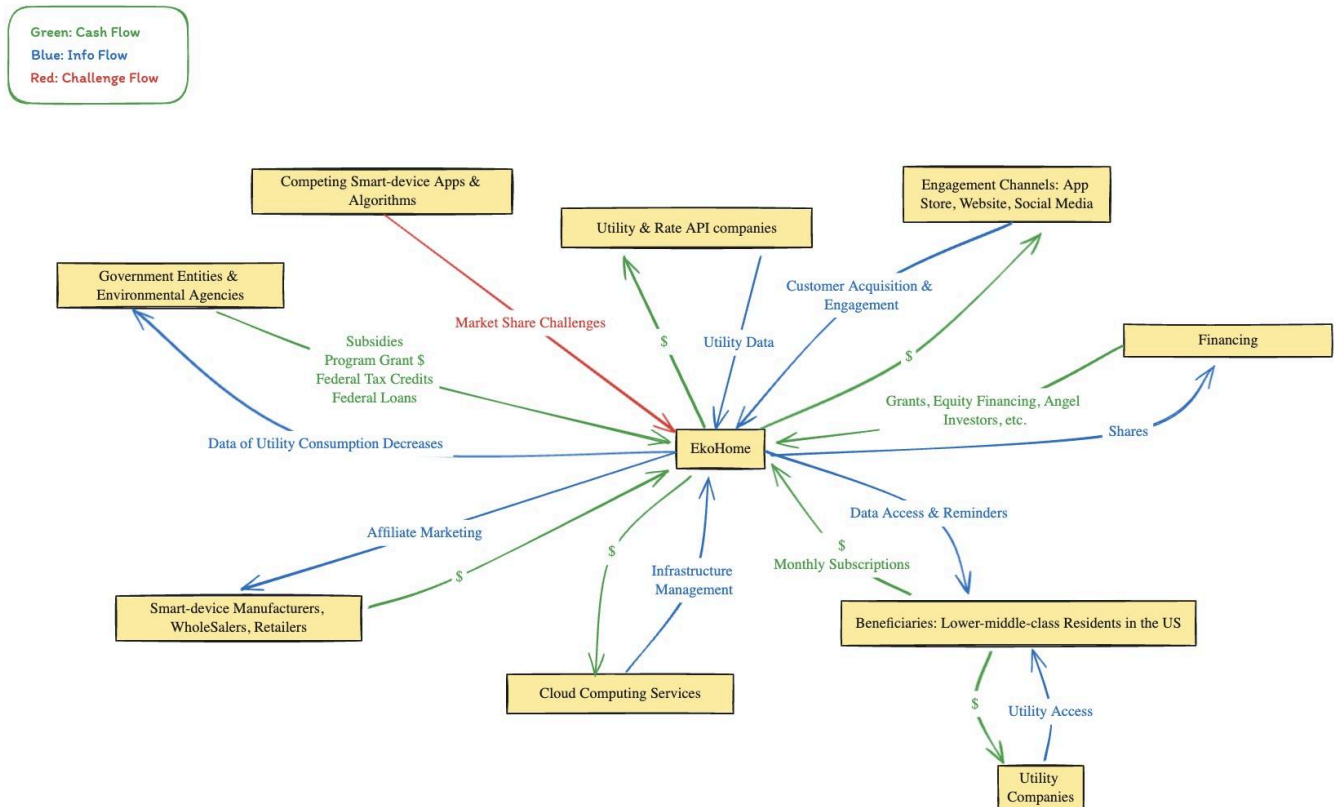


Figure 5-1, Industry Map

## ***The Five Competitive Forces that Shape Strategy***

1. **Threat of New Entrants**
  - EkoHome's market may have high barriers to entry due to technology development costs and the need for API partnerships, which can act as a deterrent to new competitors.
2. **Bargaining Power of Suppliers**
  - Suppliers for EkoHome, such as API providers, smart device manufacturers, and cloud computing services, have bargaining power as they provide essential services and technologies that are integral to the offering of EkoHome
3. **Rivalry Among Existing Competitors**
  - The existence of other smart home device apps and companies like Homey or Google Home suggests significant competition in this space, which may affect EkoHome's market strategies.
4. **Bargaining Power of Buyers**
  - EkoHome targets lower-middle-class residents in the United States, which could imply a **high bargaining power** of buyers, especially if they are price-sensitive and have alternatives.
5. **Threat of Substitute Products or Services**
  - The risk of substitutes for EkoHome exists in the form of other smart device applications and possibly more traditional methods of managing utility use and expenses.

### **EkoHome's Competitive Edge: Personalization, Education, Trust**

EkoHome carves out a unique space in the competitive landscape by not just easing the complexities of energy management through innovative technology but also mending the trust gap between ratepayers and utility companies. EkoHome is setting new standards in sustainable energy practices, proving itself as an indispensable ally for energy-conscious consumers. By centralizing energy data and offering a platform that breaks down energy management into understandable chunks, EkoHome brings simplicity and efficiency in an otherwise complex industry:

**Centralized and Personalized Energy Data:** EkoHome distinguishes itself from utility companies by providing personalized updates that truly resonate with users, enabling them to grasp their energy patterns and uncover areas for improvement.

**Empowering Users with Knowledge:** Recognizing the intricacies of energy management, EkoHome equips users with educational resources and simplifies the convoluted topics of utility credits, rebates, and rate changes, empowering them to make informed decisions.

**Fostering Trust and Sustainability:** By leveraging partnerships with community and government programs, EkoHome not only enhances the benefits available to users but also cultivates a culture of sustainability and trust, bridging the gap between ratepayers and energy solutions.

## **5.2 Stakeholders**

Stakeholder	Needs & Desires	Value Offered
<b>Individual Users (Ratepayers)</b>	Real-time alerts on rate changes, usage spikes; actionable insights for reducing	EkoHome provides a user-friendly platform for managing energy use,

	<p>bills; understanding energy patterns; integration with smart devices; data privacy.</p>	<p>offering cost savings and personalized energy consumption insights.</p>
<p><b>Government Agencies &amp; Policy Consultants</b></p>	<p>Tools to promote energy efficiency, reduce peak demand, and support environmental initiatives; data to inform policy and regulatory decisions.</p>	<p>EkoHome aids in meeting environmental goals by encouraging efficient energy use and providing data insights for policy-making.</p>
<p><b>Utility Companies</b></p>	<p>Solutions to manage demand, especially during peak periods; tools to improve customer satisfaction and engagement.</p>	<p>By encouraging users to shift energy use away from peak periods, EkoHome helps utilities manage demand more effectively, potentially reducing the need for additional infrastructure investments.</p>
<p><b>Utility Device Companies</b></p>	<p>Platforms that can showcase the efficiency and compatibility of their devices; increased sales through recommendation engines.</p>	<p>EkoHome serves as a conduit for promoting smart devices to environmentally conscious consumers, driving adoption and facilitating seamless device integration.</p>
<p><b>Environmental Agencies</b></p>	<p>Scalable solutions to reduce energy consumption and emissions; public engagement in sustainability efforts.</p>	<p>EkoHome directly contributes to sustainability by optimizing energy use and educating users about efficient practices, aligning with the agencies' mission.</p>
<p><b>API Companies</b></p>	<p>Reliable partners who can utilize their data to create user-friendly applications; expanded use cases for their APIs.</p>	<p>EkoHome leverages these APIs to fetch real-time data, demonstrating the value and versatility of API companies' offerings to a broader market.</p>

*Table 5-1, Key Stakeholder Analysis*

	<p><b>Users' Definition</b></p>	<p><b>Stakeholders' Definition</b></p>
<p><b>Process Value:</b></p>	<p>Users value a clear, intuitive, and comprehensive system that provides real-time data on energy consumption patterns. They appreciate actionable insights that guide them in making informed decisions.</p>	<p>Stakeholders value the adoption rate of the system, the accuracy of data collected, and the overall user engagement. They also value feedback loops that can help in refining and improving the system.</p>
<p><b>Final Result Value:</b></p>	<p>Users value the tangible results in the form of reduced energy bills, a more sustainable living environment, and the peace of mind knowing they are making environmentally conscious decisions.</p>	<p>Stakeholders value the broader impact on energy conservation, increased sales or adoption of energy-efficient devices, and positive environmental outcomes.</p>

*Table 5-2, Stakeholder Analysis*

Needs & Desires of Rate-Payers	Needs & Desires of Stakeholder
Receive real-time alerts on rate changes, usage spikes, and anomalies.	Scalable system to accommodate growing user base
Stay informed when utility inefficiencies are occurring.	Accurate data collection and analysis.
Receive actionable insights and bill-cutting recommendations, like when to use energy when it's cheapest on the grid.	Positive user feedback and high adoption rate.
Understand historical energy consumption patterns.	Integration capabilities with other platforms or devices.
Ensure data privacy and security.	Compliance with environmental and energy regulations.

*Table 5-3, Concept of Operations Document*

### **5.3 Engagement Strategies and Insights**

**Engagement with Ratepayers:** Conduct more user interviews to deeply understand their needs, and promote EkoHome through channels like social media, app stores, and community newsletters. Offering trial runs to gather feedback and refine the app is also crucial.

**Collaboration with Government and Utilities:** Highlight app's potential to reduce peak demand and support environmental policies. Discussions with policy leads and utility consultants about sustainable budgets and initiatives can uncover collaboration opportunities. Utilizing connections with SoCalGas and Arcadia exemplifies direct engagement with industry players.

**Partnerships with Device Manufacturers:** Demonstrate how EkoHome can drive device sales and enhance brand reputation through integration. Retail partnerships for distribution and visibility in stores like Home Depot can mutually benefit both parties.

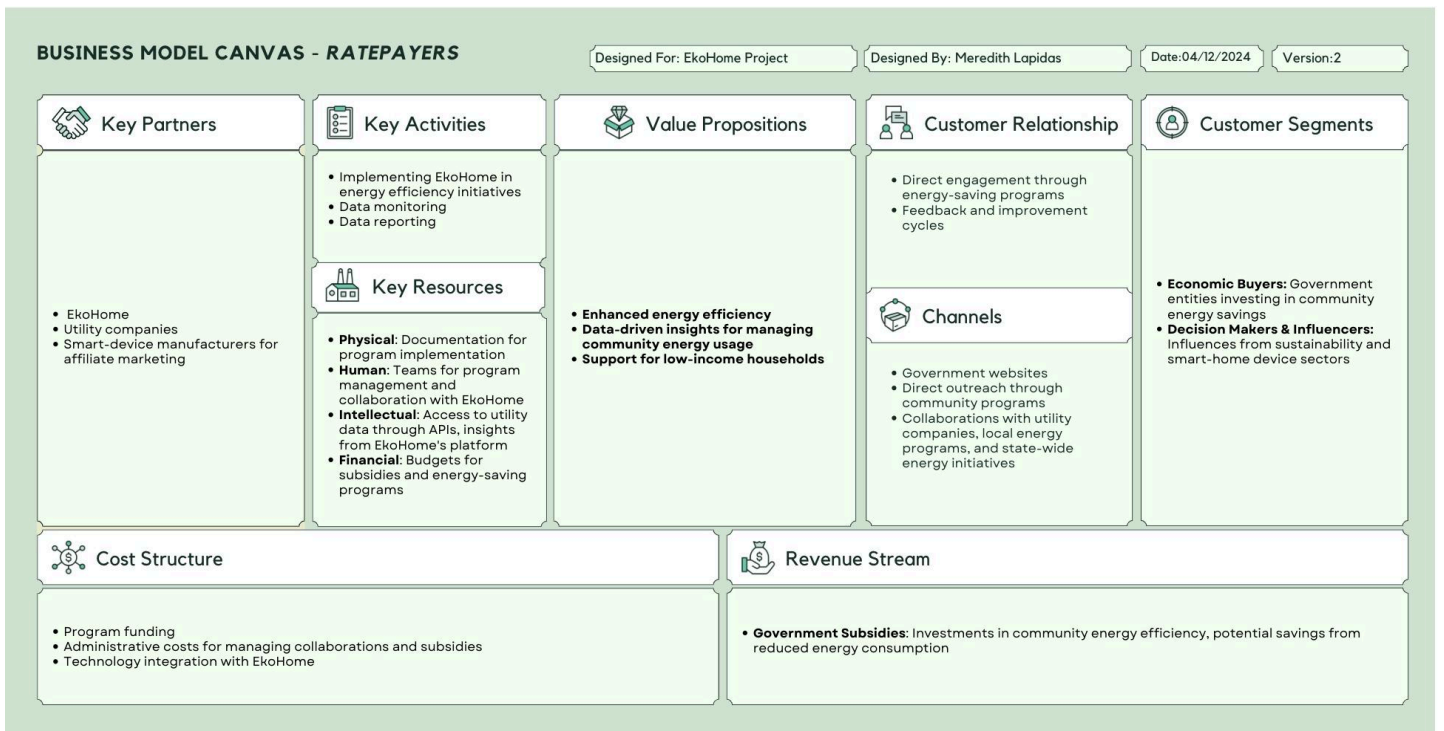
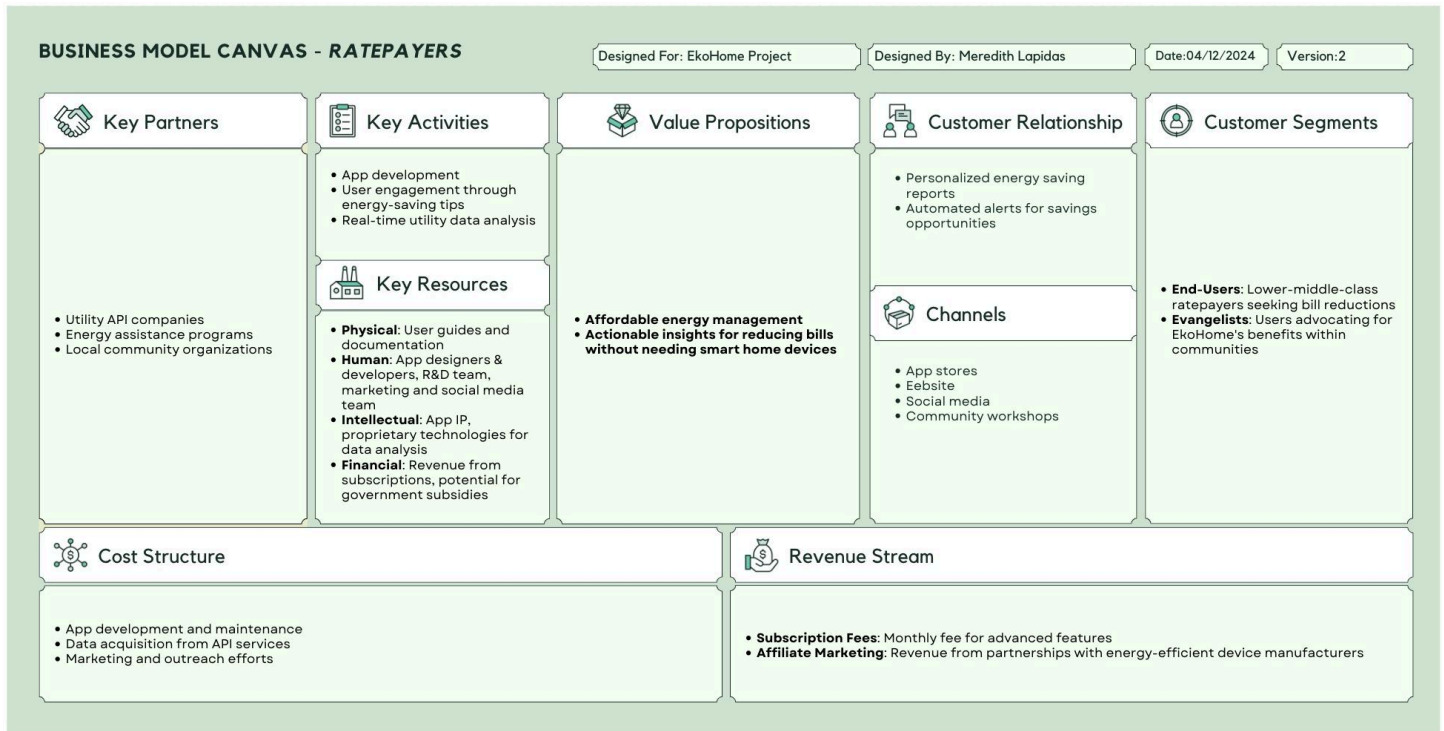
**Working with Environmental Agencies:** Present data and case studies on how EkoHome can aid in achieving emission reduction targets. Engaging in policy discussions and sustainability forums can elevate EkoHome's profile as a tool for environmental stewardship.

**Leveraging API Companies:** Building a relationship based on mutual growth, showcasing how EkoHome can serve as an innovative application of their data, and exploring co-marketing opportunities.

**To effectively engage the government as buying customer, EkoHome must showcase:**

- **Impact and Scalability:** Demonstrate how the product can significantly contribute to achieving the government's environmental targets, particularly in reducing peak utility demand and fostering widespread adoption of sustainable practices.
- **Cost-effectiveness:** Present clear evidence of the long-term savings and environmental benefits derived from investing in this project, appealing to the government's motivation to find economically viable solutions.
- **Social Equity Benefits:** Articulate how this project can help address socioeconomic disparities in energy access and affordability, aligning with the government's emphasis on social equity.
- **Comprehensive Support and Collaboration:** The commercialized product will not just be a product but also a partnership opportunity, providing full support for program implementation, including data analytics for monitoring energy savings and public engagement strategies.

# Chapter 6. Business Model Canvas



## Chapter 7. Revenue Models

### 7.1 Revenue Streams

EkoHome introduces a dual model approach to subscriptions, accommodating both individual users and government entities. The service offers a no-cost download with optional premium subscriptions, enhancing accessibility while promoting premium services. In parallel, government collaborations could see subscriptions partially or entirely subsidized, enhancing energy efficiency efforts for qualifying households without imposing additional costs.

#### Subscription Fees

EkoHome will offer a flexible, dual-model subscription approach, catering to both B2C and B2B segments. This versatility allows the company to reach a broader audience, from individual households to businesses and government entities. Users can download EkoHome for free and opt for a subscription to access premium features. This ensures basic accessibility while offering enhanced services for a fee. In collaboration with government agencies, subscriptions could also be partially or fully subsidized for qualifying households, promoting energy efficiency without the burden of additional costs. By demonstrating EkoHome's effectiveness in reducing energy bills for low-income families, the company will seek subsidies from entities like the EPA and city-wide programs. These subsidies not only support user access but also align with governmental goals of increasing energy efficiency and reducing energy poverty. The company will also negotiate funding models with government entities based on the tangible savings EkoHome achieves, creating a win-win scenario that fosters widespread adoption.

#### Subscription Price Points

- **B2C Model: Direct Subscriptions at \$10/month/household**
  - Targeting both unsubsidized and subsidized segments.
- **B2B Model: Government-Sponsored Subscriptions at \$9/month/household**
  - This negotiated bulk rate could be feasible for government entities to subsidize access, providing widespread benefits at a sustainable cost.

#### Affiliate Marketing

- **Affiliate Marketing Initiatives:** EkoHome aims to partner with smart-device manufacturers and retailers to feature their products in the EkoHome app, and to generate revenue through advertising fees or profit-sharing from app-driven sales.
- **Brand Development and User Engagement:** The company will leverage EkoHome's growing user base and market presence as a platform for affiliate partnerships. EkoHome will focus on demonstrating user engagement and brand loyalty to attract and secure affiliate relationships.
- **Strategies for Expanding Market Presence:** The company will utilize community and government programs to showcase EkoHome's benefits, enhancing its credibility and attracting new users. EkoHome will share success stories and quantifiable savings achieved by users to underline the app's value proposition. The company will implement targeted

digital marketing campaigns to highlight potential savings and ease of use, aiming to broaden the user base.

- **Pricing Model for Affiliate Marketing:** EkoHome will establish a pricing model for marketing partnerships with device brands, potentially ranging from \$500 to \$5,000 per campaign, based on visibility and campaign duration.
- **Adaptability and Financial Viability:** The company will acknowledge the need for potential adjustments in strategy based on evolving costs, user acquisition rates, and details of government partnerships. It will be important to emphasize the financial viability of EkoHome, underscored by opportunities from government subsidies and direct subscriptions.

#### **Total Projected Revenue:**

- **Total Revenue Before Expenses:** \$6,892,200 (Unsubsidized) + \$344,610 (Subsidized) + \$2,216,125 (Government Subsidy) = **\$9,452,935 in revenue for a realistic first year**

## **Chapter 8. Production and Distribution Plan**

EkoHome's production and distribution strategy is designed to ensure that our innovative energy management solution reaches our target audience efficiently while maintaining the highest standards of quality and compatibility.

### **8.1 Software Developments**

EkoHome will employ an agile development process for the app, enabling rapid iteration, testing, and deployment to respond swiftly to user feedback and market demands. The company will also continuously update the application by implementing regular software updates to enhance features, improve user experience, and integrate the latest energy-saving technologies.

### **8.2 Distribution Strategy**

#### **Digital Distribution:**

1. **App Stores:** EkoHome will be available on major app platforms such as the Apple App Store for iOS and Google Play Store for Android, ensuring easy access for all users.
2. **EkoHome Website:** Offer EkoHome for download directly from our website, providing an alternative access point for users and additional information about the app's features and benefits.
3. **Utility Websites:** Offer EkoHome for download from utility provider websites, alongside the discount or rebate promotional offer, to the app store or EkoHome's website.
4. **Retail Partnerships:** EkoHome will collaborate with retailers, like Home Depot, to promote EkoHome and related smart devices, using physical retail spaces to increase visibility and accessibility. The company will also create in-store promotional materials and demos to educate potential users about EkoHome's benefits and how it works with smart home devices.

### **Digital Channels:**

EkoHome will utilize social media platforms and website to engage with users, offer support, and provide updates on new features and tips for maximizing energy savings. The company will also develop a content strategy that includes how-to guides, FAQs, and tutorial videos to assist users in getting the most out of EkoHome.

### **Community Engagement:**

Engagement with local communities and environmental groups will promote EkoHome as a tool for achieving energy efficiency and sustainability goals. The company will also participate in community events and sustainability fairs to demonstrate EkoHome's benefits firsthand and gather feedback for further improvements.

## **Chapter 9. Marketing Plan**

EkoHome aims to redefine energy management through innovative solutions, addressing the sustainability goals of today's environmentally-conscious consumer. Our marketing strategy focuses on establishing partnerships, leveraging digital platforms, and educating both consumers and businesses about the benefits of energy efficiency.

### **9.1 Marketing Objectives**

The primary marketing objectives are to increase awareness of EkoHome, drive adoption of the product, and build partnerships. The first goal is to raise the profile of EkoHome among potential users, government bodies, and retail partners through targeted marketing and partnerships. Driving adoption includes encouraging downloads and subscriptions by demonstrating EkoHome's value in saving energy and money. Finally, EkoHome can establish strong relationships with government agencies, environmental groups, and retailers to support sales and distribution.

#### **Government and Environmental Agencies:**

EkoHome is strategically aligning with government bodies and environmental agencies to embed its technology within broader conservation and sustainability initiatives. By collaborating on policy-making, EkoHome aims to set a precedent for energy efficiency, serving as a pivotal case study for successful technology implementation in public programs. Moreover, EkoHome is working to be included in various rebate programs that incentivize users financially, making sustainability both an environmental choice and a financially sound decision.

#### **Retail Partnerships with Small Businesses:**

EkoHome's partnership strategy extends to retailers such as Home Depot, where EkoHome's compatible energy-efficient devices will be distributed. This collaboration not only benefits our retail partners by promoting them within our app as preferred suppliers but also supports EkoHome's business model through commissions on sales. Furthermore, by providing our partners with marketing support and data, EkoHome can enhance their "green" credentials while driving significant store

traffic, emulating successful models like that seen with Starbucks' personalized mobile campaigns. Starbucks leveraged its mobile app to account for 25% of the company's transactions by offering personalized advertising experiences, proving the effectiveness and ROI of tailored mobile marketing strategies. [30] Device manufacturers and retailers might be willing to partner with platforms like EkoHome if they can see a clear path to reaching their target audience effectively, with tangible ROI. Demonstrating a strong user base, effective engagement strategies, and the ability to deliver personalized content could be key to establishing such partnerships.

### **Digital Distribution and Engagement:**

EkoHome's initial launch will focus on the iOS platform, followed by an Android version, to ensure wide accessibility. EkoHome must be dedicated to maximizing the digital presence through strategic app store optimization and engagement tactics that aim to boost downloads and active use. By positioning EkoHome prominently in app stores and enhancing its digital footprint, the company plans to tap into the lucrative digital market effectively.

### **Integrated Marketing Campaigns:**

EkoHome's marketing approach includes targeted digital campaigns aimed at potential users and influencers, highlighting the unique features and benefits of EkoHome. The business plan also includes investing in community programs and rebates in collaboration with government and environmental agencies, which not only promotes community benefits but also encourages user participation through financial incentives. Additionally, EkoHome will produce educational content such as tutorials, blog posts, and videos to educate consumers on the importance of energy efficiency and the operational benefits of using the app.

## **Chapter 10. Finance Plan**

### **10.1 Channel Economics**

#### **API Costs:**

Based on UtilityAPI's pricing model, EkoHome's cost per user for accessing utility APIs can vary depending on the payment plan chosen and the frequency of data collection needed for each user's meter. Partnership with utility API companies like Arcadia API or UtilityAPI introduces variable costs based on service usage. I will use UtilityAPI as a reference for potential API costs.

- **UtilityAPI's Costs:**
  - **Historical Collections Cost:** For a **single historical collection** of data (which can range from 12 to 24 months of data per meter), costs range from **\$12.00 to \$15.00** per collection, depending on the prepaid payment plan.
  - **Ongoing Monitoring Cost:**
    - For **monthly monitoring** of each meter, costs range from **\$2.40 to \$3.00** per month.
    - For **weekly monitoring**, costs range from **\$9.60 to \$12.00** per month.
    - For **daily monitoring**, costs range from **\$24.00 to \$30.00** per month.

- Given these details, the **initial cost per user** for EkoHome would be the cost of one historical collection plus the ongoing monitoring cost. For example, using the pay-as-you-go plan:
  - **Initial Historical Collection:** \$15.00 (one-time)
  - **Ongoing Monthly Monitoring:** \$3.00 per month
- Thus, the initial cost per user could be **\$18.00** for the first month (assuming monthly ongoing monitoring starts immediately after the historical collection), and then **\$3.00 per month** thereafter for ongoing monthly monitoring.
  - Choosing a **prepaid plan** could lower these costs. For instance, with the \$3,000 prepaid plan, the initial cost per user could drop to **\$14.40** for the first month, with ongoing costs of **\$2.40 per month** for monthly monitoring.
- **EkoHome's Potential API Costs:**
  - **Initial Historical Collection:** \$15/household \* 123,075 users = total initial cost of **\$1,846,125**.
  - **Ongoing Monitoring:** \$3 per user monthly. Annually for 123,075 users = ongoing cost of **\$4,430,700** for the first year.
  - For a startup, a strategic approach to minimize costs could involve a phased rollout or negotiating better rates due to lower initial user numbers. Assuming a targeted approach that focuses on a smaller subset of the potential market initially, say 10% of the previously considered user base:  $123,075 * 10\% = 12,307.5$ , rounded to **12,308 users**.
    - **Initial Historical Collection (With a Lower Initial Amount of Users):**
      - $12,308 \text{ users} * \$15/\text{user} = \mathbf{\$184,620}$ .
    - **Ongoing Monitoring (With a Lower Initial Amount of Users):** Applying the reduction to 12,308 users:
      - $\$3/\text{user}/\text{month} * 12,308 \text{ users} * 12 \text{ months} = \mathbf{\$442,488}$

#### **App Store Fees:**

- **Unsubsidized Subscriptions: \$7 net per subscription.**
  - Calculated from \$10/month/household with a 30% commission
- **Subsidized Subscriptions: \$0.70 net per subscription**
  - Calculated from \$1/month/household with a 30% commission

#### **Backend Database and Maintenance:**

- A smaller team can leverage cost-effective cloud solutions
- Around \$12,000 in the first year

#### **Social Media & Marketing:**

- By optimizing digital marketing strategies, the cost can be lowered to cover digital advertising and content creation efforts
- Around \$30,000 in the first year

#### **Direct Costs:**

- **API Costs (Initial Collection + Ongoing Monitoring):**
  - $\$184,620 + \$442,488 = \mathbf{\$627,108}$
- **Backend Database and Maintenance Costs:**
  - Around \$24,000 annually
- **Legal Fees and Patent Registration Costs:**

- Around \$75,000 for the first year
  - This includes the costs of patent searches, application fees, lawyer fees for patent filing, and other legal advice. Legal fees and patents are crucial for EkoHome to protect intellectual property and ensure compliance.
- **Total Direct Costs:**  $\$627,108 + \$24,000 = \$751,108$

#### Operating Expenses:

- **Sales & Marketing:**
  - \$2,500,000 from an estimated \$5 per lead over digital platforms aiming to convert at least 5% into active users
- **R&D:**
  - Budgeted at \$1,500,000 focusing on feature innovation, security enhancements, and usability improvements.

#### COG (Cost of Goods) Breakdown:

- **Labor & Material:**
  - A team of 20 focusing on essential operations
  - Designers, Developers: \$750,000 for team salaries and freelance work.
  - Customer Support: \$250,000 for salaries, training, and tools.
  - Total = \$1,000,000
- **Operations Overhead:**
  - Optimizing cloud services and virtual operations reduces the need for physical office space
  - Cloud Services: \$300,000 for API data processing and backend support.
  - Office Space & Utilities: \$100,000 for operational workspace.
  - Total = \$400,000

#### User Acquisition Costs:

- Aiming to convert into 500 new customers, resulting in a CAC of \$40 per user.
- Total estimated expenditure: **\$20,000**

## 10.2 Profitability Analysis:

#### Total Expenses Calculation:

- Operational Expenses (COGS, Sales & Marketing, Distribution, General & Administrative, R&D) = **\$4,400,000**
- Direct Costs = API Costs + Legal Fees + Maintenance + Marketing =  $\$627,108 + \$75,000 + \$12,000 + \$30,000 = \$744,108$
- Total Expenses = Operational Expenses + Direct Costs =  $\$4,400,000 + \$744,108 = \$5,144,108$

#### Net Profit Calculation:

- Net Profit = Total Revenue - Total Expenses, given a Total Revenue of \$9,452,935
- **Net Profit** =  $\$9,452,935 - \$5,144,108 = \$4,308,827$

#### Profitability Milestone:

- **EkoHome could potentially achieve profitability within its first year**, assuming effective user acquisition and cost management.

## Chapter 11. Go Forward Plan

*The objective is to establish EkoHome as a leader in the energy management sector by leveraging our unique value propositions, ensuring system reliability and security, and focusing on user acquisition and engagement for sustained growth.*

As EkoHome moves forward, key strategic questions must be addressed to ensure successful integration and market penetration. A critical area of focus is determining the potential for device manufacturers and retailers to advertise on the EkoHome platform. This requires researching how similar companies decide to invest in advertising and the factors influencing their choices. An opportunity exists to create an additional revenue stream akin to Facebook ads, where EkoHome not only promotes but also recommends devices such as Flume's water management tools or Nest's thermostats in response to specific user needs, such as leak detection or energy efficiency.

Building on successful models like Flume and Nest, EkoHome will explore partnerships and promotional activities. Flume's success story, beginning with three engineering majors who quickly established critical relationships during a historic drought, shows the importance of rapid, impactful engagement with the market. Their approach, involving seamless utility onboarding and strategic partnerships with organizations like CalWep, underscores the potential for EkoHome to implement a similar strategy. Nest's collaboration with LADWP, which rewards customers for participation in energy-saving programs, provides a template for how EkoHome could structure incentives within its own partnerships.

Additionally, understanding government expectations for energy savings and the specific targets they seek from technological integrations will be essential. This knowledge will guide EkoHome's development and marketing strategies, ensuring the platform aligns with governmental energy reduction goals and maximizes its appeal to both public agencies and private consumers. By examining these models and strategies, EkoHome plans to position itself as a significant player in the energy management sector, leveraging technology to foster sustainable practices among a broad user base.

### **11.1 Timeline and Milestones**

#### **Phase 0: Design & Development (0-5 Months)**

- **Concept Refinement:** Focus on finalizing the service offerings and user interface.
- **Technical Infrastructure:** Set up the basic API integrations and backend systems.
- **Initial Partnerships:** Begin discussions with potential government and retail partners.

#### **Phase 1: Launch Preparation (0-3 Months)**

- **Technical Testing:** Implement continuous system performance tests to iron out any issues.

- **Security Audits:** Conduct initial comprehensive security checks to safeguard user data.
- **Market Analysis:** Finalize analysis of competitor offerings and user needs to refine EkoHome's marketing messages.
- **App Store Optimization:** Prepare for launch on iOS and Android with keyword research and promotional materials.

#### **Phase 2: Launch and Initial Growth (4-6 Months)**

- **Official Launch:** Release EkoHome on both iOS and Android platforms.
- **User Acquisition Campaigns:** Start targeted digital marketing campaigns focusing on user acquisition, emphasizing real-time notifications and user-friendly platform features.
- **Partnership Development:** Initiate collaborations with smart-device manufacturers, retailers, & government agencies.
- **Community Engagement:** Engage with users via social media and community events to boost brand visibility and user feedback.

#### **Phase 3: Expansion and Optimization (7-12 Months)**

- **Scalability Tests:** Conduct tests to ensure EkoHome can handle an increasing user base.
- **Feature Updates:** Based on user feedback, roll out updates and new features that address user needs.
- **Business Growth Analysis:** Evaluate initial business growth metrics and adjust strategies accordingly.
- **Expansion of Partnerships:** Broaden retail and smart-device manufacturer partnerships to increase distribution channels.

#### **Phase 4: Sustained Growth and New Markets (Year 2 Onwards)**

- **New Market Entry:** Explore opportunities in new geographic locations based on market research.
- **Continued Optimization:** Ongoing system performance, security, and scalability testing and improvements.
- **KPI and Growth Monitoring:** Regularly review key performance and growth indicators, adjusting strategies to maintain positive trends.
- **Innovation and Diversification:** Investigate and develop additional features or services that complement EkoHome, keeping the platform at the forefront of technology.

#### **Measurement Methods**

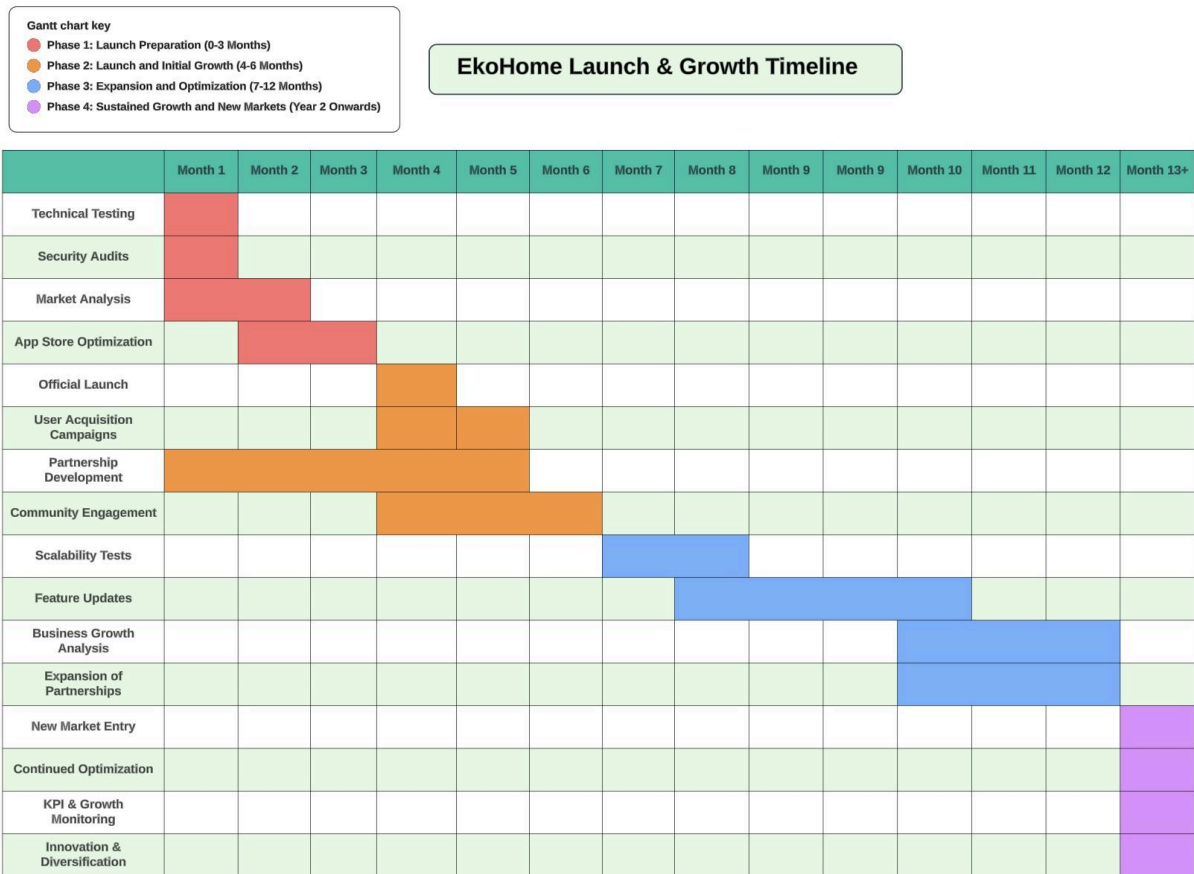
1. Regular performance and security tests will be done to ensure system reliability.
2. Metrics such as user engagement and conversion rates will be used to guide ongoing enhancements.
3. EkoHome will stand out by offering real-time energy management solutions tailored to user preferences and sustainability goals.

#### **Key Growth Indicators**

1. EkoHome will track daily/monthly active users, session length, retention rates, and website traffic to understand user behavior and preferences.
2. EkoHome will focus on evaluating the following key business metrics to measure business health and guide the company's financial decisions: Lifetime Value (LTV), Customer Acquisition Cost (CAC), and Return on Investment (ROI).

**Differentiation and Traction**

1. By capitalizing on offering real-time notifications and a user-friendly platform, EkoHome will address gaps left by traditional utility companies.
2. EkoHome will prioritize user feedback and continuous improvement to ensure that the company remains responsive to user needs and preferences, fostering loyalty and word-of-mouth referrals.



*Figure 11-1, EkoHome Launch and Growth Timeline*

By executing this go-forward plan, EkoHome aims to not only capture but sustain a leadership position in the energy management market, delivering unparalleled value to users and setting new standards in the industry.

# Executive Summary

# Executive Summary



## Introduction

In an era prioritizing sustainability and energy efficiency, EkoHome stands out as a beacon for change, specifically designed to empower low-income ratepayers. This innovative solution demystifies energy management, offering a pathway to reduced energy bills and a smaller carbon footprint. EkoHome bridges the gap between essential energy-saving opportunities and the communities most in need, making sustainable living accessible to all.

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## About the Company

EkoHome provides low-income households with easy-to-use tools for optimizing their energy consumption. Our mission is to simplify the complex world of energy data, transforming it into actionable, understandable insights for everyday users. EkoHome is committed to enhancing the quality of life for its users while actively contributing to global environmental conservation efforts.

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## Products & Services

EkoHome stands out for its real-time utility rate insights and personalized energy feedback, crafted for ease of use without the need for smart home device integration. Our services focus on delivering actionable recommendations for reducing bills, timely alerts on rate changes, and educational content aimed at fostering energy savings knowledge. EkoHome makes energy management both accessible and impactful for its users.

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## Market & Competitor Analysis

In the crowded energy management space, EkoHome distinguishes itself by serving low-income households, a group often ignored by the industry. Our solution doesn't require smart home devices, setting us apart with greater accessibility and directly addressing a vital market gap. EkoHome's commitment to inclusivity places us at the forefront of the energy efficiency movement.

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## Conclusion

EkoHome transcends being merely an app to become a catalyst for inclusive sustainable living. With a focus on simplicity and direct impact, we're democratizing energy management for low-income families, challenging the status quo of who benefits from energy conservation. Moving forward, EkoHome is dedicated to broadening its impact, ensuring economic barriers don't hinder participation in sustainable practices.

# Appendices

## *Appendix A: List of Key Industry Interviews*

### **Kate Henningsen**

*COO and Co-founder, Arcadia*

Key Learnings: Discussed the feasibility of EkoHome and facilitated platform access for thorough testing. Emphasized the importance of API integration for user data access.

### **Evan Birenbaum**

*Previous Co-Founder of Chai Energy*

Key Learnings: Provided insights into technological viability and the impact of the Green Button Initiative. Discussed Chai Energy's challenges with user interface and market sustainability which led to its bankruptcy.

### **Ralph Kaiser**

*Senior Director of Enterprise Sales, Flume*

Key Learnings: Outlined Flume's strategy for utility engagement and rebate programs. Noted Flume's success in drought states and potential partnerships aimed at conservation technologies.

### **Joe Leiva**

*Team Member, Research, Development & Demonstration at SoCalGas*

Key Learnings: Shared insights on SoCalGas's internal innovations focus, particularly the 'Aspire 2045' project. Suggested more customer-facing perspectives might benefit EkoHome's alignment with utility goals.

### **Dawn Oberg**

*Environmental Protection Specialist, EPA*

Key Learnings: Provided links and resources related to environmental justice and energy efficiency programs, crucial for navigating federal support and enhancing EkoHome's outreach to disadvantaged communities.

### **Crystal Soo**

*Mentor, CleanTech Open*

Key Learnings: Highlighted the importance of mentorship in guiding startups through market strategy and financial modeling, essential for EkoHome's market positioning.

### **Ken Hayes**

*Executive, CleanTech Open*

Key Learnings: Discussed the competitive nature of the cleantech market and the importance of local utility partnerships and federal initiatives in facilitating community-oriented energy solutions.

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