

A BUSINESS PLAN FOR RESIDENTIAL MICROGRID SOFTWARE

By

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May 2020

Masters project submitted in partial fulfillment of the
requirements for the Master of Environmental Management degree in
the Nicholas School of the Environment of
Duke University

BUILD MY GRID

an energy analytics and engagement platform

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Executive Summary: Have you ever thought about going solar or getting an electric vehicle? Do you know which utility rate would save you the most money? Does getting a battery make sense for your home?

BUILD MY GRID is the first customer-centric platform that helps residential homeowners answer some of these questions. BUILD MY GRID relies on backend algorithms that optimize utility rates and renewable energy technologies to show customers how they can save the most money by going green. Specifically, customers can compare utility rates, examine different technology combinations, and see available grid services.

The energy landscape is morphing into a sustainable decentralized system of energy resources. Residential customers will become increasingly empowered to participate in bidirectional energy management. BUILD MY GRID will help individuals engage in the energy transformation while simultaneously providing an important dataset for traditional energy players, such as utilities.

Approved



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April 20, 2020

Master's Project submitted in partial fulfillment of the requirements for the Master of Environmental Management degree in the Nicholas School of the Environment, Duke University May 2020.

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INTRODUCTION

This Master's Project follows the story of a California-based entrepreneur, who chose to go all-in on the creation of a residential microgrid software. The original purpose of this project was to create a business plan for this entrepreneur, Ria Langheim, and therefore does not follow a traditional scientific method framework. Instead, this Master's Project focused on the key components of a business plan. The first half of the paper provides market research that justifies the need for this product. The paper then moves into the business plan, which includes a strategy proposal, a marketing plan, an operational structure, and the financials. There is also a brief Epilogue, which provides an update on the current status of the project.

THE OPPORTUNITY

If you were a homeowner looking to go green, where would you start? If you start with solar, you would have to determine how much energy (which means money) you would save over the life of the system. Oh, and would you be able to charge your electric vehicle with energy from the solar system? Which utility rates would you choose in order to save the most on your monthly bills?

The energy landscape is morphing into a sustainable decentralized system of energy resources. Residential customers will become increasingly empowered to participate in bidirectional energy management. The energy landscape will become more customer-centric: residential energy resources will provide critical grid support; neighbors will look to local energy trading markets; and utility customers will demand transparency.

Providing residential customers with easy-to-access, comprehensive, and accurate insights on sustainable technology investment choices and the value of engaging in grid services is crucial to building out the energy grid of the future.

At the same time, vendors, utilities, and grid service aggregators often do not have the complete picture of their customers. These market leaders often have fragmented energy profiles for customers, as many energy data streams do not always communicate. Furthermore, these leaders may not fully understand the investment interests of their customers or make economic opportunities readily available. This disconnect creates a disadvantage for effective energy market development.

While there is currently an array of energy modeling platforms available, there is no comprehensive platform out there helping residential customers understand multi-technology adoption scenarios and co-usage of solar, electric vehicles, and battery storage technologies. No platform includes information on grid services value opportunities to customers.

The market currently does not offer customer-centric energy optimization platforms to effectively engage homeowners with future grid development.

BUSINESS DESCRIPTION

BUILD MY GRID enables residential energy consumers to choose the combination of utility rates, distributed energy technologies, and grid services that best meets their economic and environmental goals. Residential customers will finally have access to a free, user-friendly, online platform that evaluates the upfront and long-term economics of going green, so they don't have to. Customers can access the platform across multiple devices as data will be stored through secure cloud services. As more customers use the platform to inform their decisions and manage their energy profiles, the platform will have access to a swath of invaluable data for vendors, utilities, and grid service aggregators.

Our Vision is to build a free, user-friendly, online platform that accelerates the adoption of sustainable technologies and the shaping of a customer-controlled grid where homeowners can obtain value by providing grid-services.

There are three core product features on the BUILD MY GRID platform.

Utility Rate Comparisons: One of BUILD MY GRID's distinctive features is its access to a variety of utility rates and seamless incorporation of those rates into backend algorithms. In today's energy environment there are a wide array of available utility rates including Time of Use (TOU) options, Electric Vehicle Charging rates, and even solar-storage tariffs. Although the utilities are offering these diverse rates as a service to customers, they provide no value if customers do not know about them and cannot calculate the economic benefit of switching rates.

Technology Costs and Savings: The second, and perhaps core, feature of BUILD MY GRID is the ability to estimate the costs and savings associated with various distributed energy resources through backend optimization. Specifically, this feature strives to help customers answer questions such as, "I have an EV and want to go solar. What size system should I install? What does my payback look like under different financing scenarios? Which utility rate should I use?" There are so many technologies, rates, and vendors on the market for distributed energy resources, even energy experts struggle to design the best combination of technologies and quantify the economic impacts of going green. This product feature incorporates up-to-date utility rates, customer energy consumption data via Green Button APIs, and technical specs for a variety of renewable energy technologies. Customers will enjoy a simple online experience that optimizes the complexity of today's energy markets.

Third-Party Grid Services: The third feature of BUILD MY GRID is the ability to offer customers third party grid services. As the clean energy ecosystem diversifies, startups across the country are proposing grid solutions that support both utilities and customers. Grid services might include demand response programs, vehicle-to-grid pilots, and smart thermostat remote control. Most of these programs strive to take advantage of residential distributed energy resources during times of peak demand or grid stress. This saves the utility strain on its infrastructure and significant expenses associated with ramping up just-in-time “peaker” power plants. Homeowners, in turn, can receive various forms of compensation. BUILD MY GRID makes it easier for homeowners to see which services are available in their region and get started.

MARKET ENVIRONMENT

Overview

Around the world, there is a push for the adoption of clean energy and more efficient energy consumption. According to the Executive Director of the International Energy Agency, Fatih Birol, “if the world is serious about meeting its climate targets, then, as of today, there needs to be a systematic preference for investment in sustainable energy technologies.”¹ Specifically, to meet the internationally agreed upon climate goals set forth in the Paris Climate Agreement, penetration of renewable energy would have to rise from one quarter to two thirds of the global energy supply by 2040.² The US will be responsible for a significant portion of this growth.

Within the US, California often acts as a leader, providing policy frameworks and customer behavior for other states to emulate. Specifically, California has already demonstrated exceptional growth in solar, electric vehicle, and energy storage adoption. For this reason, BUILD MY GRID will launch in California. Specifically, BUILD MY GRID will first focus on customers in San Diego Gas & Electric Territory. The reasoning behind this decision will be discussed further in the target customer section.

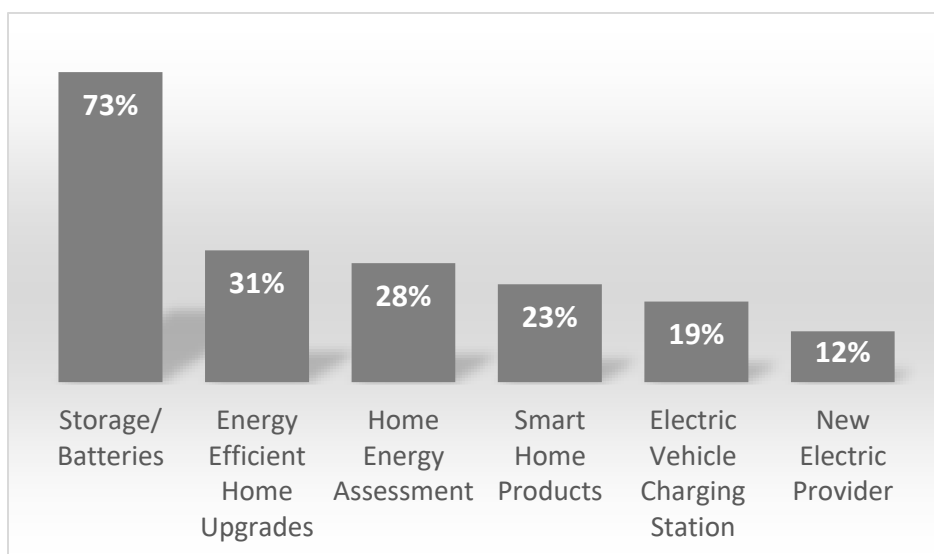
To gain a better understanding of the growth potential in California, one can look at the recent history of residential solar adoption in the state. Residential solar growth in California has accelerated year over year, pushing California to rank first nationally for cumulative megawatts of installed solar (*See Figure 1*). Within California, San Diego has proven to be a first-mover and leader, surpassing the all other utility territories in terms of residential installed capacity (*See Figure 2 and 3*).

Given that the residential solar industry has consistently experienced growth rates upwards of 50% throughout the last decades, growth rates are showing signs of flattening.³ Nonetheless, one should not interpret this as a declining market. In 2018, the California Energy Commission passed a New Building

Solar Mandate, requiring all new residential constructions to have rooftop solar. Even though rooftop solar has historically accounted for a small percentage of residential solar installations, the mandate “provides significant upside to California’s long-term forecasts beginning in 2020.”⁴

Perhaps more importantly, growth in residential solar suggests there will be growth in other distributed technologies as well. Nationally, solar customers are pre-dispositioned to have an interest in adding other technologies to their residential portfolio: for example, among customers who have already installed residential PV systems, 73% expressed interest in energy storage options, and 19% expressed interest in EV charging infrastructure.⁵

Figure 4: Percentage of US Residential Solar Customers Who Expressed Interest in Additional Distributed Energy Resources When Surveyed



Source: EnergySage Solar Marketplace Intel Report 2017-2018, page 13.

An interest in purchasing electric vehicles is a logical extension from purchasing rooftop solar. A survey of California EV drivers who received EV incentives between 2017 and 2018 suggests that there could be co-adoption of technologies—particularly solar and EVs.⁶ About 20% of EV adopters living in single family homes had installed solar before they bought the car.⁷ About 15% indicated they would like to install solar after the EV purchase.⁸ California has demonstrated tremendous growth in electric vehicle sales over the past seven years (See Figure 5). Just between 2015 and 2016 the electric vehicle market in California grew 20%.⁹ There are now a total of 366,000 EVs in California statewide, representing 49% of all EVs in the US.¹⁰ Within California, San Diego is the third fastest growing electric vehicle market, having grown 23% between 2016 and 2017.¹¹

Equally as important as the electric vehicle itself are the consumer charging patterns. Idaho National Laboratory conducted a large study of charging behavior and found that 80% of EV charges took place at the home.¹² Furthermore, customers decided when to charge based on the most affordable electricity rates. In San Diego, the study found, most EV owners charged their vehicles between midnight and 5 AM.¹³ Synchronization between utility rates and customer charging infrastructure will be increasingly important as the electric vehicle market expands (*See Figure 6*).

Energy storage is the third technology that the BUILD MY GRID platform will incorporate into the optimization service. Legislation and price drops have spurred the residential energy storage market in CA with over 6.5 MW currently deployed at the residential level.¹⁴ Over the past year, residential solar has experienced particularly explosive growth, growing 3,833% year-over-year in terms of megawatts and 4,234% year-over-year in terms of megawatt hours.¹⁵ Growth is expected to continue or increase because of new incentives: SB 700 legislation extends Self Generation Incentive Program (SGIP) by \$166M in the residential market per year through 2023.¹⁶ Most importantly, there is no hint of this slowing down (*See Figure 7*).

To summarize the market environment: there is huge growth in solar, EVs, and battery storage. There will be an increasing need to synchronize these technologies both from the homeowner perspective and the utility perspective. California in particular is leading this charge and pushing catalyzing policy.¹⁷¹⁸

Competition

No company currently offers an online platform directly targeting residential customers to make comprehensive energy investment decisions. However, there are few barriers to entry into this market. The BUILD MY GRID platform requires access to utility tariff rate schedules, an understanding of the distributed generation technology landscape, and knowledge of policy incentives for clean energy development. No regulatory approval is required to design the platform as platform use is entirely optional and does not require proprietary utility data. Therefore, there are no major barriers that might prevent others from designing competing platforms.

In an interview with a local entrepreneur, the BUILD MY GRID team gained valuable insights about possible failure in the process. Specifically, a woman living in San Diego attempted to create a platform where homeowners could manage their home energy, with a focus on sustainability. During the interview, she emphasized that the greatest challenge was proceeding with sales and acquiring a large customer base. Although there is an inherent need for residential energy management platforms, the entrepreneur said that it is very difficult to monetize these kinds of platforms. This lesson will influence how BUILD MY GRID designs its business strategy.

Existing competition fits into three general groupings: analytics; quote estimators; and optimization platforms for engineers and developers.

Analytics: The largest category of competition to BUILD MY GRID comes from software companies providing energy analytics. Most of these services target electric utilities and commercial energy users. Users can upload utility data, run scenarios, and examine the energy impact of various distributed energy technologies including battery storage, electric vehicles, and rooftop solar. Some of these platforms also allow users to compare the financials of energy investments and download financial summaries to their desktops. However, none of the existing platforms are specifically designed to help residential customers model optimized sustainable energy scenarios for their home.

Companies: Clean Power Research (Watt Plan service), PlotWatt, Energy Toolbase

Quote Estimators: Several companies offer online platforms where customers can compare proposals from different solar installers. The most famous of these quote estimation companies is EnergySage. EnergySage has created a user-friendly experience while simultaneously generating millions of data points for the solar industry. To begin comparing estimates, the user enters his or her property address; indicates whether the property is residential, commercial, or nonprofit; and estimates the average monthly electric bill at that address. EnergySage then provides an estimate of total lifetime savings under a purchase or financing option. Customers can then create a free account and begin receiving bids from local contractors. Given that all existing quote estimators focus on solar, there may be an opportunity for BUILD MY GRID to partner with one of these platforms.

Companies: EnergySage, Solar Estimator, Solar Power Rocks

Optimization Platforms for Engineers and Developers: Several optimization platforms are available online for engineers, academics, and developers looking to design microgrid systems. However, these platforms are analytically complex and often difficult for busy homeowners to understand and operate. Even the government sponsored platforms require a subscription fee.

Companies: HOMER, Energy Toolbase, Geli, NREL

Application Programming Interface (APIs): APIs allow for seamless communication between various digital components. In the energy sector, APIs usually facilitate the transfer of utility bill or customer consumption data to external platforms capable of analyzing that data. This category does not compete with BUILD MY GRID, and in fact, BUILD MY GRID may look into partnership or subscriptions to pre-existing APIs that might facilitate data interactions.

Companies: enACT, UtilityAPI, Papros Inc, Smart Customer Mobile

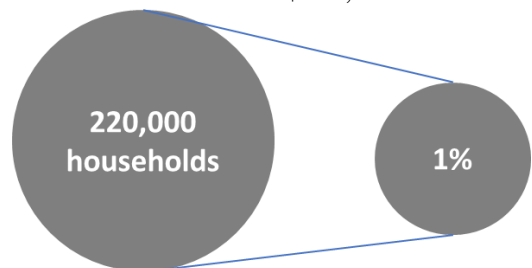
Other: There are a few companies that do not fit into these three main energy service providers. For example, OhmConnect, notifies residential customers when the grid is using “dirty” powerplants and offers financial incentives to residential customers to encourage them to power down during those times.

STRATEGY

Target Markets

Phase 1: The first phase focuses on running pilots in San Diego Gas & Electric (SDG&E) territory. There are several reasons why BUILD MY GRID has chosen to launch in SDG&E territory. One of the most important reasons for choosing SDG&E is that the utility has installed smart meters in all households. The smart meters are capable of reporting customer energy consumptions in 15-minute intervals, which can be downloaded and shared via Green Button. SDG&E has also implemented mandatory Time of Use (TOU) rates for all its solar customers and has created optional TOU rates for customers with EVs. Finally, San Diego has a high penetration of EVs and solar, and the adoption of energy storage is starting to take off. Thus, there is a substantial pool of homeowners who are interested in sustainable technologies and want to understand how to optimize usage.

A Census data cross tabulation of existing single family residential households with \$100,000+ income shows that our market size is approximately 222,000 households. Based on sales/user information from other analytical energy applications offered to residential customers, we estimate that the actual user base will be 1% of the market size—or 2,200 users.



Phase 2: The second phase will expand pilots into other leading markets—namely North Carolina, Nevada, and Arizona. These states consistently rank among the top 10 best markets for solar.¹⁹ Therefore, there is a strong customer base already aware of the benefits of distributed generation. Furthermore, these states remain regulated. BUILD MY GRID, therefore, only needs to research the rates associated with several regulated utilities as opposed to incorporating rates of various power providers.

Target Customers

BUILD MY GRID will target customers living in single family residential households with existing distributed energy resources and/or EVs as well as residential households interested in adopting additional distributed energy resources and electric vehicles. Research suggests that existing sustainable energy technology adopters and EV drivers typically own their homes, live in detached homes, live in areas that have high solar and EV penetration, have higher household incomes (\$100,00+), and higher education

(undergraduate+).²⁰ Time series analyses reveal that over time adoption typically extends to households with slightly lower incomes mainly due to technology price drops. The primary motivation for clean energy adoption is cost savings.²¹ A considerable fraction is driven by environmental motivations.²² Early adopters of the more expensive set of technologies (e.g., Tesla's, energy storage) also report to be driven by the desire to own newest technologies.

MARKETING PLAN

The short-term priority for BUILD MY GRID is to attract users and get customers to upload data to the platform. Whenever BUILD MY GRID enters a new territory, it will focus on "Office Hour" Testing followed by "Web-based Testing." Upon completing both of those testing stages, BUILD MY GRID will focus heavily on customer acquisition to grow the customer base in a given territory.

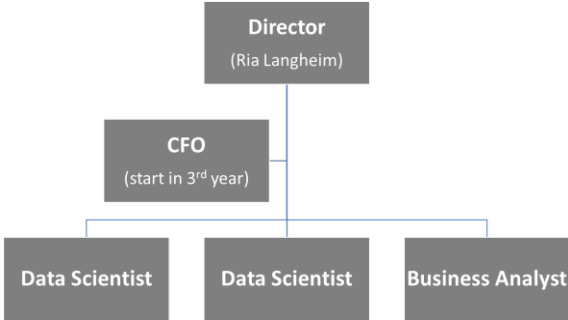
Office Hour Testing: BUILD MY GRID already has a testing group of roughly 45 customers who have expressed interest in piloting the platform in SDG&E territory. During Office Hour Testing, BUILD MY GRID staff will simply run simulations 1:1 with potential customers using a desktop version of the platform. The team will gradually automate different components of the platform in the order warranted by user testing. BUILD MY GRID will hold consultations with these early-stage customers and ask these customers to spread the word among friends.

Web-based Testing: BUILD MY GRID will complete at least three rounds of web-based testing before launching in a new territory. The first round involves a simple model (Minimum Viable Product). The second round features a more advanced version, refined based on user feedback. Once the second-round web-based platform has been robustly tested and refined, BUILD MY GRID will publish a third version, which will serve as the launch platform.

Customer Acquisition: BUILD MY GRID will focus primarily on word of mouth and building an online presence to grow its customer base. The customers who participate in Office Hour Testing will be critical to encouraging friends and neighbors to adopt BUILD MY GRID. Furthermore, the BUILD MY GRID team will work from shared working spaces and can participate in workspace events to promote the product. Beyond word of mouth, BUILD MY GRID will also establish social media accounts (i.e., facebook, twitter, Instagram, NEXTDOOR app) and provide contact information (i.e., email, phone). BUILD MY GRID already has a working website where customers can learn more about the product, even if the web-based platform is not yet available. BUILD MY GRID will also focus on partnerships with realtors, EV dealers, educational organizations, and businesses that may find the platform useful to their own development.

Phase	Task	Target Completion Date	Target												
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
1	"Office Hour" Testing	Feb-19													
1	"Web-based Testing," Refinement	Jun-19													
1	Launch Beta Version	Jul-19													
1	Incorporate BUILD MY GRID	Mar-19													
1	Customer Acquisition SDG&E	ongoing													
2	New Territory Utility Data Research	Apr-19													
2	"Office Hour" Testing in NC	May-19													
2	"Web-based Testing," Refinement	Aug-19													
2	Launch Beta Version	Oct-19													
2	Customer Acquisition New Territory	ongoing													

MANAGEMENT & OPERATIONAL STRUCTURE



Salaried staff:

Director: Ria Langheim is the founder and owner of BUILD MY GRID and will serve as the Director.

Business Analyst: BUILD MY GRID will hire a business analyst during the second year of operations. The business analyst will primarily assist the Director with business development.

Data Scientist: BUILD MY GRID will hire one data scientist in the first year (CTO) and one data scientist during the second year of operations. The data scientists will be the only full-time programmers on the team unless the need develops for more backend support.

Contractors: BUILD MY GRID will contract several programmers to help with platform development and outsource several administrative roles. BUILD MY GRID may reconsider these roles as the company grows.

Frontend Programmer: The frontend programmer will primarily be responsible for the user interface and webpage design. The majority of this work will take place during the first year, although there will be frontend contract work as needed moving forward.

Backend Programmer: The backend programmer will assist the Director in writing the optimization code. The majority of this work will take place during the first year of operations, although there may be more programming required in subsequent years.

Data Update Assistant: The Data Update Assistant will track new utility rate changes and upload relevant new rates into the model.

Accounting & Operations Services: BUILD MY GRID will outsource accounting in order to meet regulatory requirements at minimum cost. BUILD MY GRID will onboard a CFO in the fourth year once revenues warrant a full-time position.

Human Resources: BUILD MY GRID will outsource human resources. Many startups outsource human resources in order to abide by the proper hiring laws and to minimize time lost to administrative work. Most Professional Employer Organizations (PEO) set their rates as a percentage of employee salaries or as a flat monthly fee (in the case of companies employing fewer than 10 employees). PEO's typically charge "2 percent to 11 percent of wages" or a monthly fee around \$150.²³

FINANCIALS

BUILD MY GRID is exploring several possible monetization strategies. Specifically, BUILD MY GRID has identified six primary monetization strategies: user subscriptions, vendor sales commission, partnerships, neighborhood microgrid analytics for third parties, customer engagement services for utilities, and research grants. BUILD MY GRID believes that developing a strong user base will be critical to any monetization strategy the business ultimately pursues.

The Profit and Loss Statement below provides a depiction of the cash flow under a subscription scenario where customers pay for advanced platform functions. The costs depicted below represent an estimation of what could be possible based on preliminary assumptions.

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Year 5</u>
			<i>(in USD)</i>		
No. of new users (sales)	2,200	10,000	20,000	40,000	50,000
Upfront Subscription Fee	\$25	\$25	\$25	\$25	\$25
Revenues	\$55,000	\$250,000	\$500,000	\$1,000,000	\$1,250,000
COGS	\$123,757	\$23,479	\$23,479	\$23,479	\$23,479
Gross Profit	-\$68,757	\$226,521	\$476,521	\$976,521	\$1,226,521
General Administration	\$17,400	\$5,400	\$5,400	\$5,400	\$5,400
R&D (Staff)	\$91,000	\$520,000	\$656,400	\$734,448	\$785,859
Sales & Marketing	\$3,900	\$7,800	\$9,800	\$9,800	\$9,800
EBIT	-\$181,057	-\$306,679	-\$195,079	\$226,873	\$425,462
Taxes	-\$16,005	-\$27,110	-\$17,245	\$20,056	\$37,611
Free Cash Flow	-\$165,052	-\$279,569	-\$177,834	\$206,817	\$387,851

EPILOGUE

Ria has continued to work on Build My Grid since the start of this project in the fall of 2018. Shortly after the conclusion of this research, Ria had to move quickly on several administrative developments. Namely, Ria had to pick an official company name, incorporate the business, and reserve a URL address. After taking a poll from friends and prospective customers, Ria settled on the name e-Wallaby. With an official name, Ria could then proceed with incorporation and creation of the website.

With some of the administrative requirements out of the way, Ria realized that she needed help with coding if she wanted to stay on schedule. She hired several programmers from nearby universities, co-working spaces, and job sites. Specifically, Ria needed UX/UI, full stack developers, and content engineers. With new teammates on board, Ria then had to juggle the construction of her platform with managing a diverse team. Ria constantly struck a balance between doing the work herself according to the vision she had in her mind and delegating work with multiple iterations.

Finally, the team was able to use its freshly completed prototype to conduct user testing. User testing is a key step in product development and takes place throughout the product's lifespan. User testing does not

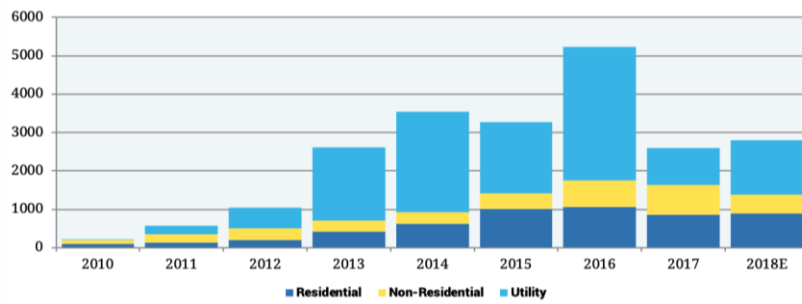
merely test the usability of the product, but rather it provides a value assessment: “Will customers use or buy the product and, if not, why not?”²⁴ During 1:1 meetings, Ria was able to show the platform to potential users and receive real-time feedback. Initial feedback suggested that users still struggled to understand the differences between different utility rates and the renewable technology offerings. Given that this is core to eWallaby’s mission, Ria knew the platform needed clarification.

Today, eWallaby’s strategy is to focus on the community. eWallaby can provide a platform for neighbors to communicate with each other and could potentially also provide a software solution for community choice aggregators (CCAs). Community choice aggregation is a policy enabled by state-level legislation that permits local governments to aggregate the electric demand of its constituents and procure that energy on behalf of its customers directly from power producers.²⁵ At the same time, CCAs can continue to use the transmission and distribution lines managed by the regional investor owned utility. Aggregators are traditionally mission-driven nonprofit entities.

Many jurisdictions in California—notably the City of San Diego—are rapidly establishing CCAs, providing an enormous opportunity for eWallaby. Given the CCA focus on community and heavy emphasis on renewables, eWallaby could potentially serve as a tool to help CCA customers find the best rates given their technological setup at home. Ria is currently in conversation with multiple CCAs and hopes to find a mutually beneficial partnership opportunity in the future.

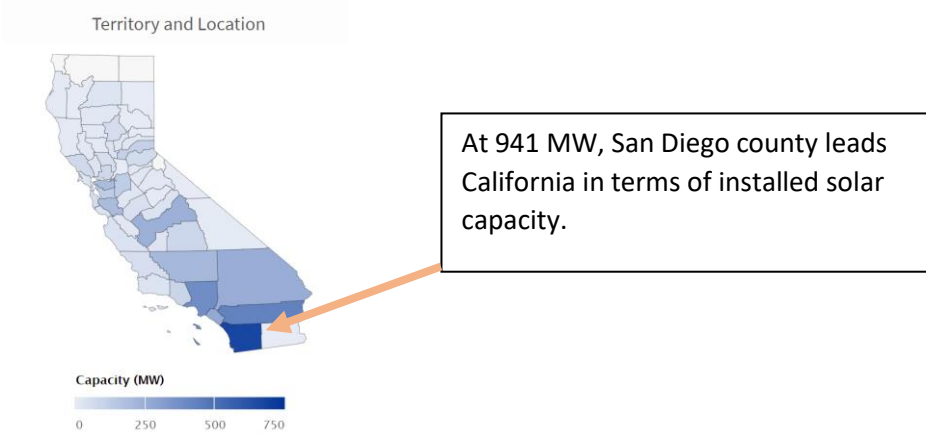
APPENDIX

Figure 1: California PV Installation Forecast (MW)



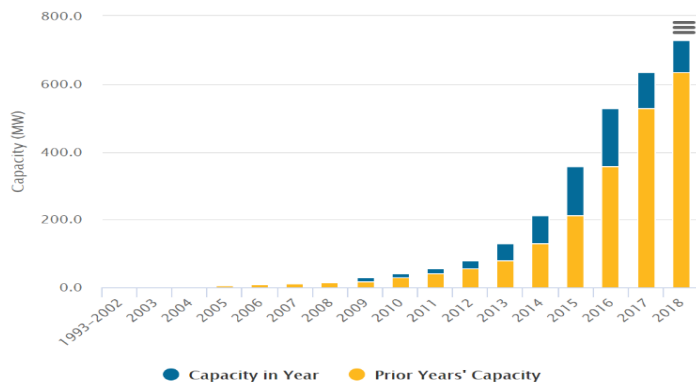
Source: “California Solar,” *Solar Energy Industry Association*, Accessed November 2019, <https://www.seia.org/state-solar-policy/california-solar>.

Figure 2: Installed Solar Capacity (MW) by Territory



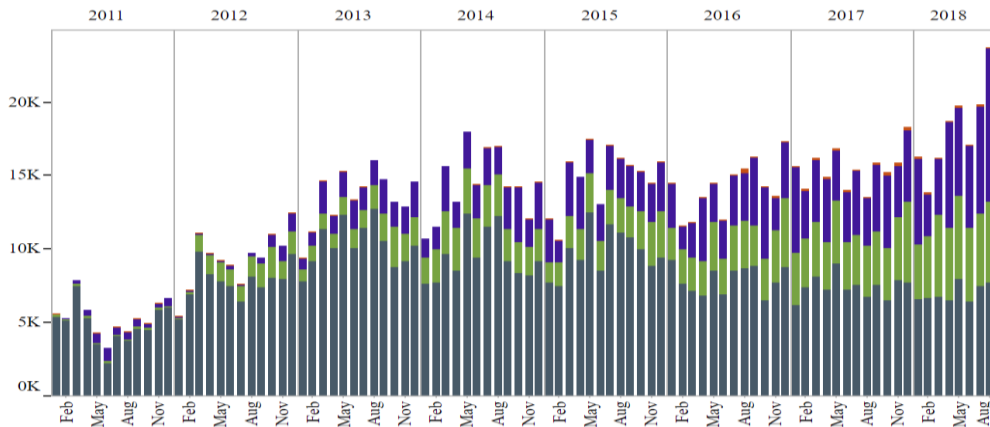
Source: “Statistics and Charts,” *Go Solar California*, Accessed November 2018, <https://www.californiadgstats.ca.gov/charts/>.

Figure 3: Year-Over-Year-Capacity-Growth



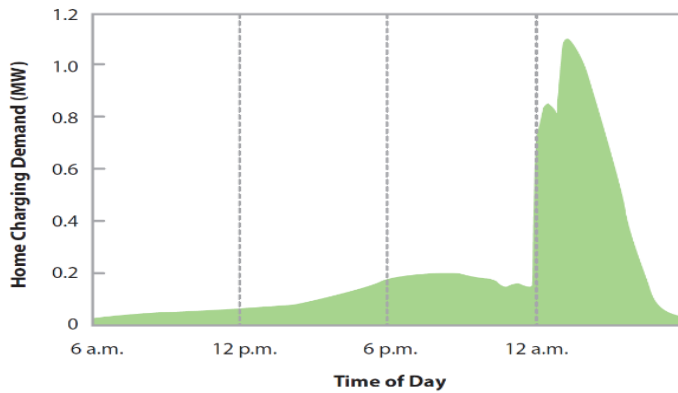
Source: “Statistics and Charts,” *Go Solar California*, Accessed November 2018, <https://www.californiadgstats.ca.gov/charts/>.

Figure 5: Monthly Electric Vehicles Sales in California



Source: “Advanced Technology Vehicle Sales Dashboard,” *Auto Alliance*, Accessed November 2018, <https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/>.

Figure 6: Total Power Drawn by EVs Charging at Home Over the Course of a Day in San Diego



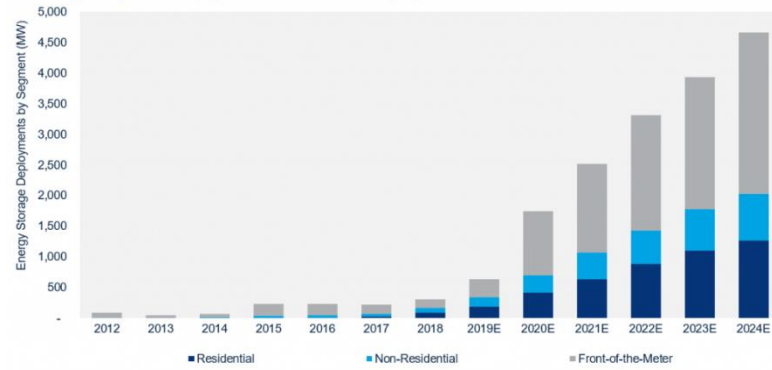
Source: “Plugged In: How Americans Charge Their Electric Vehicles,” *Idaho National Laboratory*, Accessed November 13, 2018, <https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf>.

Figure 7: Quarterly US Energy Storage Deployments (MW)

U.S. energy storage annual deployments will reach 4.7 GW by 2024

Utility procurements, changing tariffs and grid service opportunities all drive the market forward

U.S. energy storage annual deployment forecast, 2012-2024E (MW)



Source: Wood Mackenzie Power & Renewables

Source: “U.S. Energy Storage Monitor,” *Energy Storage Association*, Accessed March 29, 2020, <https://energystorage.org/resources/industry-resources/us-energy-storage-monitor/>.

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- ² “International Energy Outlook 2018,” *U.S. Energy Information Administration*, last modified July 24, 2018, https://www.eia.gov/outlooks/ieo/executive_summary.php.
- ³ “Solar Industry Research Data,” *Solar Energy Industries Association*, accessed March 29, 2020, <https://www.seia.org/solar-industry-research-data>.
- ⁴ “Solar Market Insight Report 2018 Q2,” *Solar Energy Industries Association*, accessed March 29, 2020, <https://www.seia.org/research-resources/solar-market-insight-report-2018-q2>.
- ⁵ EnergySage Solar Marketplace Intel Report 2017-2018, *Energy Sage*, page 13.
- ⁶ Bodanyi, Ryan, “EV Charging and the Vehicle Purchase Process: Lessons Learned from Rebated Consumers,” 22nd Annual Energy, Utility & Environment Conference, San Diego, California, February 27, 2019, https://cleanvehiclerebate.org/sites/default/files/attachments/EUEC_2019_EV_Charging_0.pdf.
- ⁷ *Ibid.*
- ⁸ *Ibid.*, 27.
- ⁹ “Update: California’s electric vehicle market,” *The International Council of Clean Transportation*, page 6, accessed November 19, 2018, https://www.theicct.org/sites/default/files/publications/CA-cities-EV-update_ICCT_Briefing_30052017_vF.pdf.
- ¹⁰ *Ibid.*, page 2.
- ¹¹ *Ibid.*, page 3.
- ¹² “Plugged In: How Americans Charge Their Electric Vehicles,” *Idaho National Laboratory*, Accessed November 13, 2018, <https://avt.inl.gov/sites/default/files/pdf/arra/PluggedInSummaryReport.pdf>.
- ¹³ *Ibid.*
- ¹⁴ “SGIP PROGRAM STATISTICS,” *Self-Generation Incentive Program (SGIP)*, Accessed March 29, 2020, <https://energycenter.org/sgip/statistics>.
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