**Thesis Project Portfolio**

# Solar Storage Development

(Technical Report)

# Analysis of the Integration of Sustainability in the Energy Industry

(STS Topic)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

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Bachelor of Science, School of Engineering

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## Table of Contents

Sociotechnical Synthesis

Solar Storage Development

Analysis of the Integration of Sustainability in the Energy Industry

Prospectus

# Sociotechnical Synthesis

In the United States and the rest of the world, there has been sincere effort to increase the use of renewable energy. Solar energy in particular has become much more prevalent in the state of California with the implementation of state and federal incentive programs. Simultaneously, there have been issues with predetermined blackouts due to forest fires near live electric lines. Because of this, solar storage technologies are being leveraged for short-term power outages to maintain electricity in households and businesses.

Our team has researched and designed a preliminary solar storage battery innovation in order to combat power outages and effectively integrate net metering – varied cost of electricity during peak and non-peak hours of the day. We completed this using the overarching metrics of battery type, the system as a whole, and the financial model. The battery must meet an optimal combination of cost, ecological and environmental safety, lifespan and efficiency of charge and discharge. The system as a whole regards the programming required to effectively meet standards of solar incentive programs while optimizing a priority queue of the client's choice (e.g. cost-effectiveness of net metering, full charge during blackout periods). The financial modeling takes into account the cost of the system and battery as well as the available incentive programs and creates the most affordable plan for clients based on their unique situations (e.g. low-income residential, commercial use, geographical location).

Through research, the team found the most effective battery to be a 65kWh Lithium-Iron-Phosphate (LFP) battery, using an automated and client selected priority queue system. The financial modeling uses a database – DSIRE – to find available funding programs integrated with a fixed payment plan similar to that of a mortgage. By using these solutions, there will be limited

ecological concern in gathering the battery material as well as the ability to maintain a household for an extended blackout period. Most incentive programs were established as initiators to the solar energy market, so issues in the future are more so about the continuation of government funding in the future, as the programs are ending and their renewal is tentative.

While the technical report analyzes a specific technology in renewable energies, the STS Research Paper takes a more wholistic approach of the sustainable energy sector. It analyzes the present challenges to creating a system within the United States that is both long-lasting and utilizes renewable energies.

By reviewing historical events that developed into the current energy infrastructure and focusing on obstacles to be faced by individuals, businesses, and government officials with further evolution of renewable energies, it better puts into perspective the challenges for our specific project, and the possibility of seeing our solar battery come to fruition.

The STS Research Paper explains the inefficiencies of each of the three major renewable energy sources – solar, wind and hydroelectric. The examination of the solar industry identifies needs within the industry that our team could aid in solving, those of which could be mutually beneficial to our battery's success.

In the same way, by noting federal and state involvement in energy subsidies as well as tax crediting and various power implementations, the Research Paper helped to shape our solar battery into something more cost effective for ourselves and future possible consumers, as well as create a more sustainable design in the market.

Both the Technical Report and the STS Research Paper challenge the current condition of renewable energy, although one does it through innovation and the other does it analytically and

holistically. Together they give perspective to the renewable energy sector, both from a micro and macro level.