POWERING THE FUTURE

A Collaborative Project by Paige Leeseberg, Manikantan Eakiri Lakshmanan, Zachary Beaver, and Jay Casey

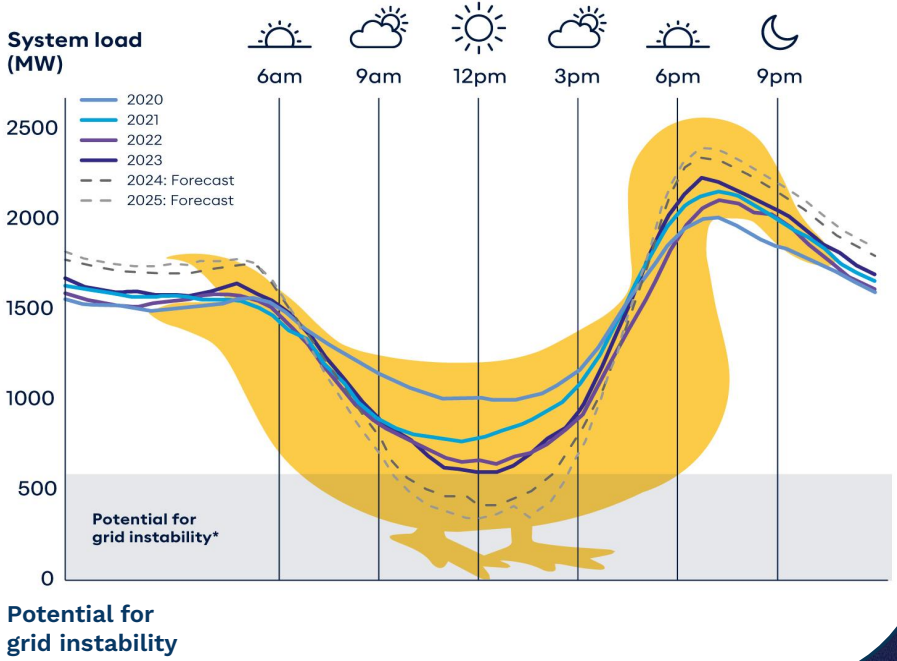
Introduction

- **Solar + Storage:** Key to reliable, sustainable, and affordable energy.
- **Regional Focus:** Hawaii, California, and Texas.
- **Drivers:** Solar potential, carbon offsets, and qualification rates.
- **Data Source:** Google Project Sunroof via BigQuery.
- **Goal:** Understand how regions use storage to boost solar adoption and grid stability.

Overview of Energy Storage Solutions

- Solar energy is **intermittent** — only works when the sun shines
- **Battery storage** makes solar power usable **24/7**
- Stores daytime energy for evening or emergency use
- Critical for **grid stability** in high solar adoption states
- Reduces **fossil fuel reliance** and improves energy resilience

Duck Curve: A Key Challenge in Grid Management



Hawaii's Solar-plus-Storage Solutions

- Uses **Lithium Iron Phosphate** batteries — safe and cost-effective
- Essential for **isolated island grid** with no external connections
- Delivers energy at ~**half the cost** of oil-generated electricity
- Programs like **Battery Bonus** incentivize solar storage adoption
- **Target: 100% renewable energy by 2045**

Energy Storage System

Flow of Energy

California’s Solar-plus-Storage Solutions

- Faces midday solar surplus vs. evening demand spikes (“**duck curve**”)
- Uses **battery storage** to shift solar energy to **peak times**
- Over **10GW** of battery capacity installed and growing
- State incentives like **SGIP** drive residential and business adoption
- Strong **policy + sunlight** = scalable renewable storage model

Texas’ Solar-plus-Storage Solutions

- **Deregulated market** and vast land ideal for **large-scale storage**
- Stores **cheap solar power** for peak demand resale
- Enhances **grid stability** during extreme weather events
- Several gigawatts of battery projects planned or in development
- Backed by **ERCOT** to support **renewables integration**

Hawaii

- Utilizes Lithium Iron Phosphate (LFP) Batteries
- Safe & Long Lasting
- Useful for Isolated Grids

California

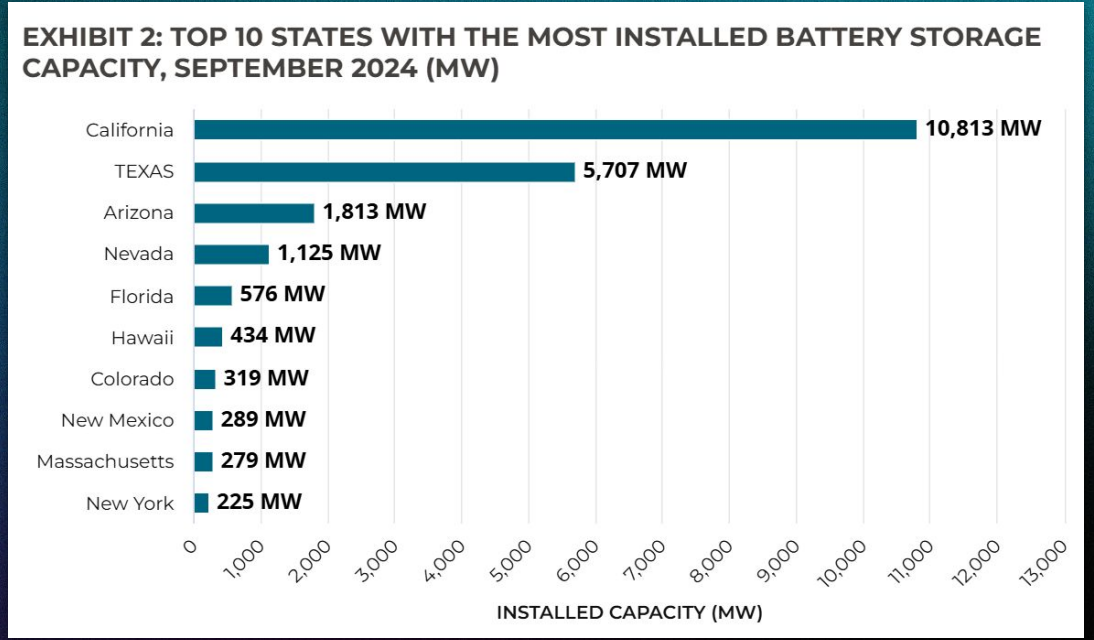
- Utilizes Lithium Ion Batteries
- Manages Duck Curve
- Keeps Grid Stable

Texas

- Utilizes Lithium Ion Batteries
- Supports Wind/Solar Farms
- Optimizes Energy Use

Battery Storage by State (August 2024)

- California is the **leading state** in battery storage
- Texas is **growing** rapidly
- Hawaii's capacity is impressive despite its size



Hawaii Energy Storage Feasibility

- **Highest electricity prices** in the USA due to historic reliance on imported oil
- Recent Solar/Storage efforts have **cut costs** nearly in half
- Working towards **100%** renewable energy by 2045

California and Hawaii Aim for 100% Renewable Energy by 2045

California Energy Storage Feasibility

- National Leader in Energy Storage (10GW+)
- Policy incentives encourage homeowners to install solar and energy storage
- Large amount of sunlight for solar production
- Working towards 100% renewable energy by 2045

Texas‘ Energy Storage Feasibility and Economics

Growth Potential for Energy Storage in Texas

- **Market Volatility:** Store low-cost solar power, sell during peak demand for profit and stability.
- **Land Availability:** Ample space for utility-scale battery systems like Tesla Megapacks.
- **Rising Renewables:** Storage balances intermittent solar and wind generation.

Benefits of Market Volatility and Land Availability in Texas

- **Market Volatility:** Enables batteries to store low-cost solar energy and sell during peak prices — boosting profits and grid balance.

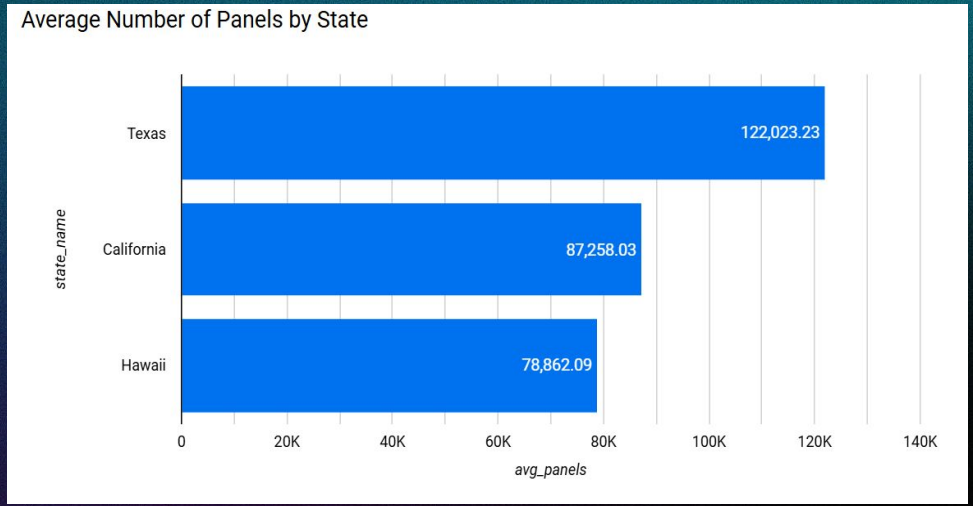
- **Land Availability:** Abundant, affordable land supports large-scale storage like Megapacks to manage high renewable output.

Energy Storage Role in Grid Stability

- **Improves resilience** in rural areas & microgrids by reducing outages and balancing supply.
- **Expands access** in remote regions by storing renewable energy for reliable use.

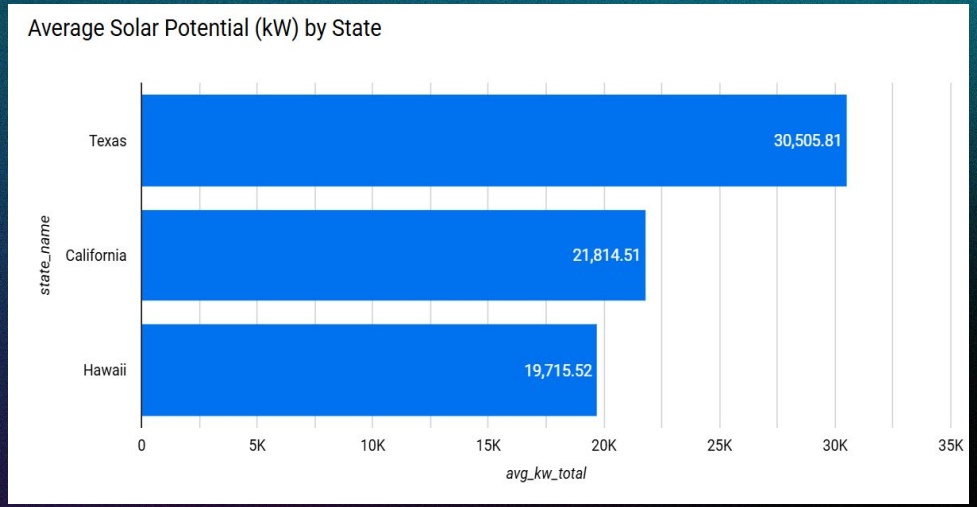
Average Number of Panels by State

- **Texas** leads with ~122K panels per census tract
- **California** follows with ~87K
- **Hawaii** averages ~79K

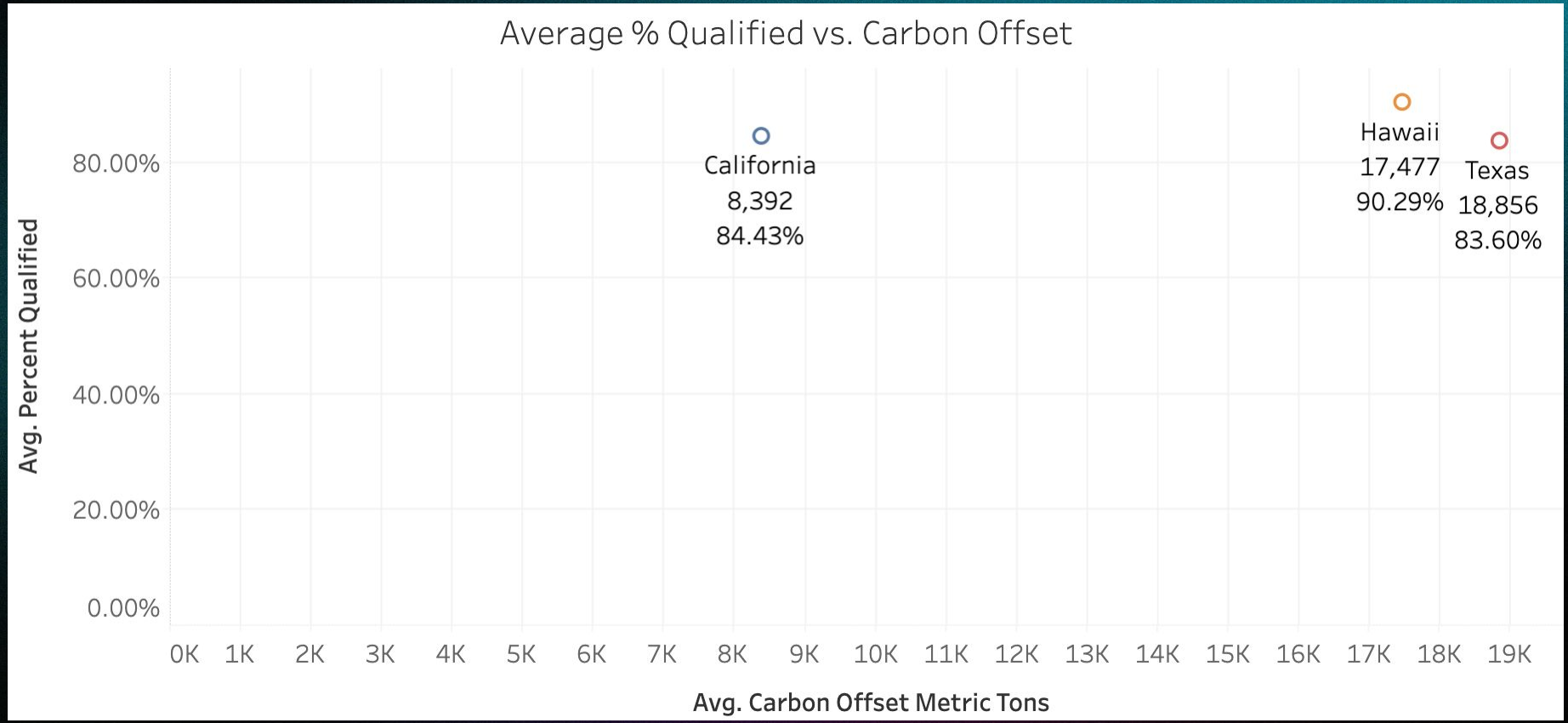


Average Solar Potential(kW) by State

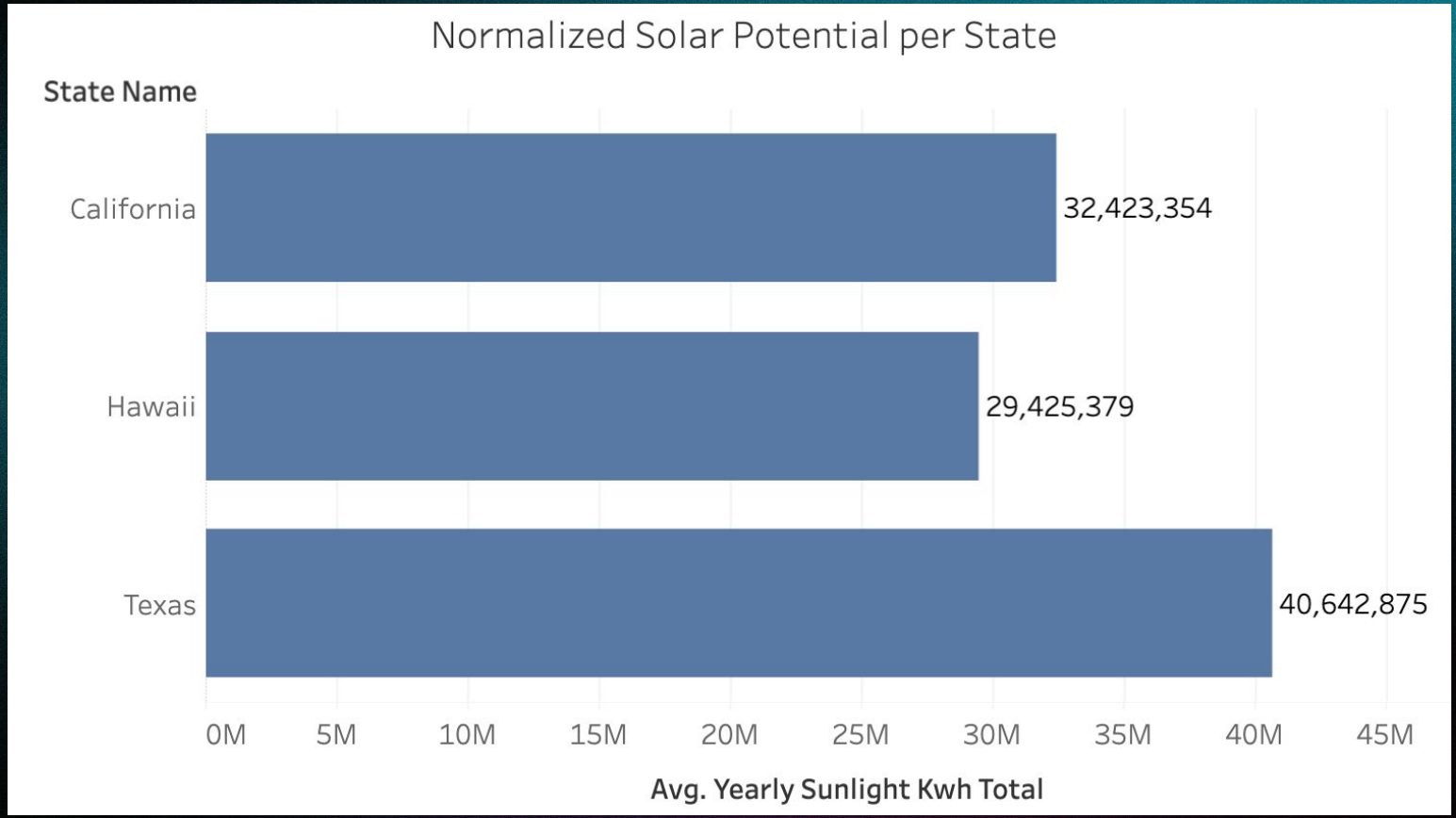
- **Texas** leads with ~30.5K kW per tract
- **California** follows with ~21.8K kW
- **Hawaii** averages ~19.7K kW



Solar Qualification Rates and Carbon Offsets by State



Solar Potential per State



Conclusion

- **Battery storage** is essential for reliable solar energy.
- **Hawaii** leads in solar qualifications but has limited potential.
- **California** excels in large-scale solar installations.
- **Texas** leverages vast land and deregulated markets for growth.
- **Energy storage** ensures grid stability and solar optimization.

Thank you for your time!

Questions?

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