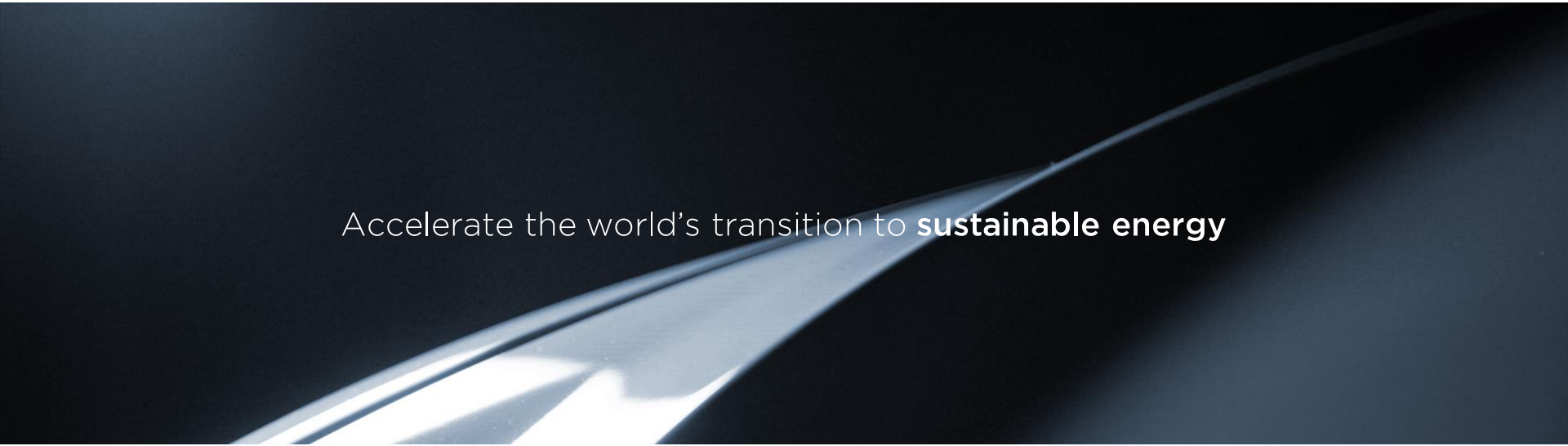
“Tesla Powerpacks enable cost effective Microgrids to accelerate the world’s transition to sustainable energy”

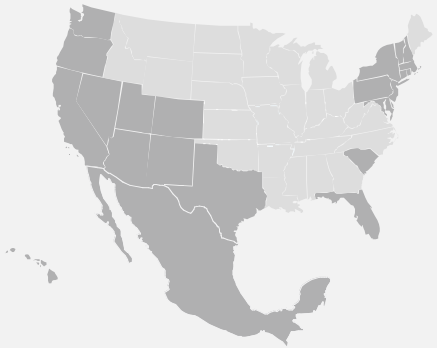
Tony Stocken and Tristan Glenwright
Tesla Energy APAC

MISSION



TIMELINE OF INNOVATION

DELIVERING SYSTEMS AT SCALE



SOLAR

2,000+ MW Solar Deployed

$9 Billion+ Project Value

STORAGE

300 MWh Storage Deployed

Systems online in 15+ countries

WORLD CLASS MANUFACTURING

Gigafactory 1

Output 50GWh/year by 2020

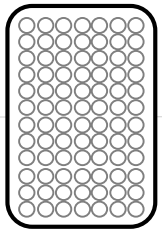
ISO 900 Quality Management

High volume, automated manufacturing producing the entire Powerpack and Powerwall systems

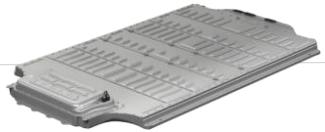
BATTERY ARCHITECTURE

Cylindrical Cells

Battery Pack



Battery Modules

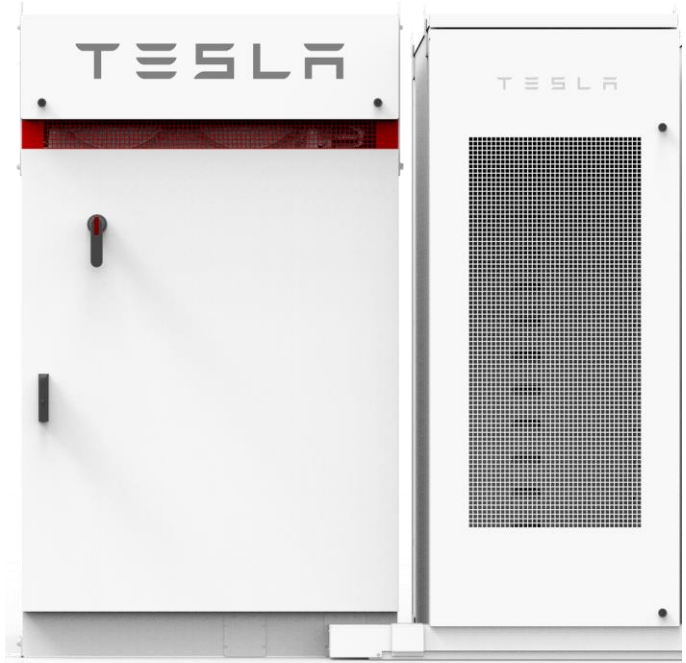


Products


POWERPACK 2

POWERPACK VALUE STREAMS

- PEAK SHAVING
- MICROGRID
- LOAD SHIFTING
- ANCILLARY SERVICES
- DEMAND RESPONSE
- CAPACITY FIRMING
- BACKUP
- T&D INVESTMENT DEFERRAL



ENERGY STORAGE BENEFITS

Reduce energy costs

Consume and shift renewable energy

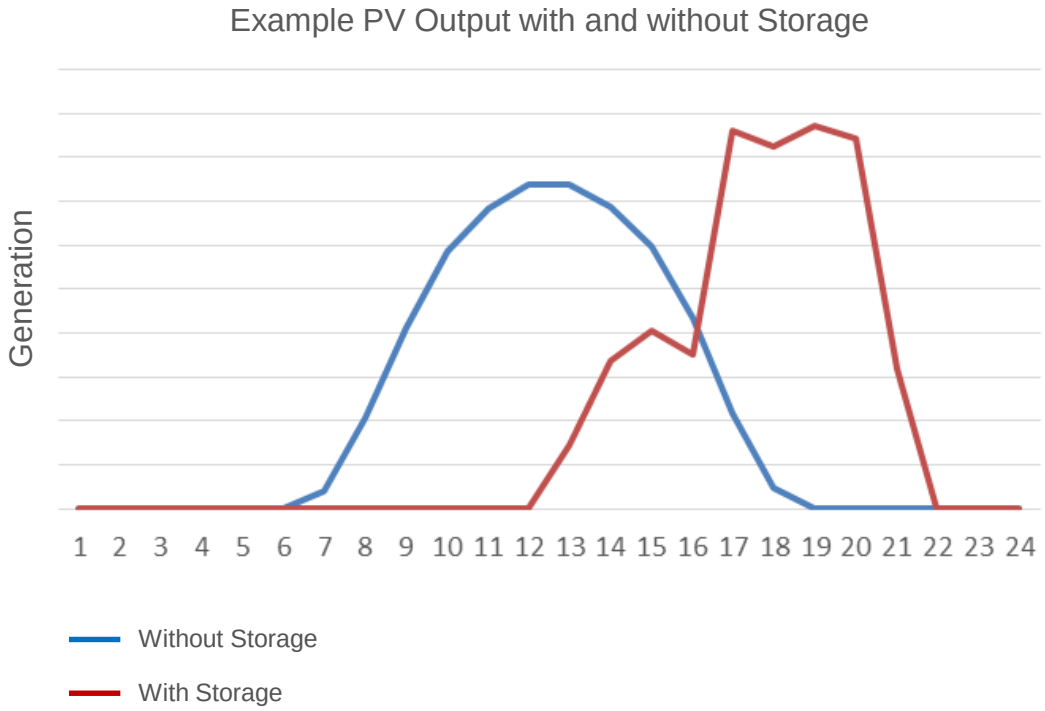
Improve power quality

Generate new revenue streams

Realise grid stability and flexibility

Drive sustainability

UTILITY SCALE PV FIRMING & TIMESHIFTING

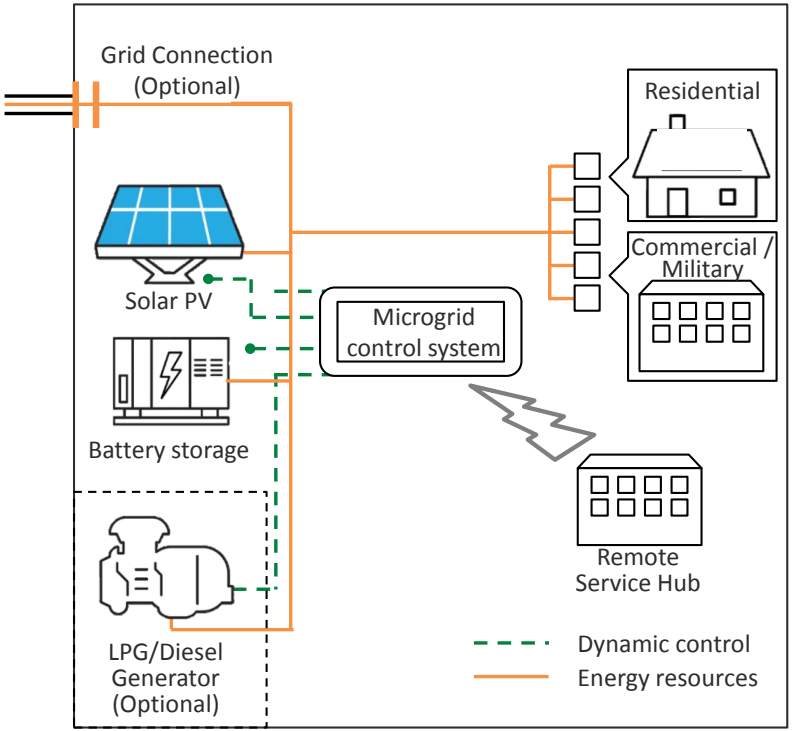


- Renewable firming and ramp rate control
- Increased grid stability
- Increased renewable energy utilization
- Time shifting of renewables

INTEGRATED MICROGRID SOLUTION

Pre-integrated System

- Solar
- Storage
- Generator (Diesel/LPG)
- Microgrid Controls
- Integrated solution that is rapidly deployable
- Highly reliable / low maintenance



COMPLETE ENERGY SOLUTION

Tesla is your single source provider of the entire energy system

POWERPACK

Lithium-ion batteries
Liquid thermal control
Isolated DC-DC converter

INVERTER

Bi-directional
Transformer-less
Modular
Off-grid and grid-tied capable
99% peak efficiency

INTEGRATED SOFTWARE

Optimization software
Battery management system
Site master controller

REMOTE MONITORING

Real-time monitoring & control
Real and reactive power services
Optimized dispatch and market participation

POWERPACK ARCHITECTURE

HIGHLY EFFICIENT CELLS

- Active liquid cooling at the cell level
  - Optimizes operational efficiency through cell temperature management
  - Maximizes the lifetime of the cells
- Operates over the widest temperature range (-13°F to 122°F / -30°C to 50°C)

SAFETY IN EVERY POD

- Sealed pod houses a low voltage battery (~50V)
- Isolated DC-DC converter minimizes risk of cascading failure
- Pod architecture creates a parallel system providing overall increased reliability
- Live battery terminals are not accessible
- IP67 rated pods

BI-DIRECTIONAL INVERTER

EFFICIENCY AT EVERY LEVEL

- Liquid cooled unit increases power density, efficiency, operating range and extends component life
- 99% peak efficiency
- 98.5% full load efficiency
- 99% CEC efficiency

MODULAR & SELF CONTAINED

- 50kW to 500kW power range per cabinet
- Modular blocks starting at 50kW
- Integrated DC combiner box from 1 to 20 Powerpacks
- Rated IP 66 (dust tight and water protected)
- Islanding and black-start capabilities
- Smart inverter features for enhanced grid support

CUSTOMER SUCCESS

ONE OF THE WORLD'S LARGEST STORAGE PROJECTS

20MW / 80MWH

48 INVERTERS

396 POWERPACKS

Customer

Southern California Edison

Location

Ontario, CA

Project Size

20 MW / 80 MWh

Applications

Peaker plant replacement

Commissioned

2016. Three months from deployment to operation

Customer

Kauai Island Utility Cooperative (KIUC)

Location

Kauai Island, HI

Project Size

13MW Solar PV

13MW / 52MWh storage

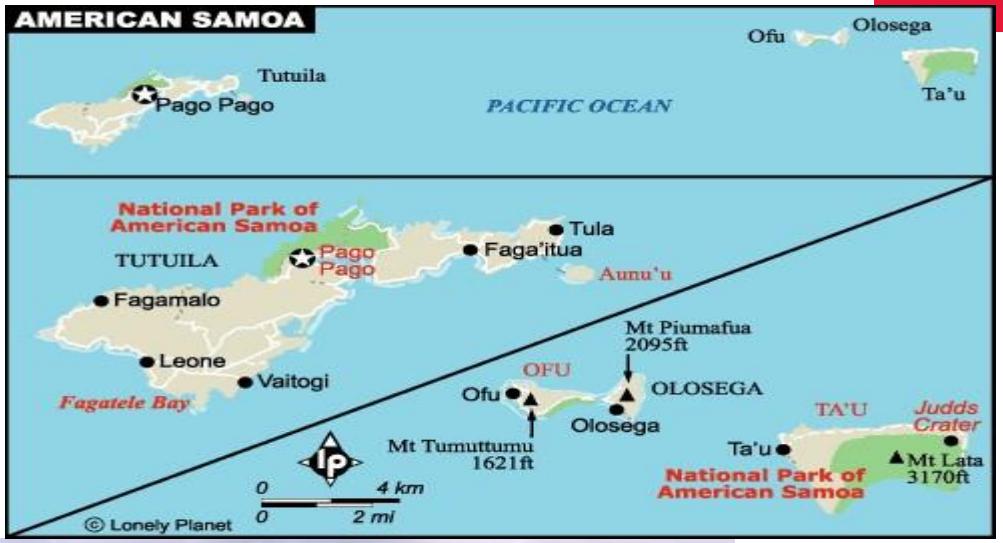
Applications

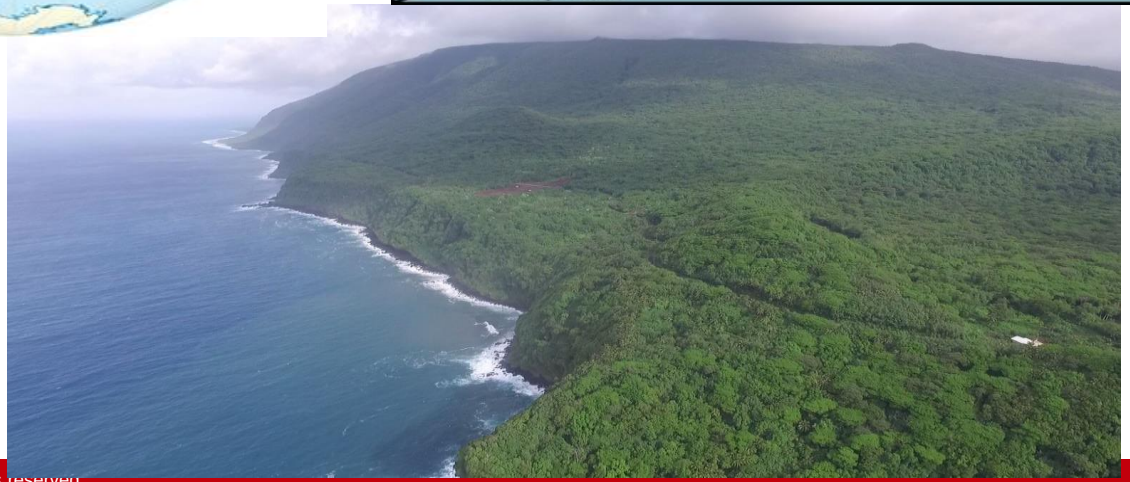
Solar energy firming and shifting

Commissioned

2017

Where is Ta'u????



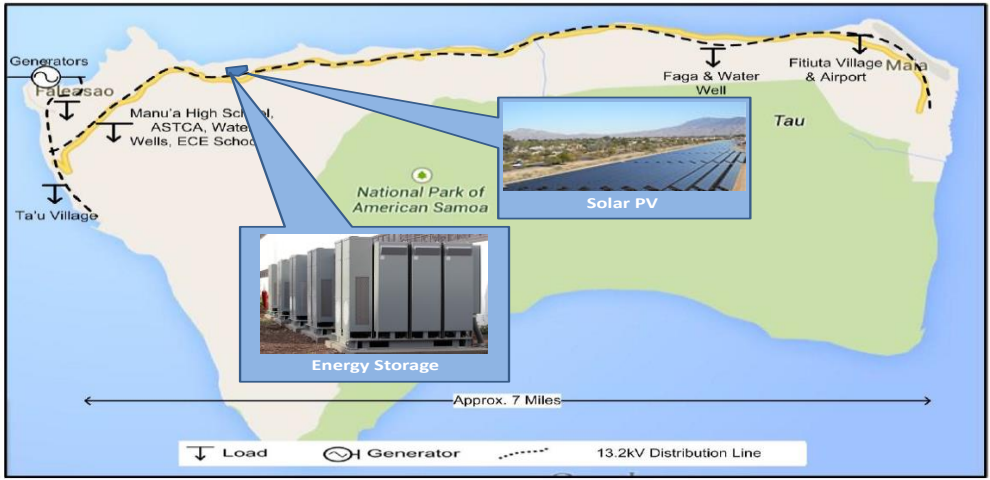


Requirements

- The primary objective of the project is to establish a sustainable and functional renewable energy system on the island of Ta'u, Manu'a.
- This renewable energy system shall be capable of providing reliable power on a 24-hour basis and meet their domestic and light industrial needs in order to facilitate economic growth
- Design Solar Hybrid Energy System that will displace 80% of present diesel use
- System is to be connected to the existing power distribution network, serving the village communities of Fitiuata, Faleasao, and Ta'u
- ASPA has 203 customers in three different villages on Ta'u
- Supply materials, build and supervise the installation of Solar PV Hybrid System which includes adequate amount of photovoltaic panels and sufficient battery storage to achieve the 80% reduction in present diesel use.
- Integrate with existing 320kW diesel generators
- Peak demand is 229kW

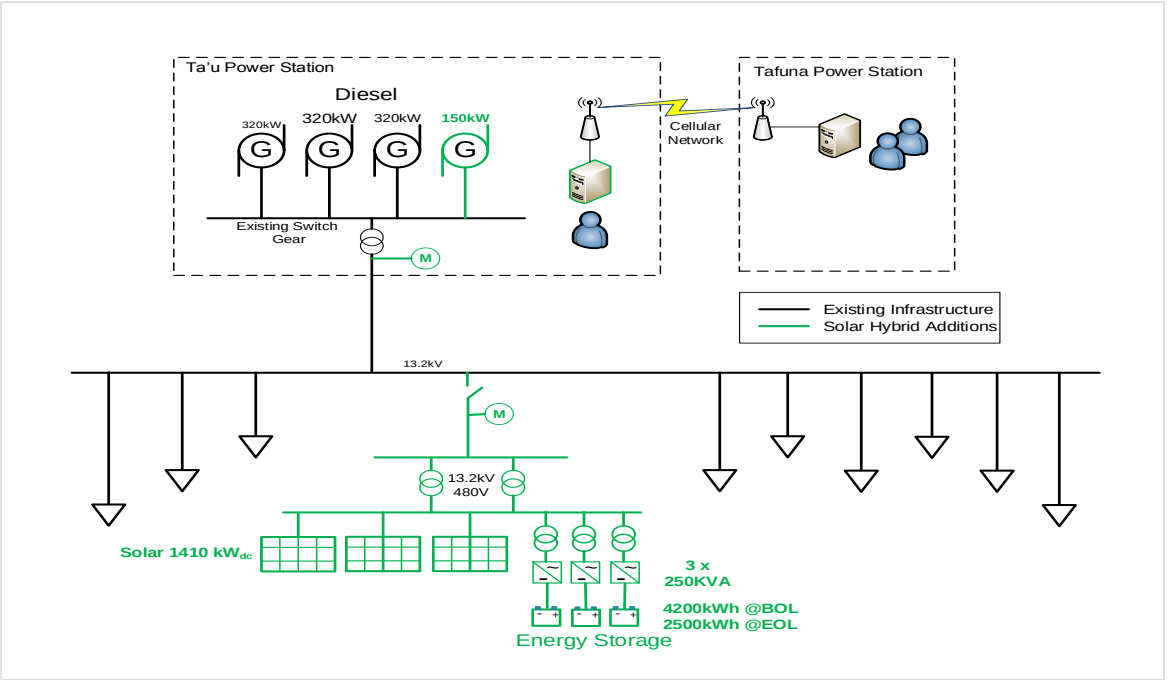
Modeling / Analysis - Overview

- Objectives
  - Size system components
  - Determine annual generation mix (% solar, % diesel, etc.)
  - Optimize economics
- Approach
  - **Economic optimization using a lifecycle cost method**
  - Combo of in-house & commercial tools (namely HOMER)
  - Modeling based off an hourly dispatch model



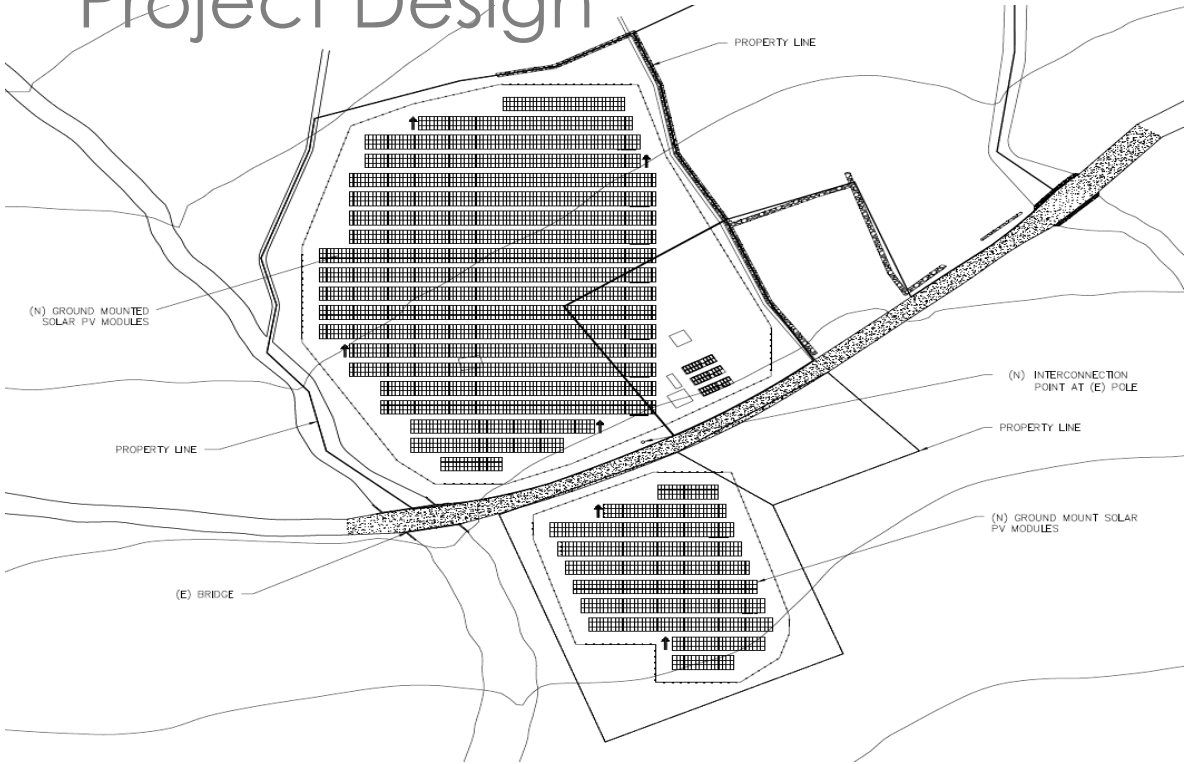
Modeling / Analysis – Results

- Final system sizing
  - 1400 kW DC PV
  - 750 kW Battery Inverter Power
  - 4,200 kWh Battery Energy Capacity
- ~85% energy from solar in year 1 (~15% from diesel)
- Battery subsequently increased to 6,000kWh



Project Design

Project Design



Equipment

Modules: Yingli 265W 60 cell
Inverter: Fronius Symo 24 kW
Energy Storage: Tesla Energy 100kWh Powerbacks and 250kW Inverter
Racking: Fixed Tilt Ground Mount
Tilt: 13°
Azimuth: 0° (North)

Specs

PV: 1,411.92 kW
Storage: 750 kW/4,500 kWh
Interconnection Voltage: 13.2 kV 3P
Interconnection Method: Grid Direct
Control System: Custom system to control storage, pv, and existing generators.

Key Challenges:

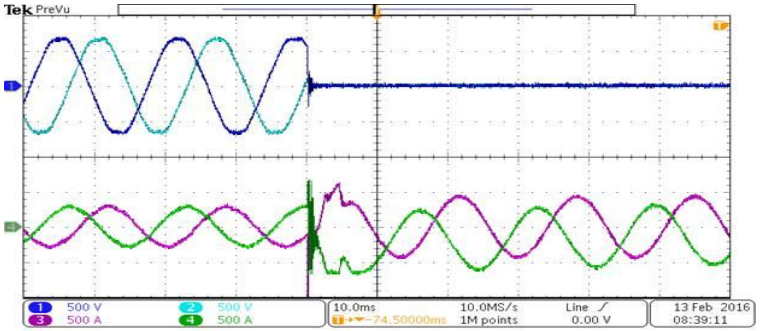
- **Logistics**
- **Client/ Contractor Dynamic**
  - Skill level of workers
- **General Remoteness**
- **Weather**
- **Other Country Nuances:**
  - Language barriers
  - Cultural sensitivities

Counteractive Solutions:

- **Patience/ empathy**
- **Perseverance**
- **Diligence**
- **Training**
- **Making it Easy (as possible)**

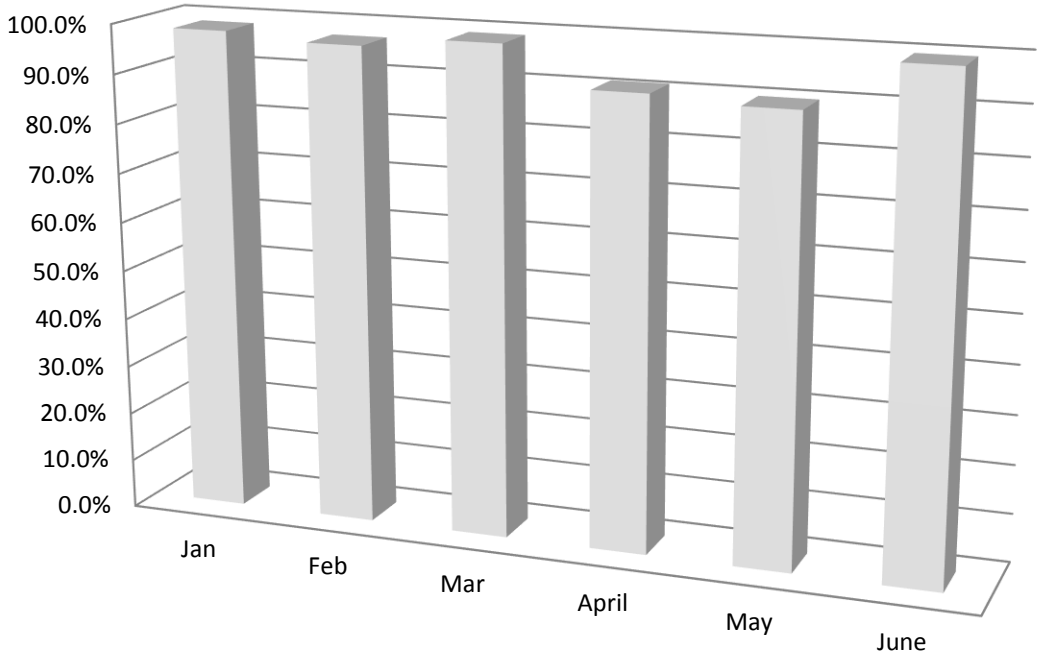
Integration Challenges

- Existing Switchgear & Generators
  - Not in good condition (older than me!)
- Electrical Distribution System
  - 3-phase at diesels
  - 1 or 2 phase distribution
  - Not balanced
- Protection Coordination
  - Island grid will be “formed” primarily by battery inverters - Power Electronics
  - Insufficient fault current to blow fused distribution system protection



Training:

Ta'u Diesel Displacement



	Jan	Feb	Mar	April	May	June
Diesel Displacement	98.4%	97.0%	99.0%	91.2%	89.9%	99.6%

THANK YOU!