

Lanai Overview

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Lanai & Kauai

- Similarity:
 - Island communities with complete dependency on oil
 - December peaking

- Differences:
 - Size and population
 - Kauai – Electric cooperative: 78 MW peak (December); 5 distinct load centers
 - Lanai – Property of single owner; Electric grid owned by MECO: 5.5 MW peak (December); 4 distinct load centers

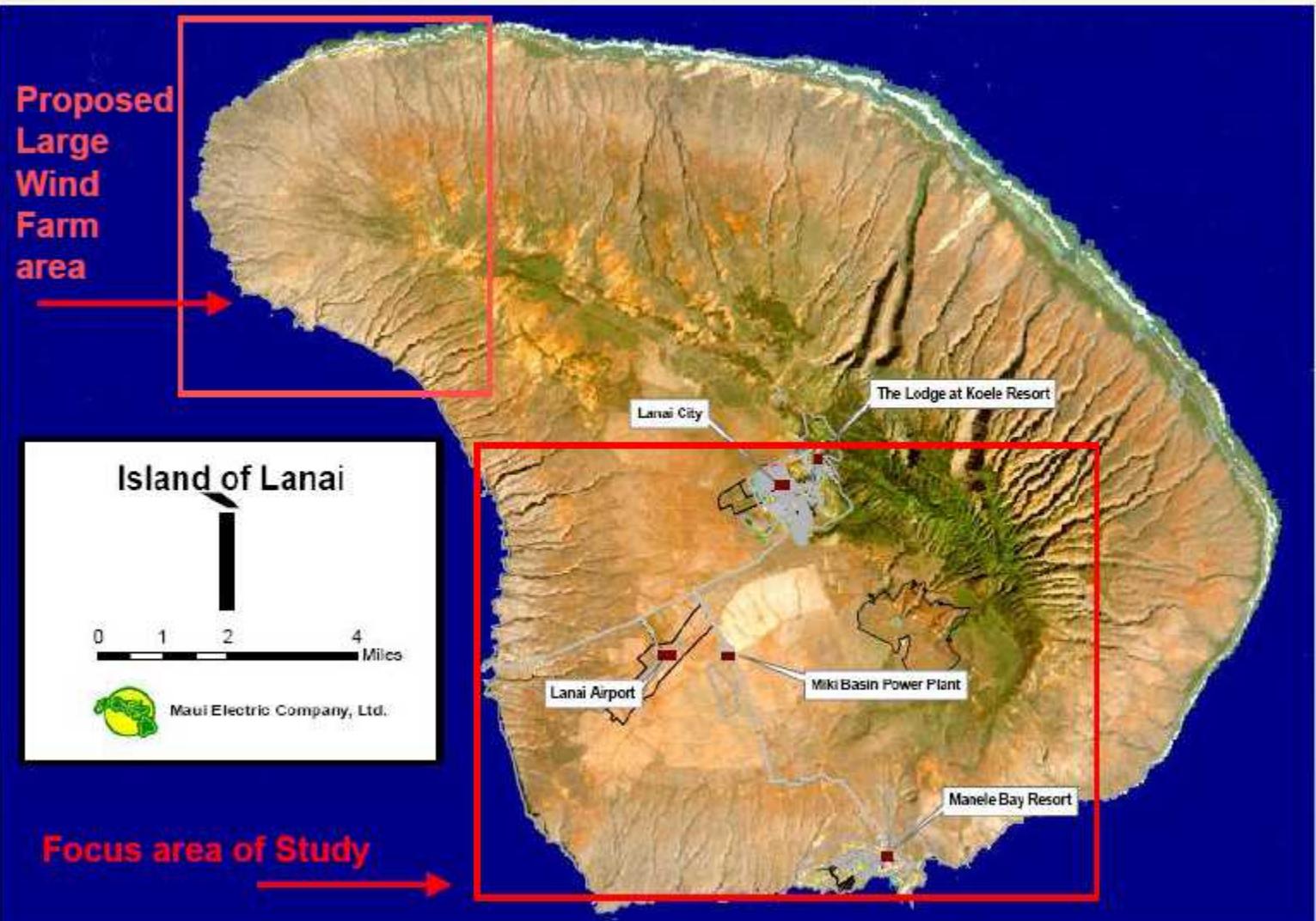




Lanai Project Objective

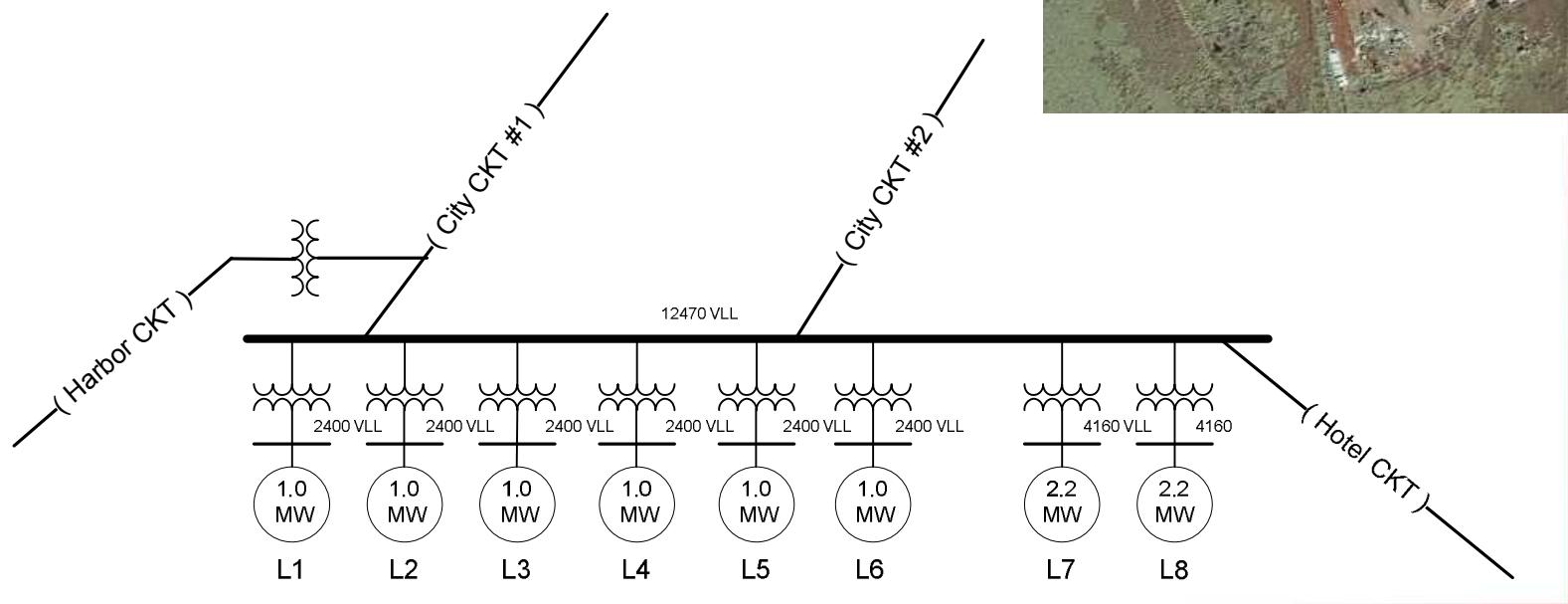
- Initial Goal:
70% penetration of renewable energy into the electric generation mix
- Final Goal:
100% renewable electricity generation and transportation services

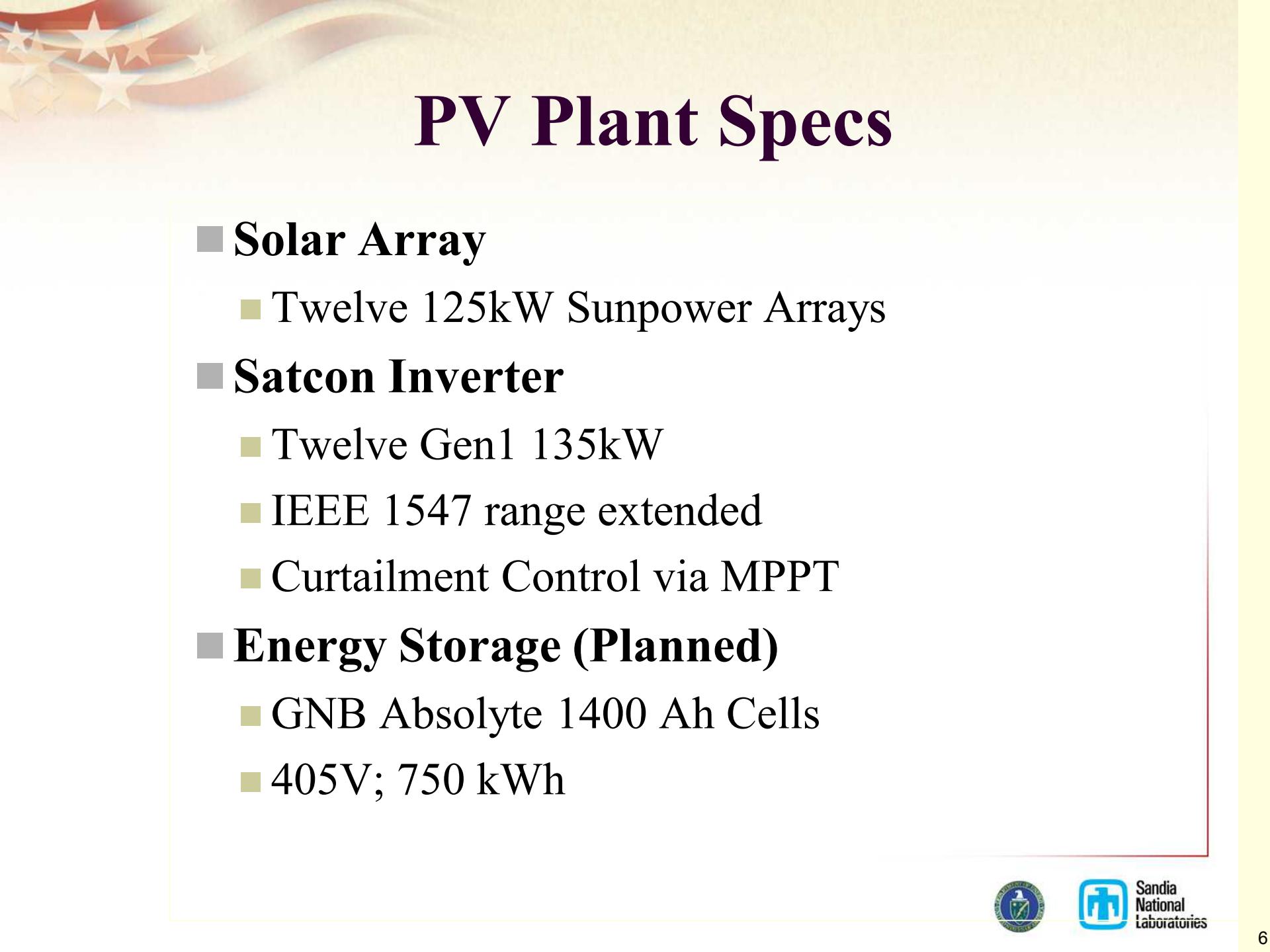




Miki Basin Power Station

Six 1.0 MW EMD Diesel Generators
Two 2.2 MW Caterpillar Diesel Generators





PV Plant Specs

■ Solar Array

- Twelve 125kW Sunpower Arrays

■ Satcon Inverter

- Twelve Gen1 135kW
- IEEE 1547 range extended
- Curtailment Control via MPPT

■ Energy Storage (Planned)

- GNB Absolyte 1400 Ah Cells
- 405V; 750 kWh





1.5MW Hawaii's largest Solar Farm in service December 2008

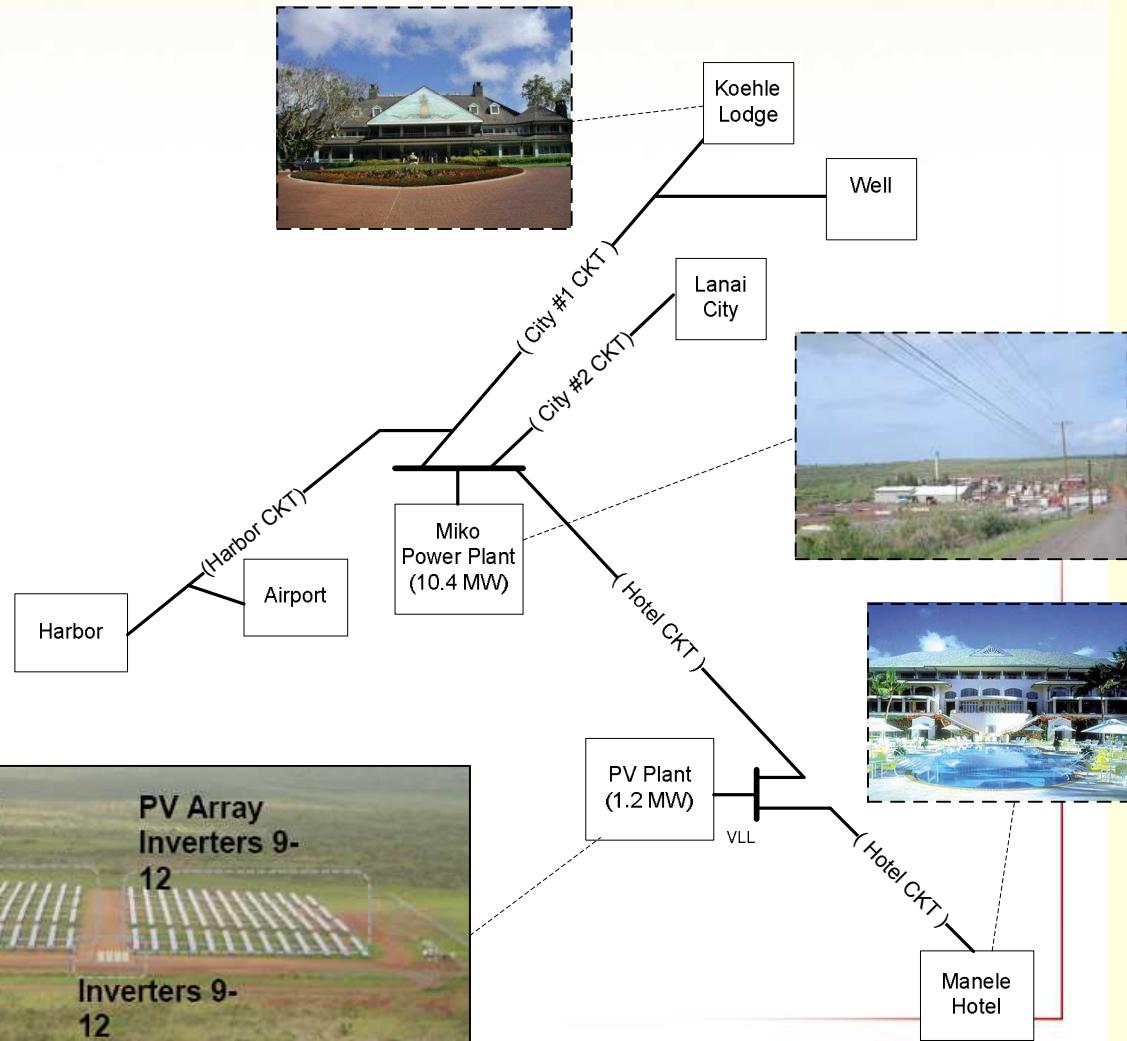
10 acres, 12 separate arrays, 7,000+ panels, tracker system

3,000MWhour production = 30% of Lanai's daytime peak demand, 10% of Lanai's annual demand

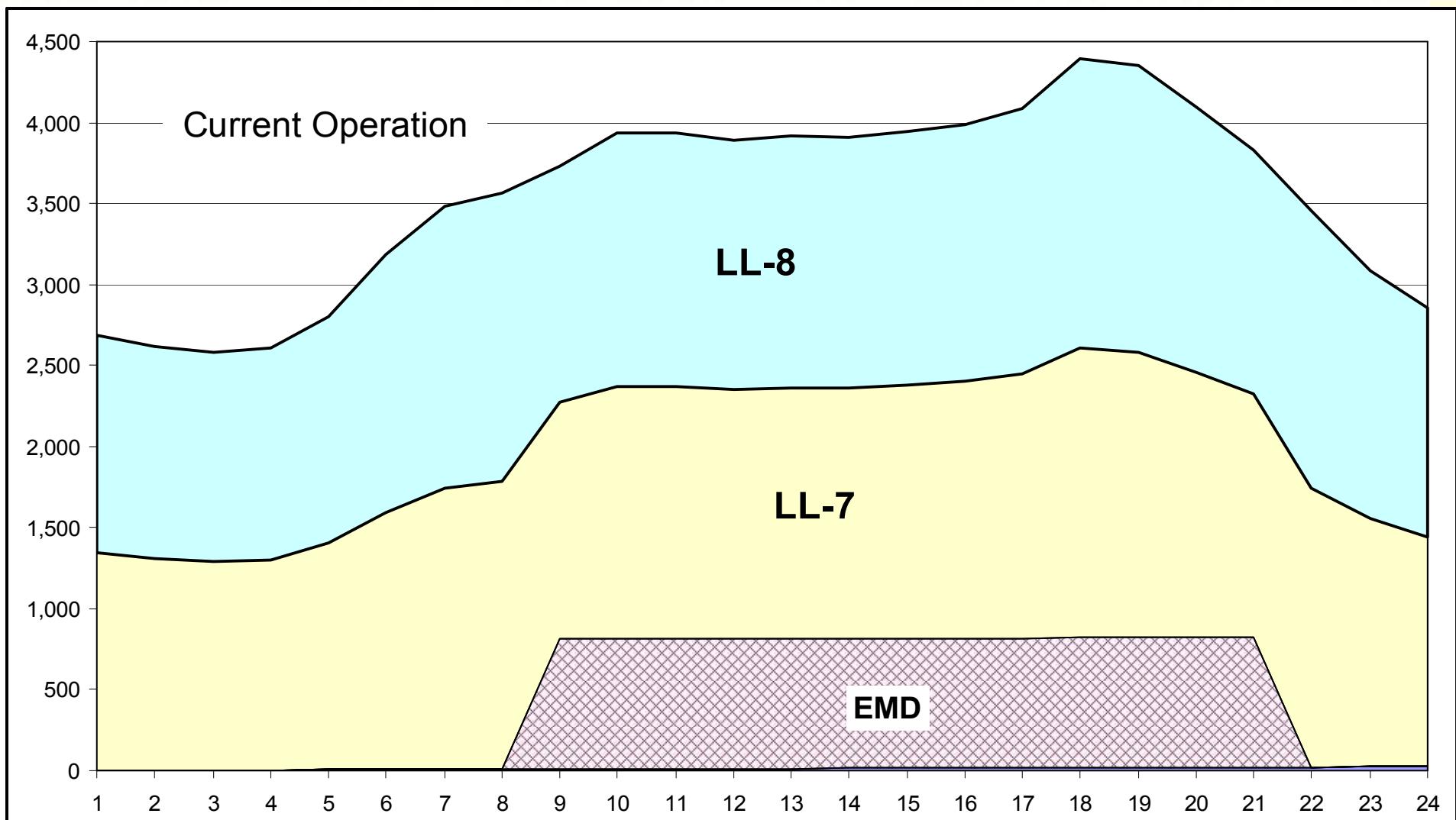
2,300 tons of carbon dioxide emissions eliminated annually = 5,000 barrels of oil or 237,000 gallons of gasoline



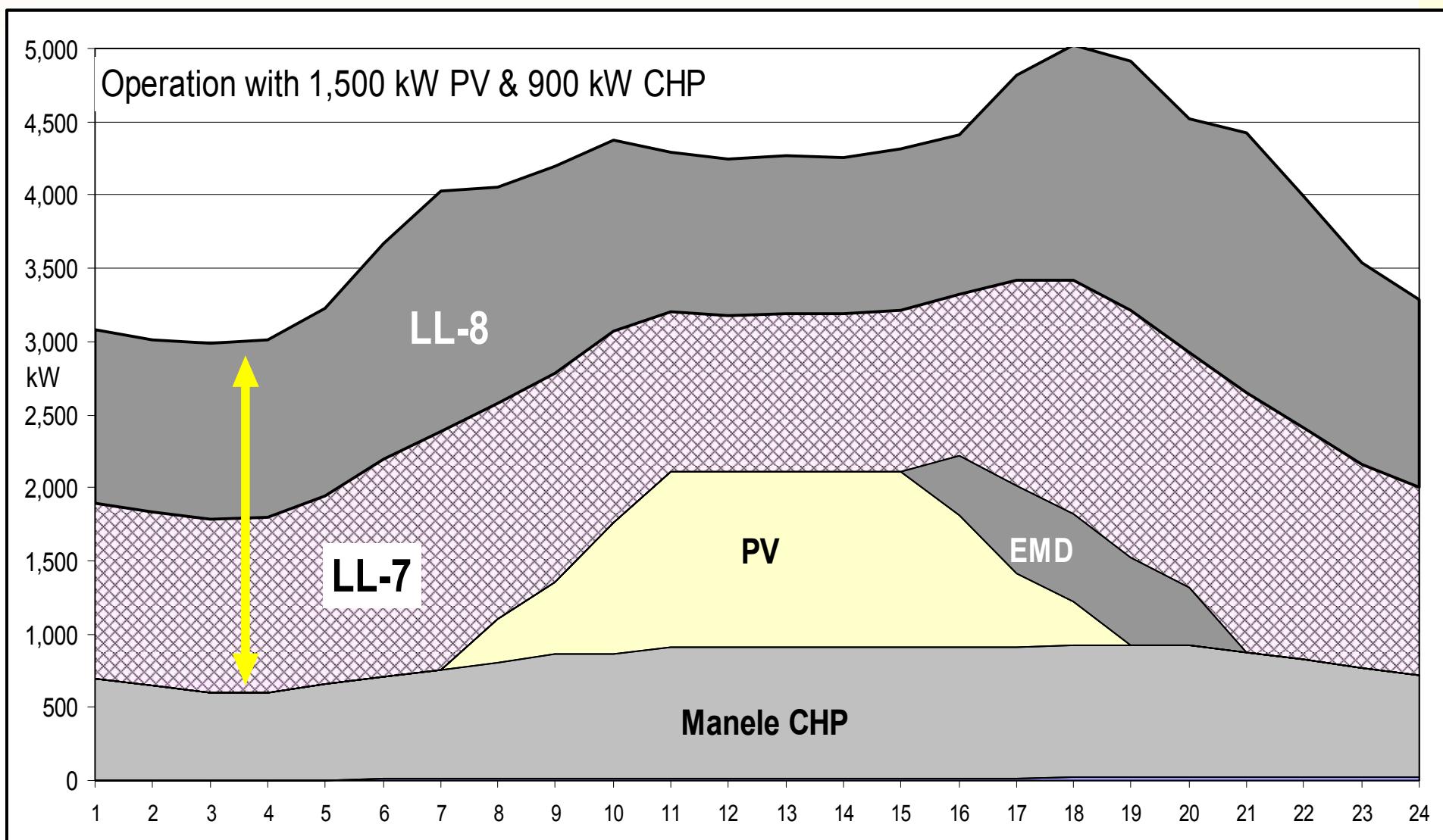
Lanai Grid



Lanai Unit Dispatch w/o PV Plant



Lanai Unit Dispatch with PV Plant and CHP at Hotel



Path to 100% Renewable Energy (Electric Grid Only)

2008	2009	2010	2011	2012
Existing Diesel Generators	Existing Diesel Generators	Existing Diesel Generators	Existing Diesel Generators	Existing Gens To Bio-diesel (18%)
				CHP (Bio-Diesel) (22%)
		CHP (Diesel)	CHP (Bio-Diesel)	Large Wind Farm Interconnect (40%)
	1.0MW solar**	1.0MW solar	1.0MW solar	
1.5MW PV*	1.5MW PV	1.5MW PV	1.5MW PV	1.5MW PV

%RE → 10%

10%

20%

50%

100%



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*Existing 1.5MW PV includes (250kW for 3hrs) battery storage

**Future 1.0MW solar includes (1MW for 3hrs) storage

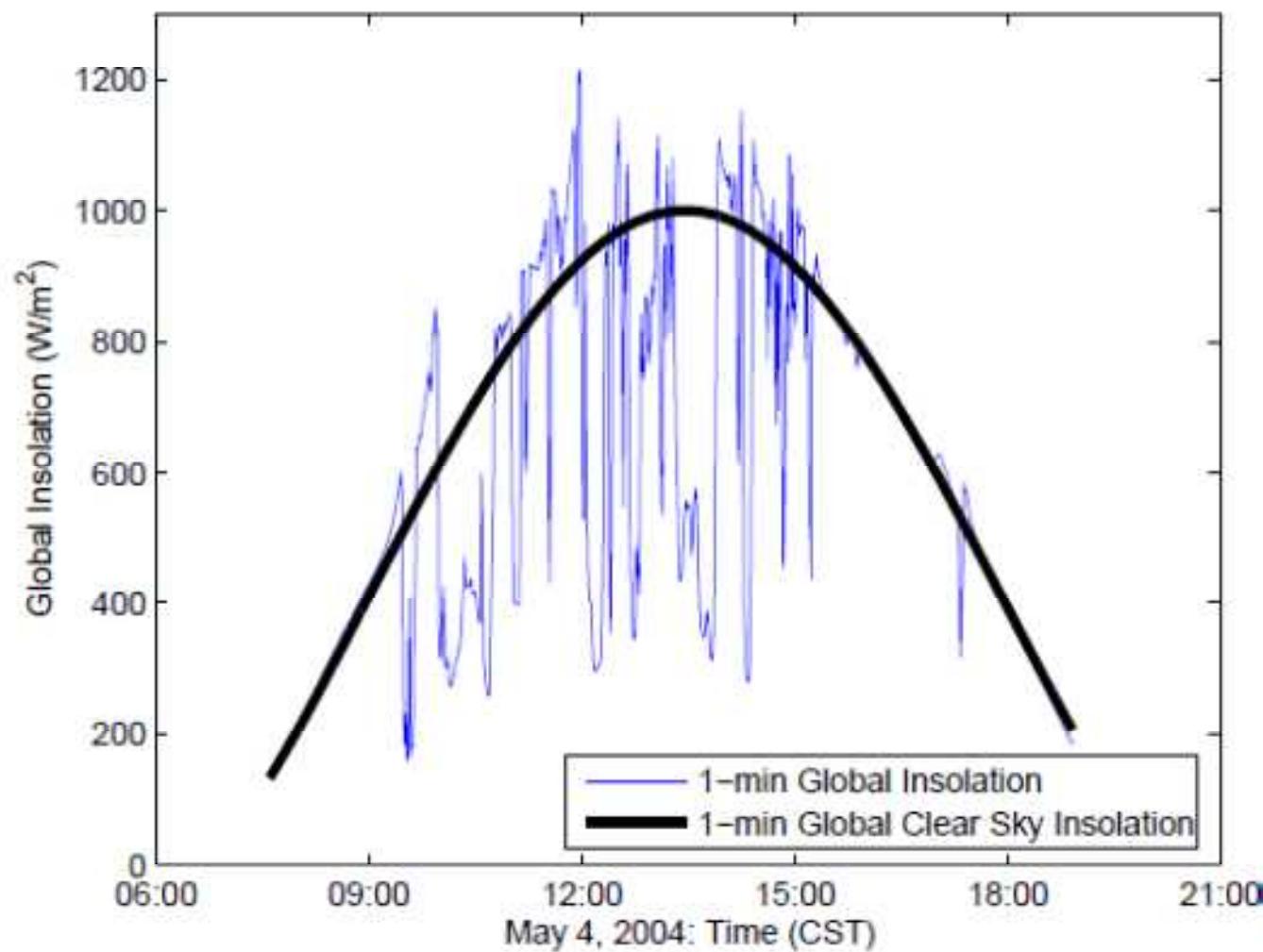
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Effects of Cloud Cover on PV Output

- Island systems need energy storage to ride through cloud cover
- Predictive data needed to manage diesel units
- Large arrays have not been studied for effects of cloud cover and cloud movement
- Sandia is implementing Lanai Irradiance Network Experiment (LINE) to characterize the effects of clouds



Clouds can produce rapid ramps in solar insolation



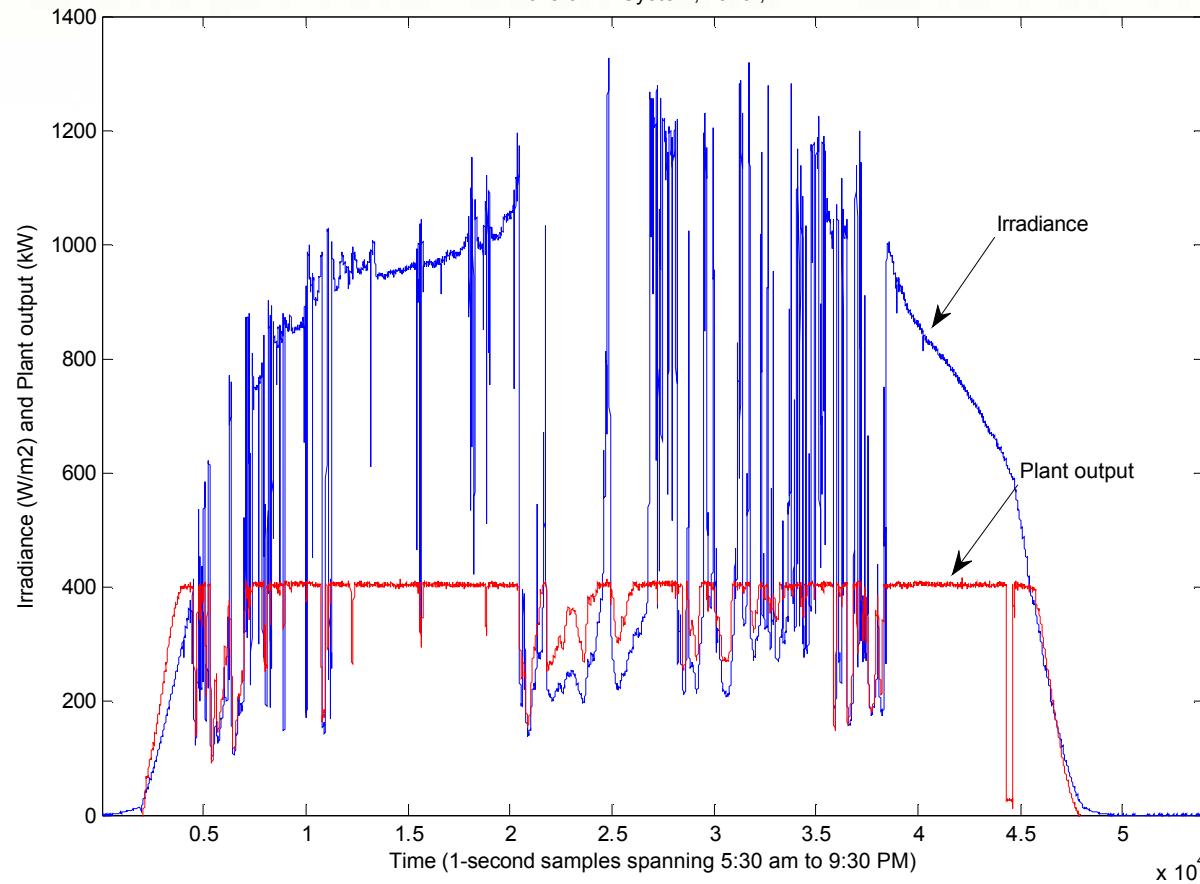
Source: LBNL analysis of Southern Great Plains data set



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PV Variability in Actual PV System

La Ola PV System, Lanai, HI



- Irradiance and PV system ac output A typical partly cloudy day in July
- PV system rating: 1,300 kW ac, presently limited to 400 kW ac (intentionally)





Lanai Irradiance Network Experiment (LINE)

- First-of-its-kind experiment to investigate effect of cloud patterns over large PV array
- Co-relate cloud movement over array to instantaneous PV power output
- Derive predictive system operation strategy to mitigate effect of cloud cover



L.I.N.E Site Plan

