

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





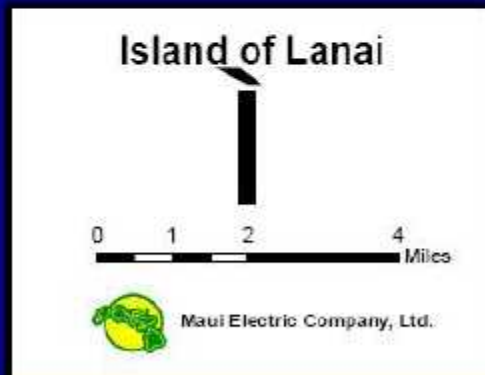
Lanai

Project Objective

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



**Proposed
Large
Wind
Farm
area**



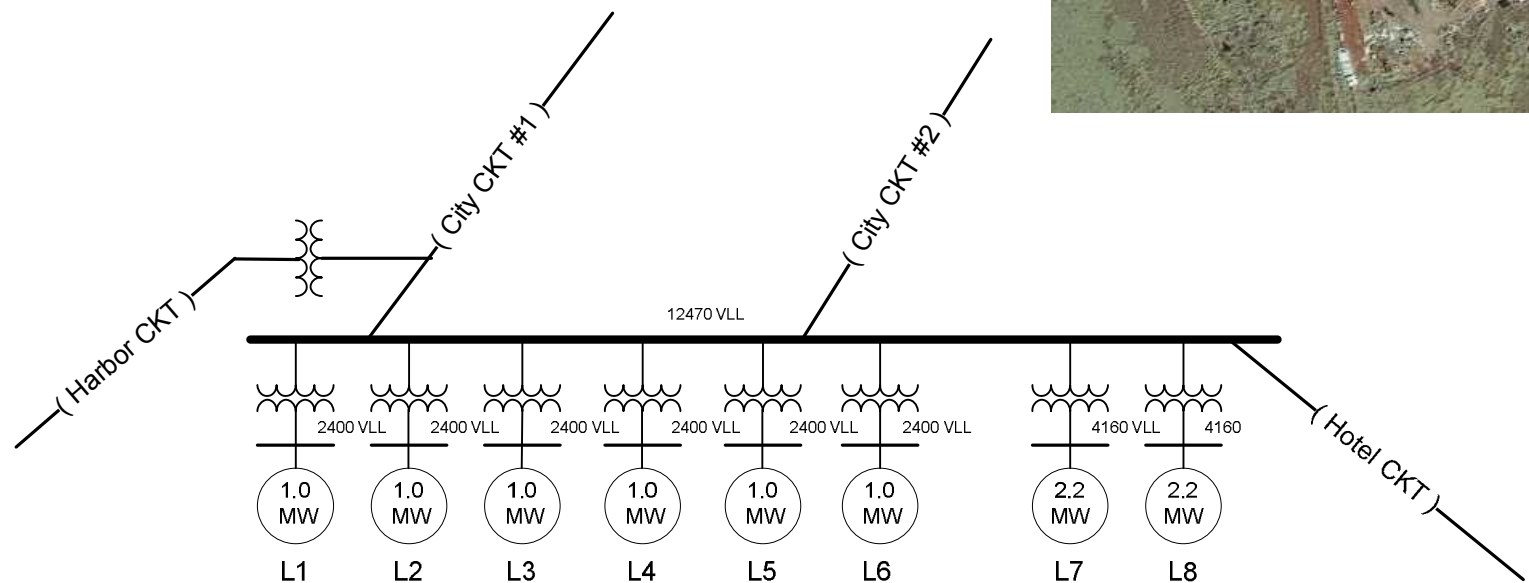
Focus area of Study



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

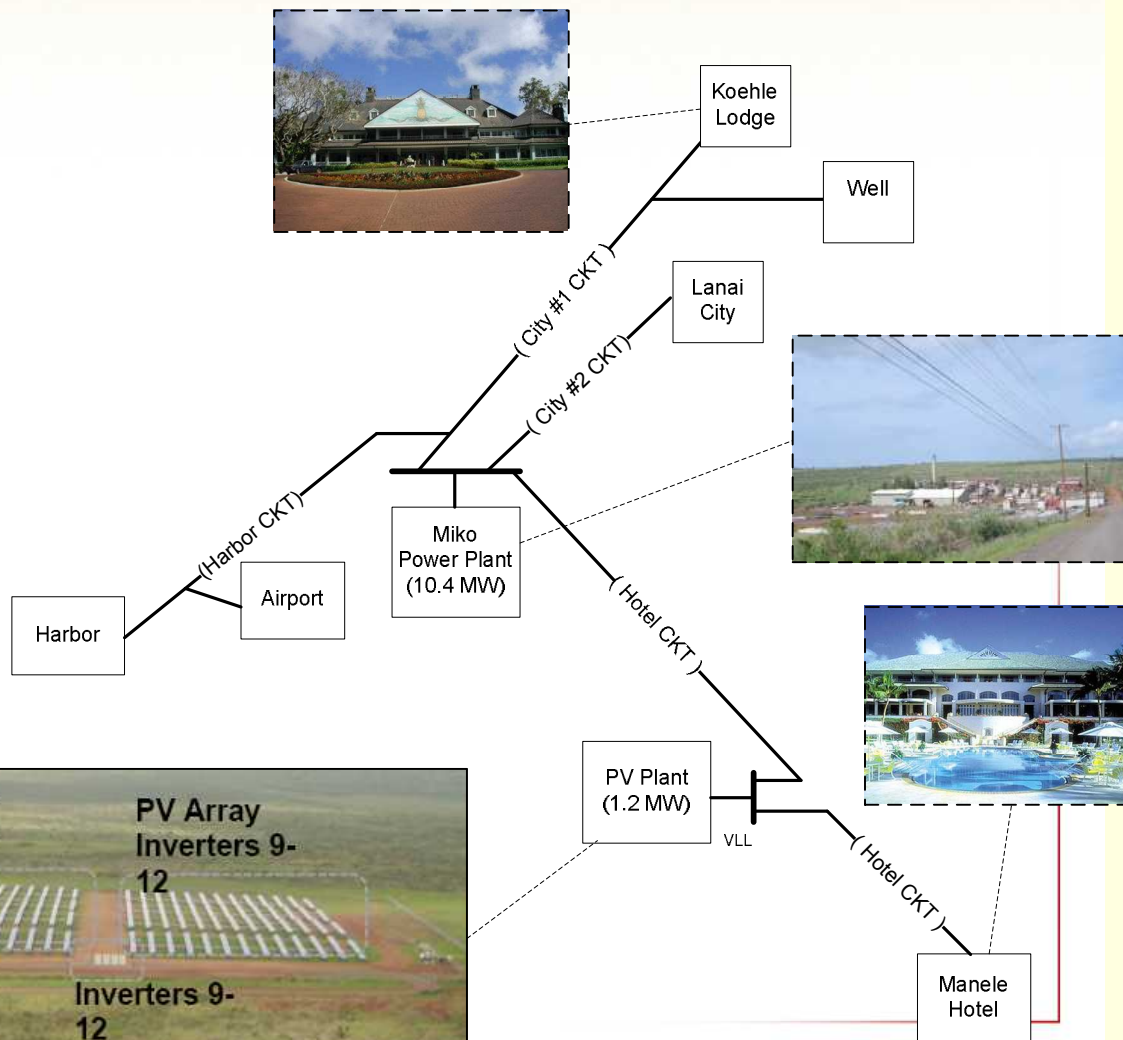
10 acres, 12 separate arrays, 7,000+ panels, tracker system

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

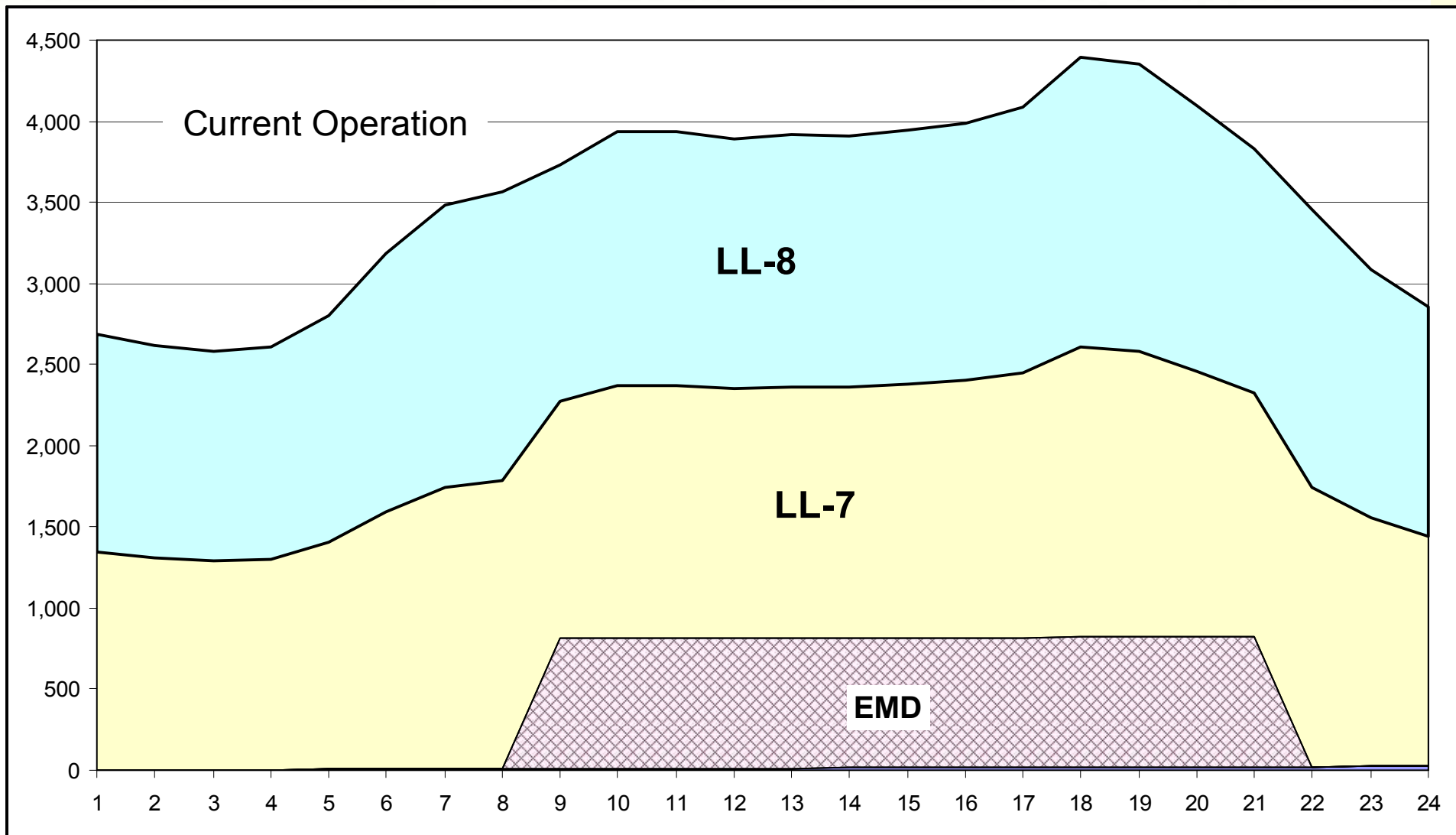
2,300 tons of carbon dioxide emissions eliminated annually = 5,000 barrels of oil or 237,000 gallons of gasoline



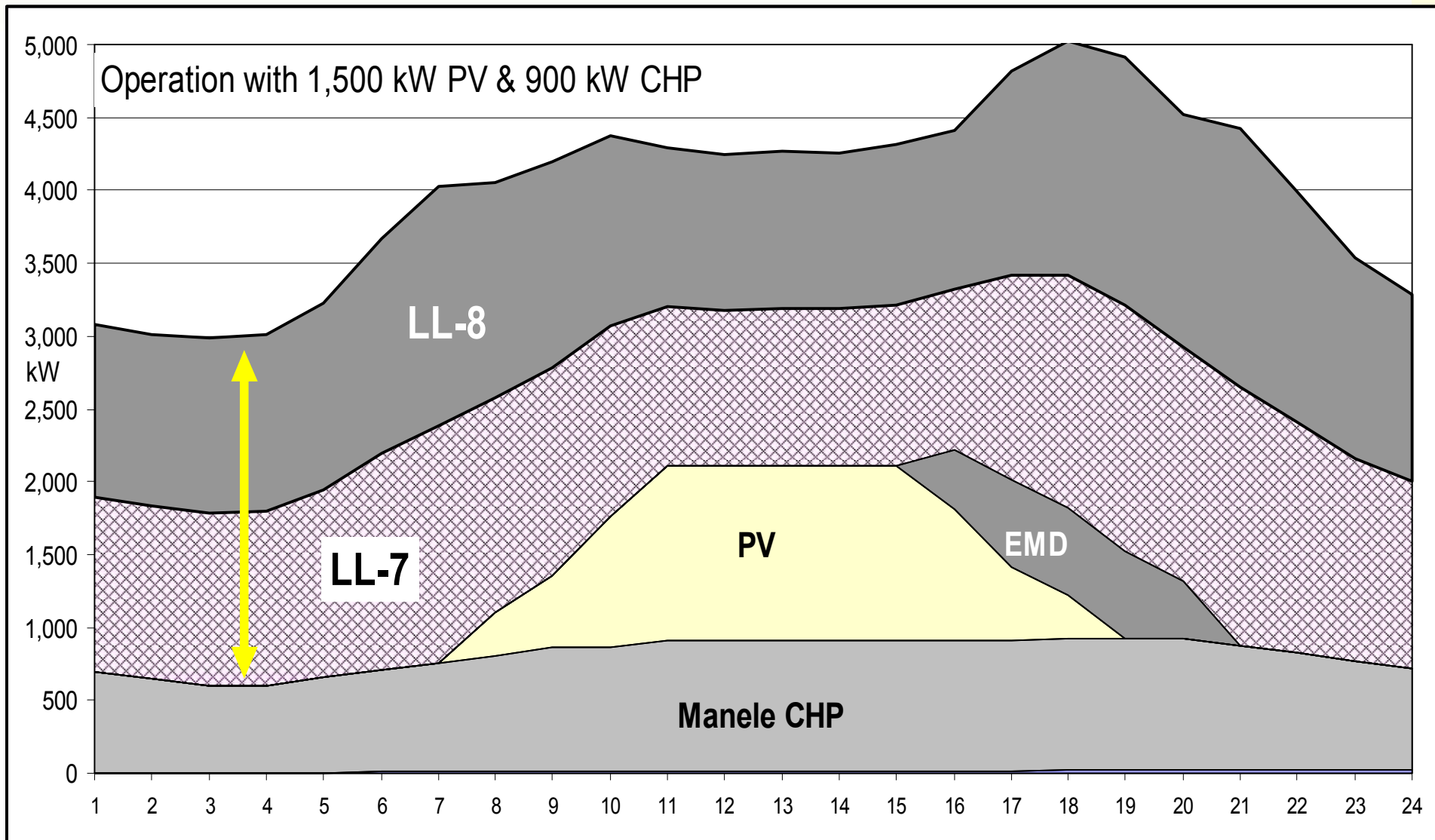
Lanai Grid



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 (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%



Sandia
National
Laboratories

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

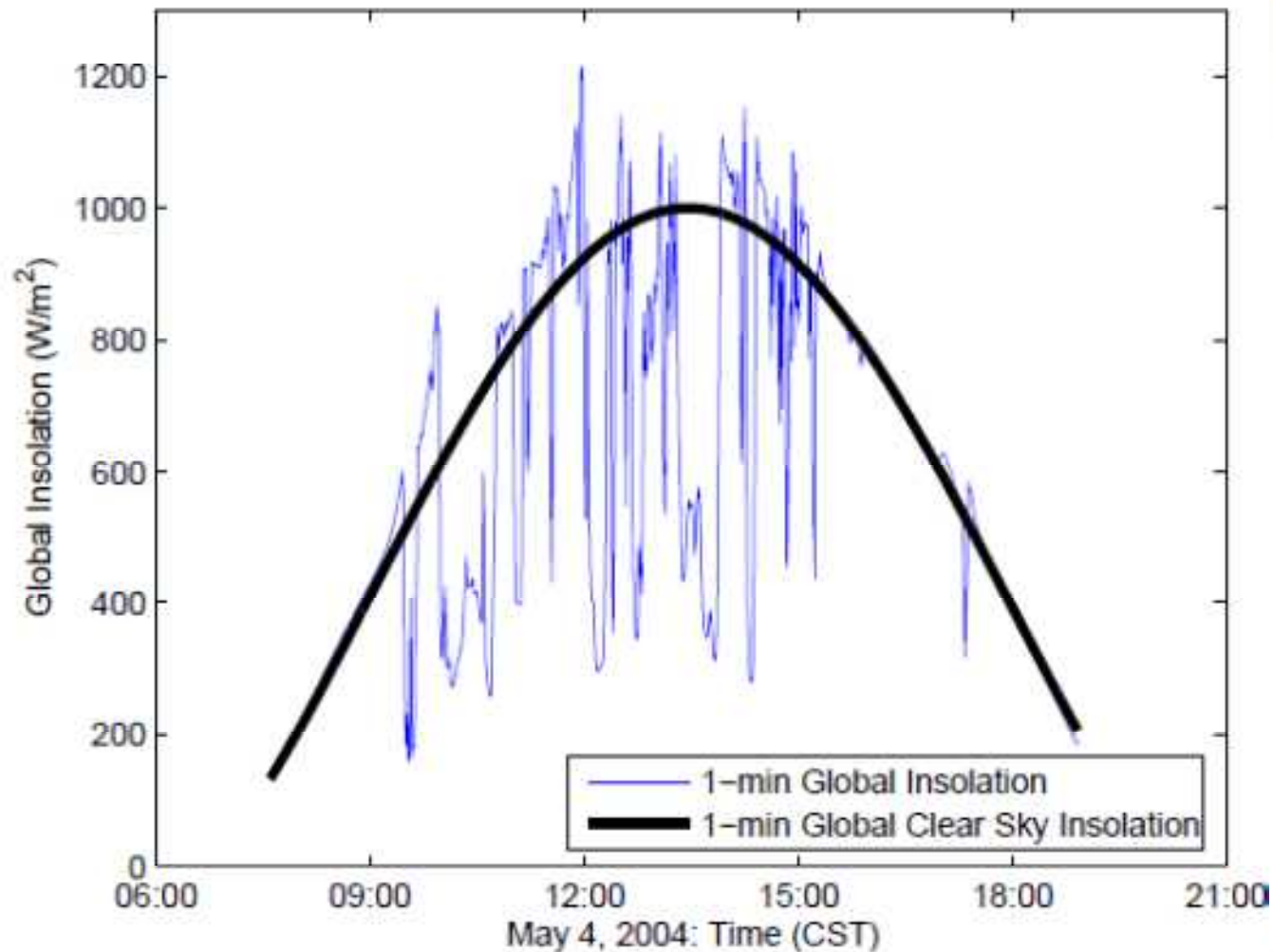
**Future 1.0MW solar includes (1MW for 3hrs) storage

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



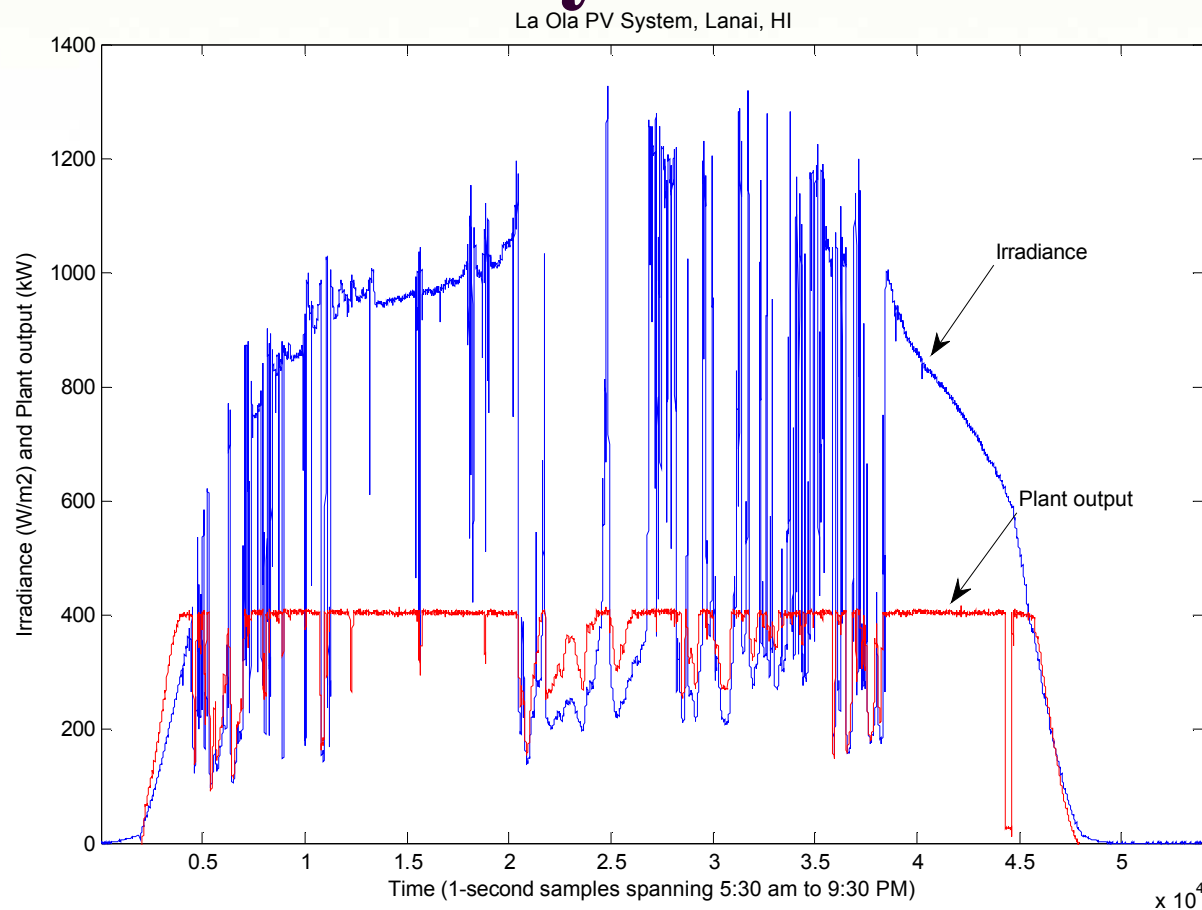
Clouds can produce rapid ramps in solar insolation



Source: LBNL analysis of Southern Great Plains data set



PV Variability in Actual PV System



- 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

(Lanai Irradiance Network Experiment)

