

ZERO NET ENERGY

at

The County Of San Diego



WHY ARE WE DOING IT?

■ ROI - Healthier Budget

- Greatly reduced operating costs
- Facility valuation stability

■ “Live Well San Diego” - Healthier People

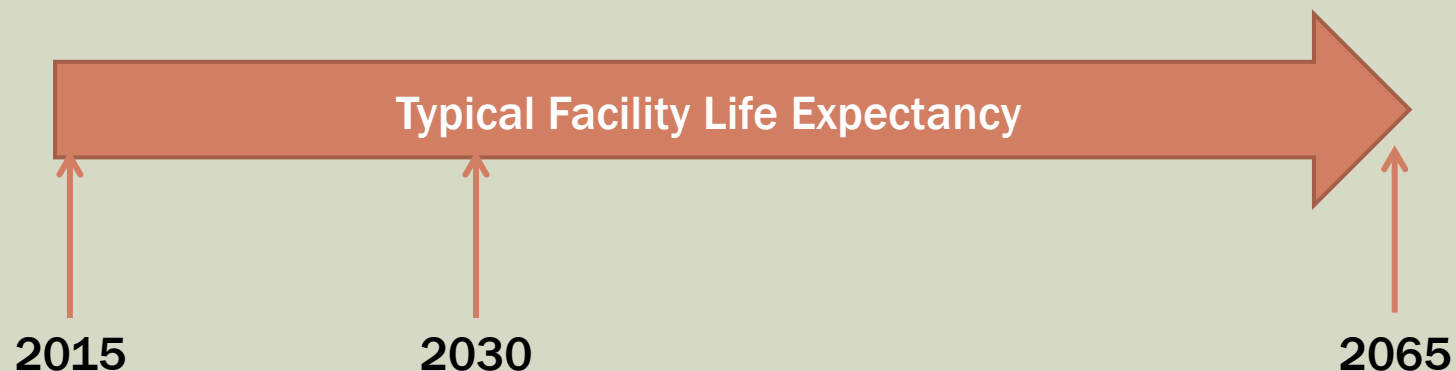
- More comfortable, healthier work environments
- Better productivity, reduced absenteeism

■ County Strategic Plan - Healthier Places

- Responsible development and economic vitality
- Model and support healthy lifestyle choices
- Protect our future environment and quality of life

WHY ARE WE DOING IT?

- **Facility is investment**
 - Typical Building life: 50 years
 - Typical Equipment life: 15 to 25 years
- **New construction ZNE by 2030**
 - Start now



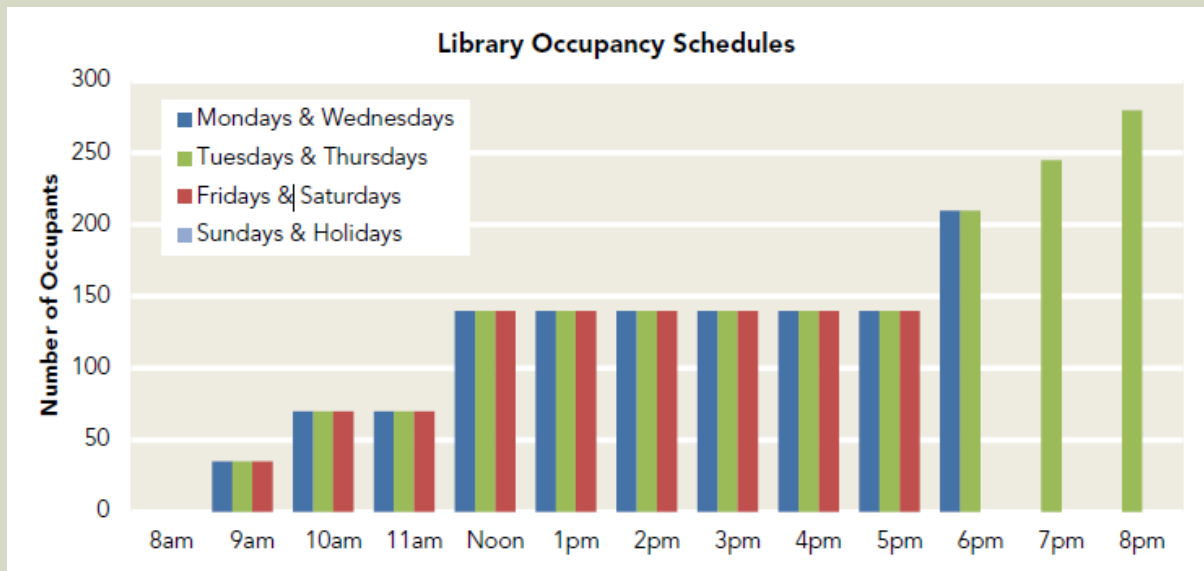
ALPINE LIBRARY

- Budget established in 2012 (w/o ZNE)
- ZNE feasibility analysis
- ZNE requirement in Design/Build RFP
- PV budget supplementary



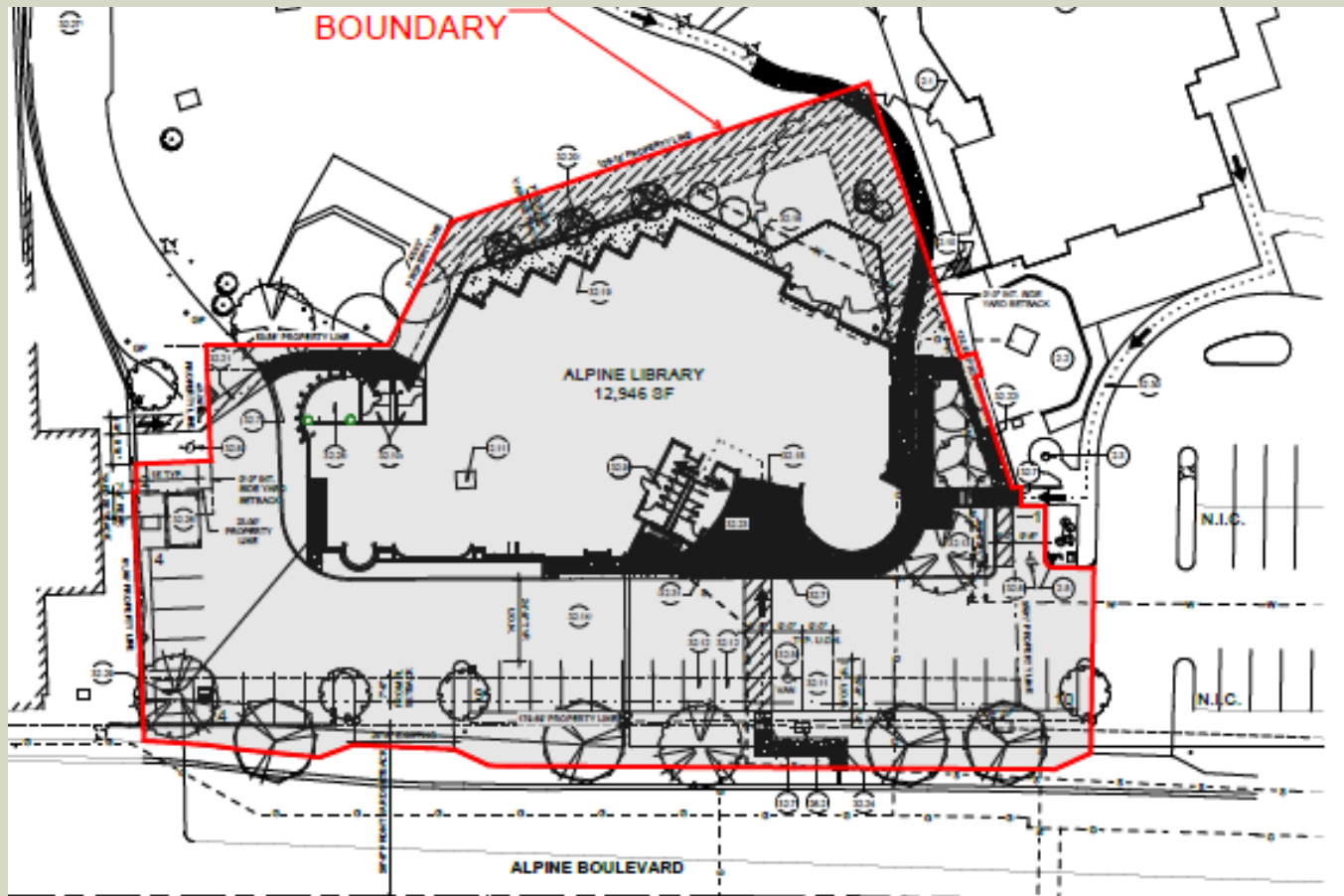
FACILITY STATISTICS

- GSF: 12,700 GSF
- Operating hours: 53/week
- Climate zone: 10



FACILITY STATISTICS

- Building site was constrained



FACILITY STATISTICS

■ Insulation

- Code compliant
- R-19 + R-5 walls, R-20 roof

■ LPD

- .62 w/sf avg.

■ HVAC

- Variable Refrigerant Flow

■ Hot water

- 90% solar thermal

■ Plug loads

- 1.4 w/sf avg.

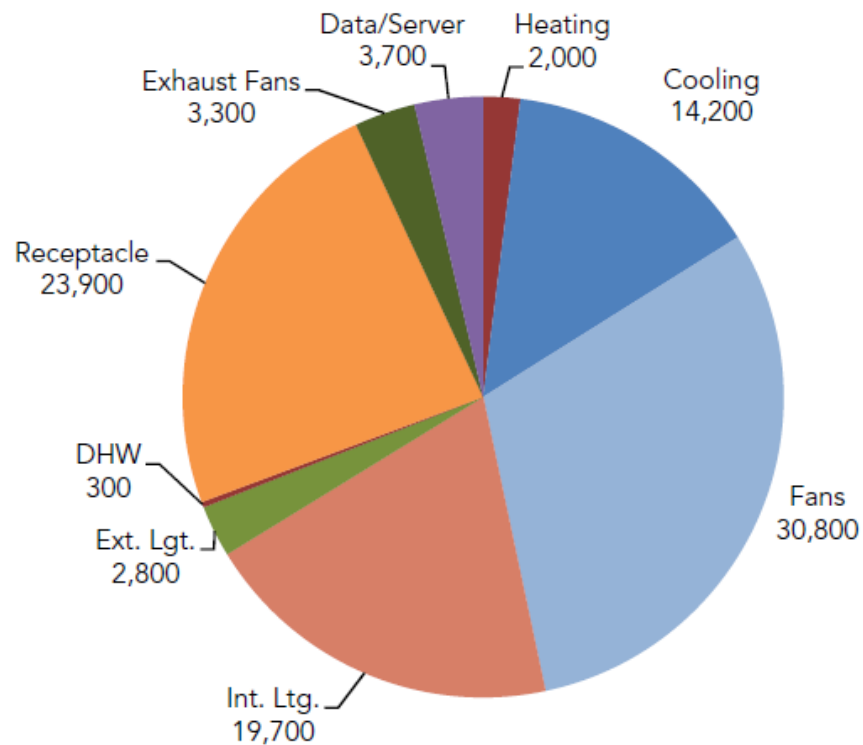
■ PV

- 72 kW DC
- 108,515 kWh/yr

■ Site EUI

- 29 kBtu/sf/yr

ENERGY END USES



End-Use	Estimated Annual Use	% of Total Use
Heating	2,000	2%
Cooling	14,200	14%
Fans	30,800	31%
Pumps	0	0%
Int. Ltg.	19,700	20%
Ext. Ltg.	2,800	3%
DHW	300	0%
Receptacle	23,900	24%
Exhaust Fans	3,300	2%
Data/Server	3,700	4%
Total Annual	100,700	100%
PV	-108,515	-108%

Energy model shows PV will produce 108% of annual energy use

Source: Brummitt Energy Associates

WHAT MAKES IT EFFICIENT?

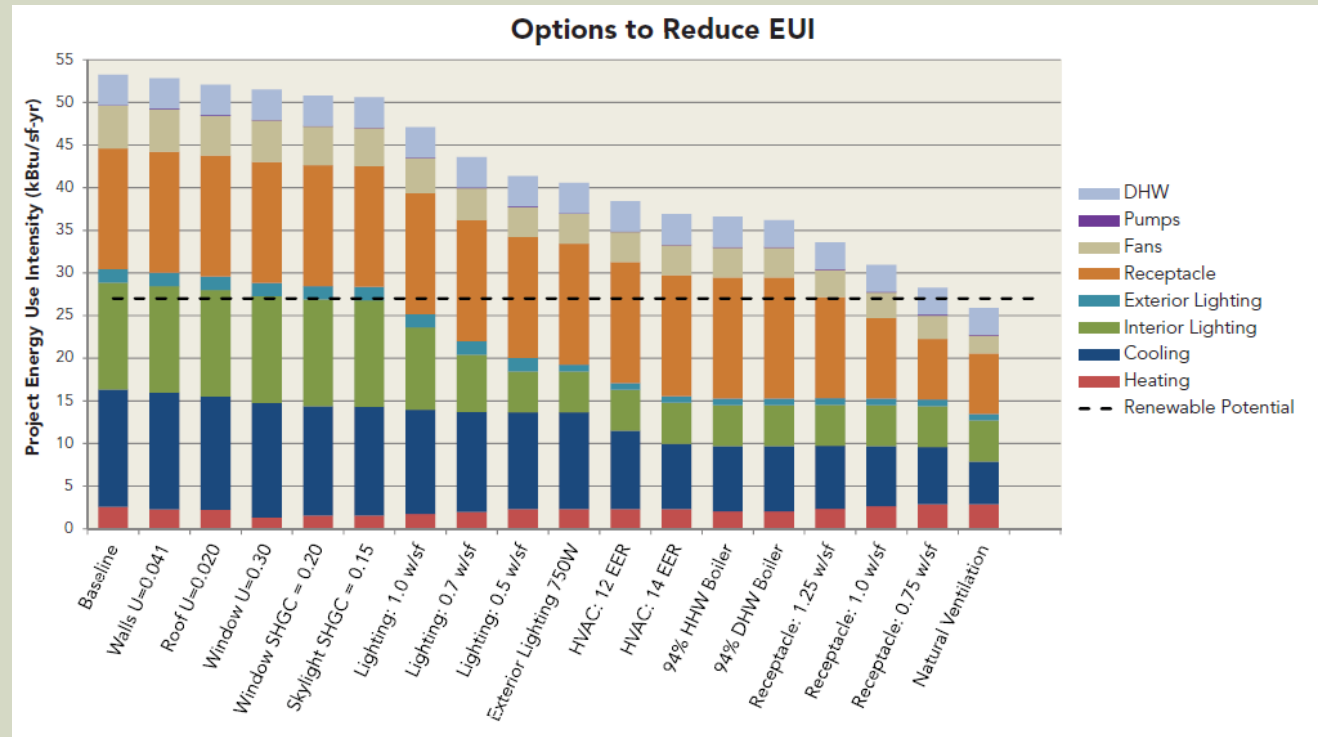
- LED lighting
- Low SHGC glazing
- VRF heating/cooling
- Controls automate processes
- Daylight autonomy in some areas

BEST PRACTICES

- **Model early and often**
 - Identify efficacy of design strategies
 - *Insulation versus glazing*
 - Detect problem areas before set in stone
 - *Modify design when it costs the least*
 - Evaluate “bang for buck” of measures
 - *Tradeoff less effective and more expensive*
 - Calibrate assumptions throughout design
 - Establish basis for M&V
 - Balance EE with programmatic changes
 - *There may be “compromises”*

BEST PRACTICES

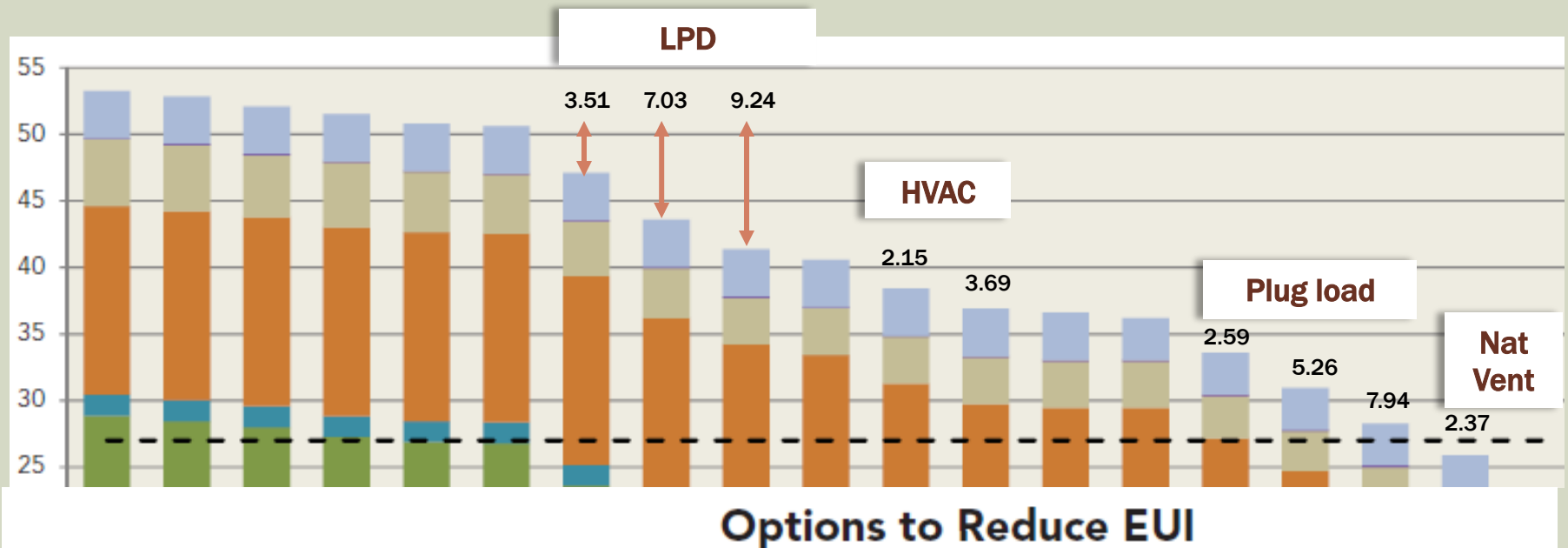
- Model early and often
 - Involve controls and modeling consultants early



Source: Brummitt Energy Associates

BEST PRACTICES

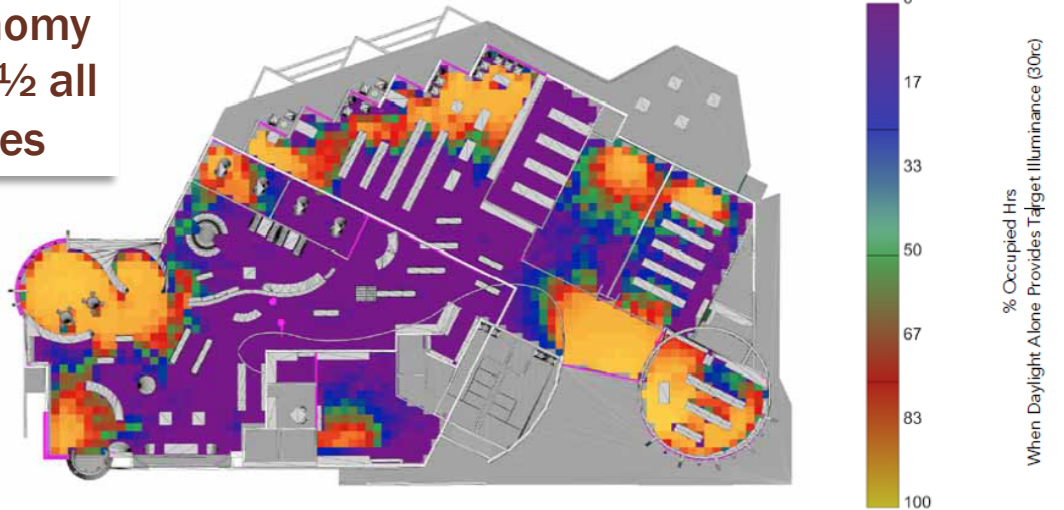
- Maximize passive technologies
 - Daylight, natural ventilation, orientation



BEST PRACTICES

- Maximize daylighting
 - Drive down lighting use and cost
 - Glare control and shading are critical

Daylight autonomy achieved at $< \frac{1}{2}$ all occupied spaces



Daylight Autonomy – Daylight Levels of 30fc at floor

Lighting= 20% total energy use

BEST PRACTICES

- Embrace your M&V plan
 - Fine tune submetering

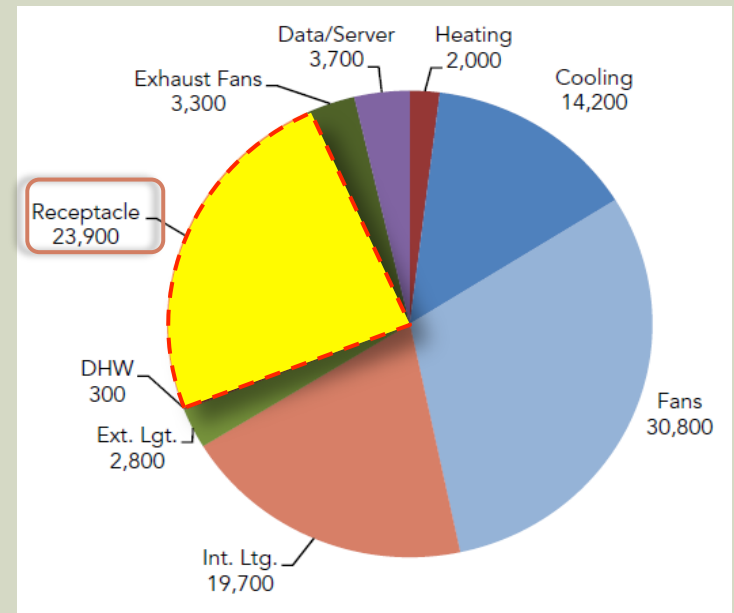
End Use	% Energy Use	Submeters
HVAC (heating, cooling, fans, DHW)	51%	1
Lighting (Interior & Exterior)	23%	1
Receptacle (Plug) Loads	24%	5
Data/Server Room	4%	1

Break down the
big chunks

- Calibrate actual use with energy model
- Building users participate in performance

BEST PRACTICES

- Plan to manage plug load
 - Variable, hard to predict, hard to control
 - Use controls and scheduling if possible
 - 25% of efficient building



FINAL ANALYSIS

■ ZNE is not free

- Guidance from “yet another consultant”
- First costs (and PV) funded by capital - Savings go to operational
- Added attention to energy use
 - *Submetering*
 - *M&V scrutiny*
- Train staff to understand building
- Alpine Library cost ~5% additional for ZNE

QUESTIONS?

