ZERO NET ENERGY

at

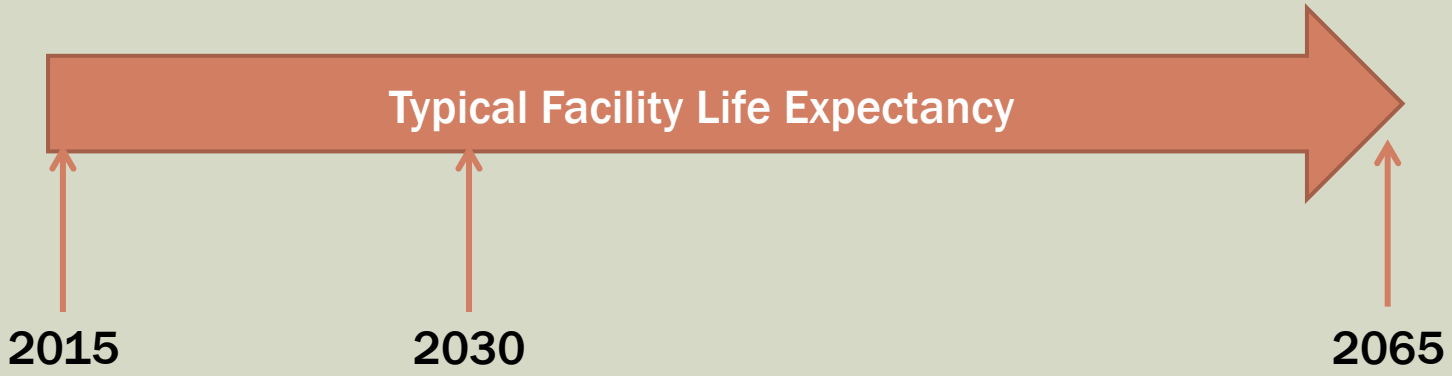
The County Of San Diego

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

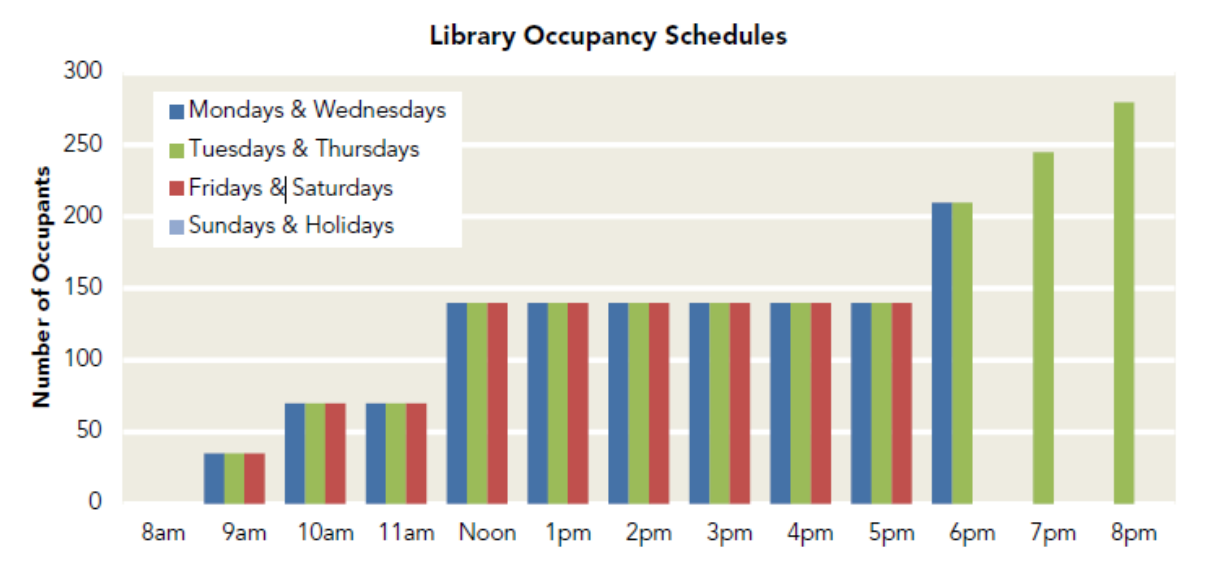


ALPINE LIBRARY

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

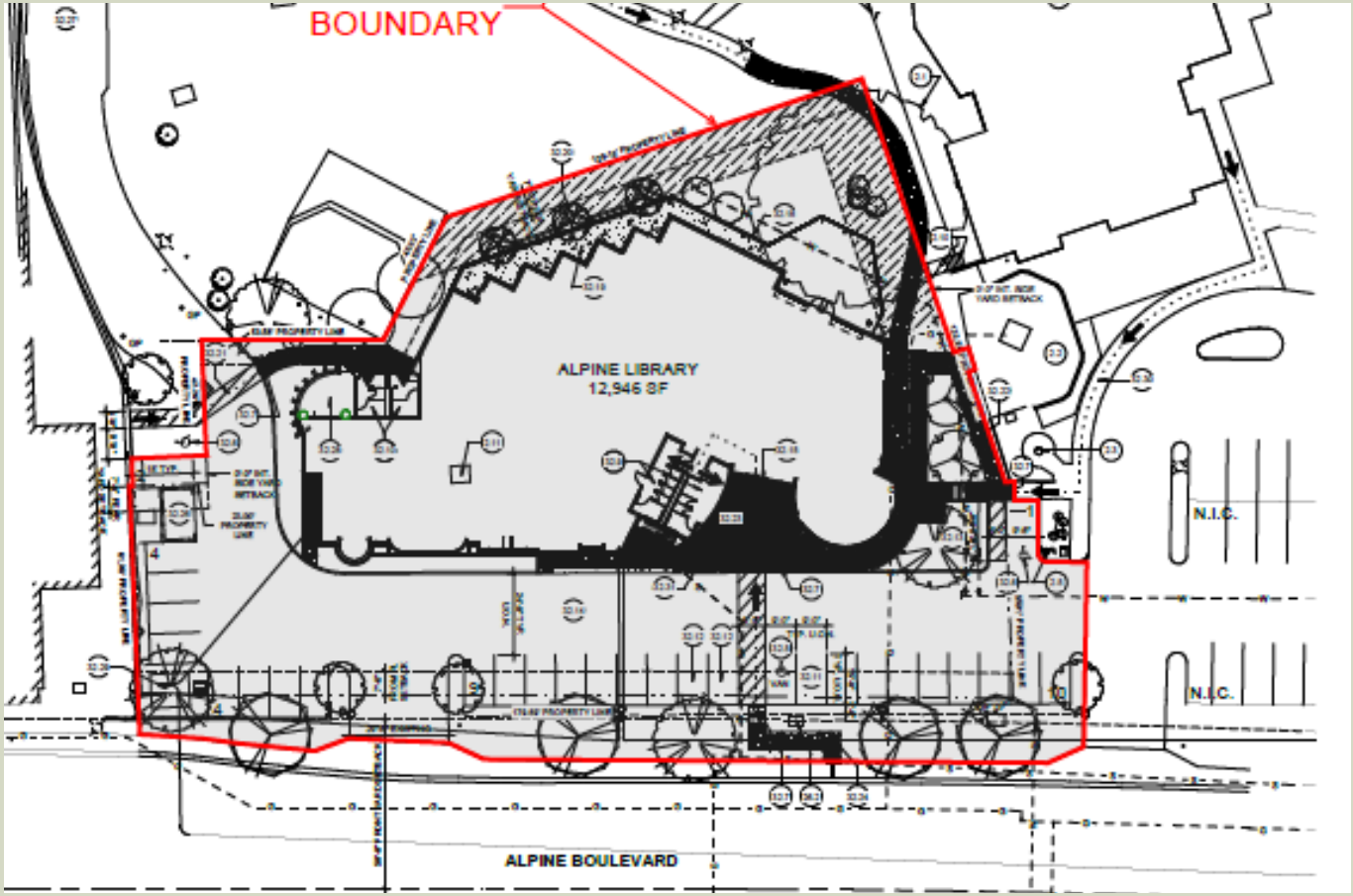
FACILITY STATISTICS

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



FACILITY STATISTICS

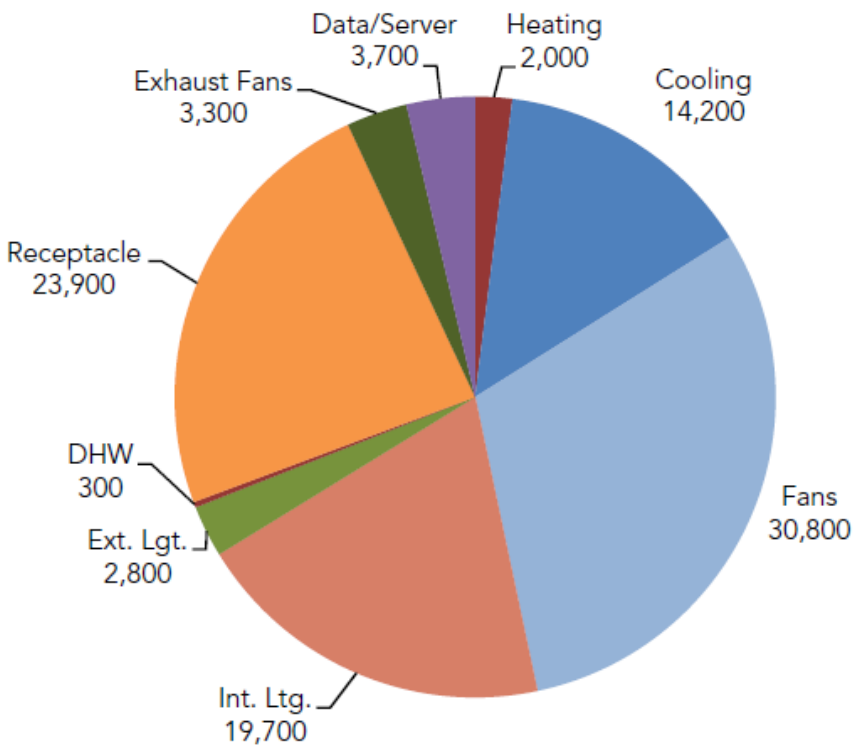
- Building site was constrained



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?

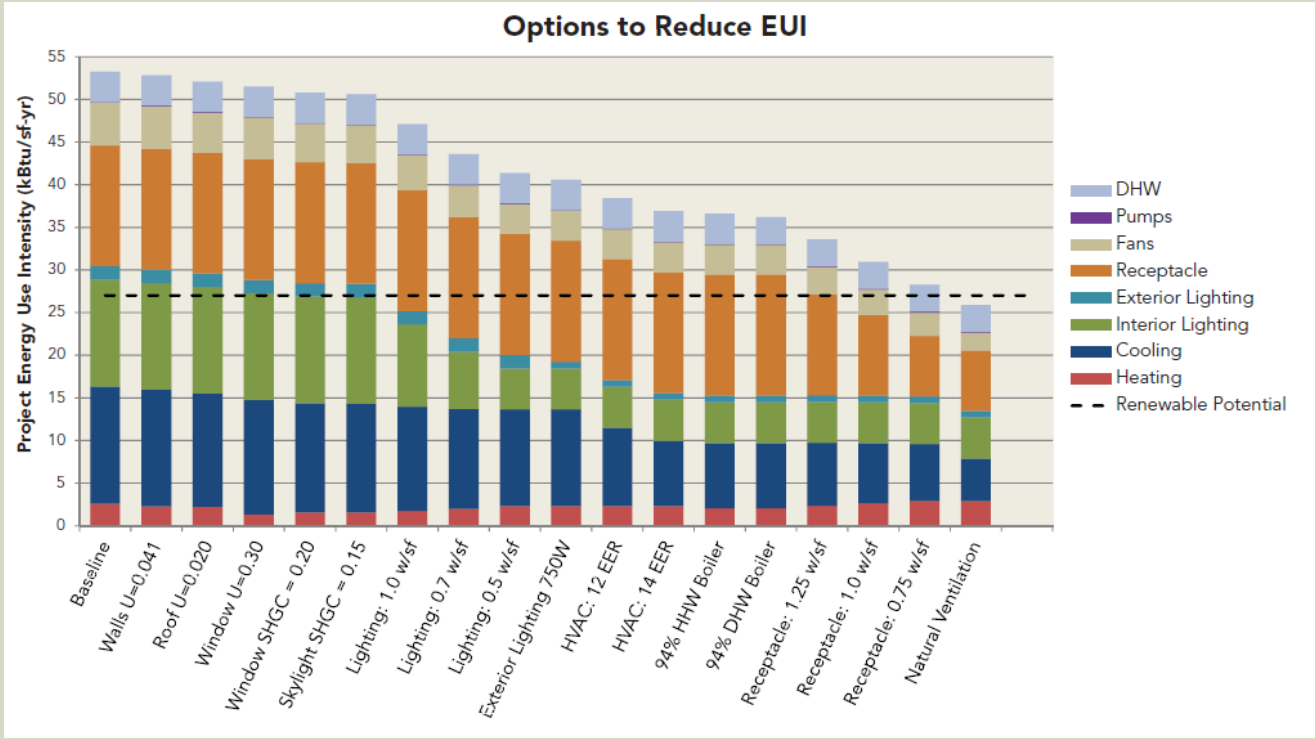
- LED lighting
- Low SHGC glazing
- VRF heating/cooling
- Controls automate processes
- Daylight autonomy in some areas

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

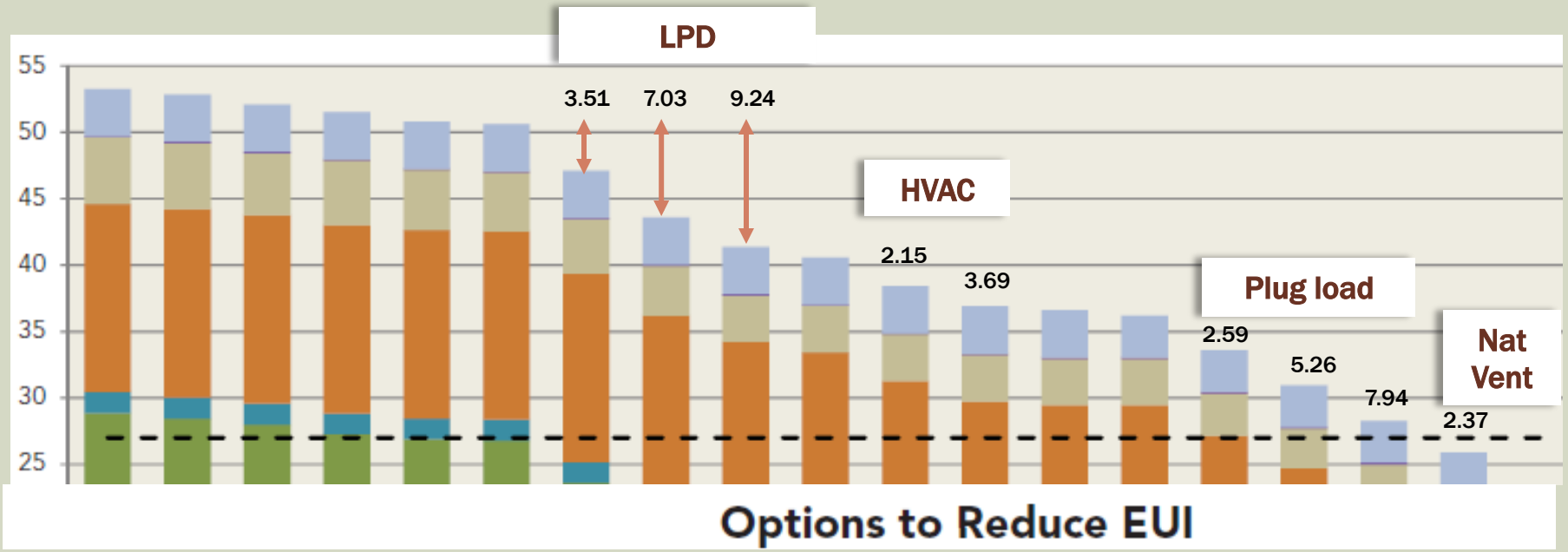
- Model early and often
  - Involve controls and modeling consultants early



Source: Brummitt Energy Associates

BEST PRACTICES

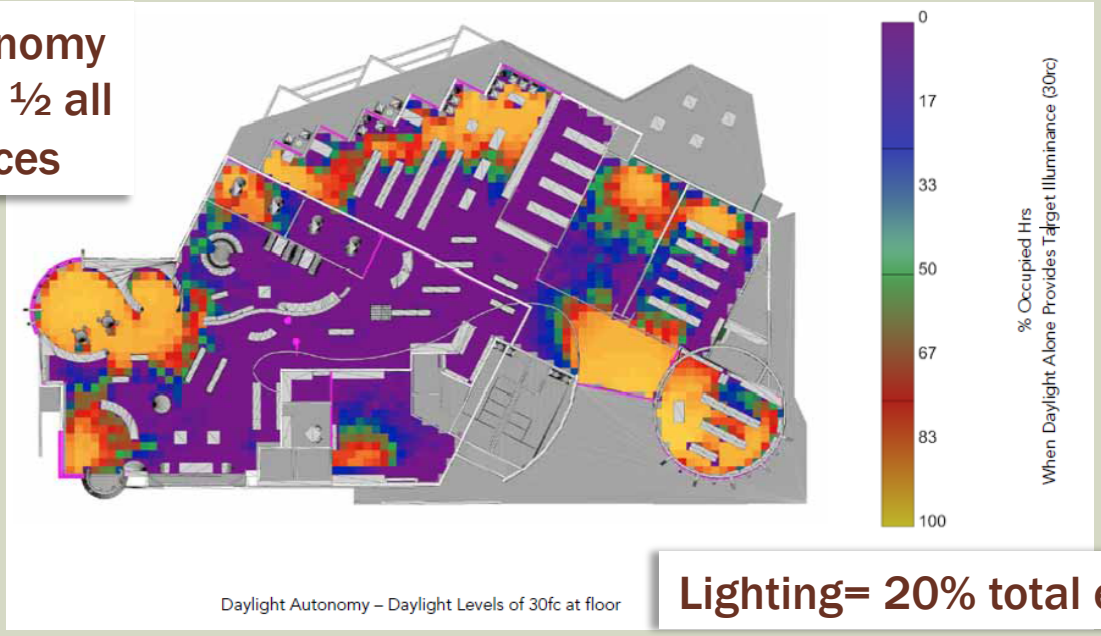
- Maximize passive technologies
  - Daylight, natural ventilation, orientation



BEST PRACTICES

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

Daylight autonomy achieved at < ½ 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

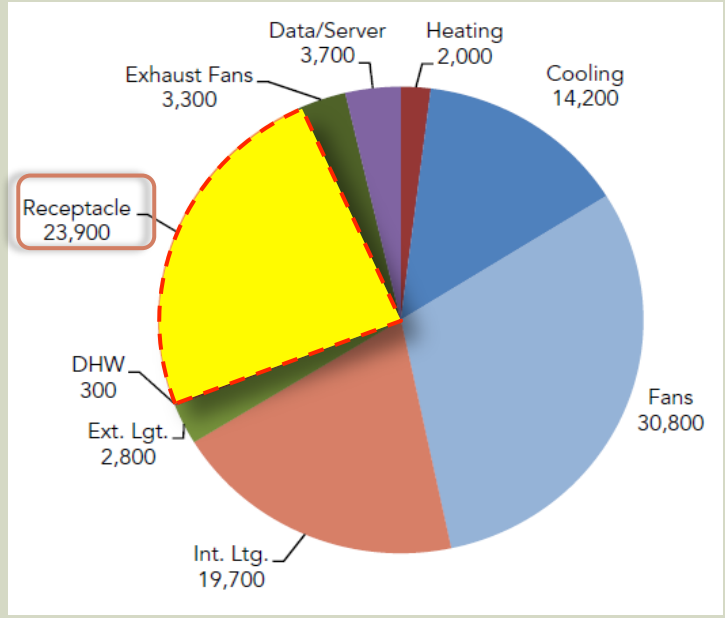
End Use	% Energy Use	Submeters
HVAC (heating, cooling, fans, DHW)	51%	1
Lighting (Interior & Exterior)	23%	1
Receptacle (Plug) Loads	24%	5
Data/Server Room	4%	1

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?