County of San Diego

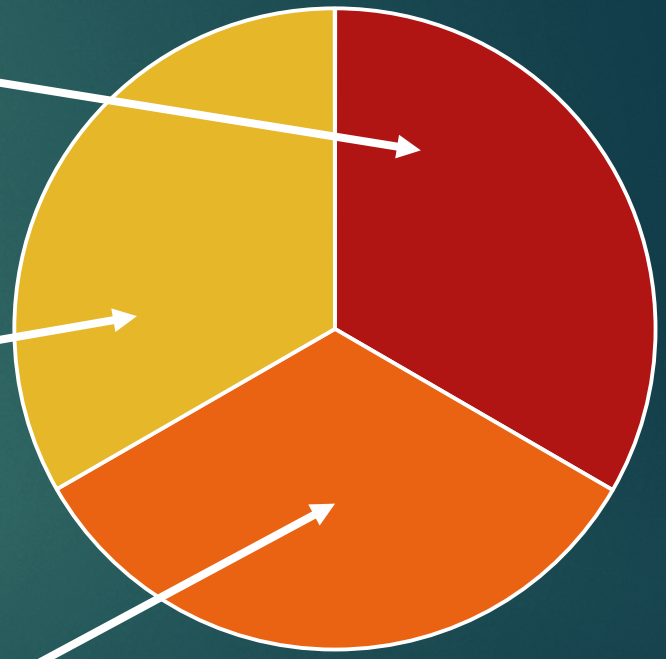
Recipe for ZNE

SEEC FORUM

21 JUNE 2018

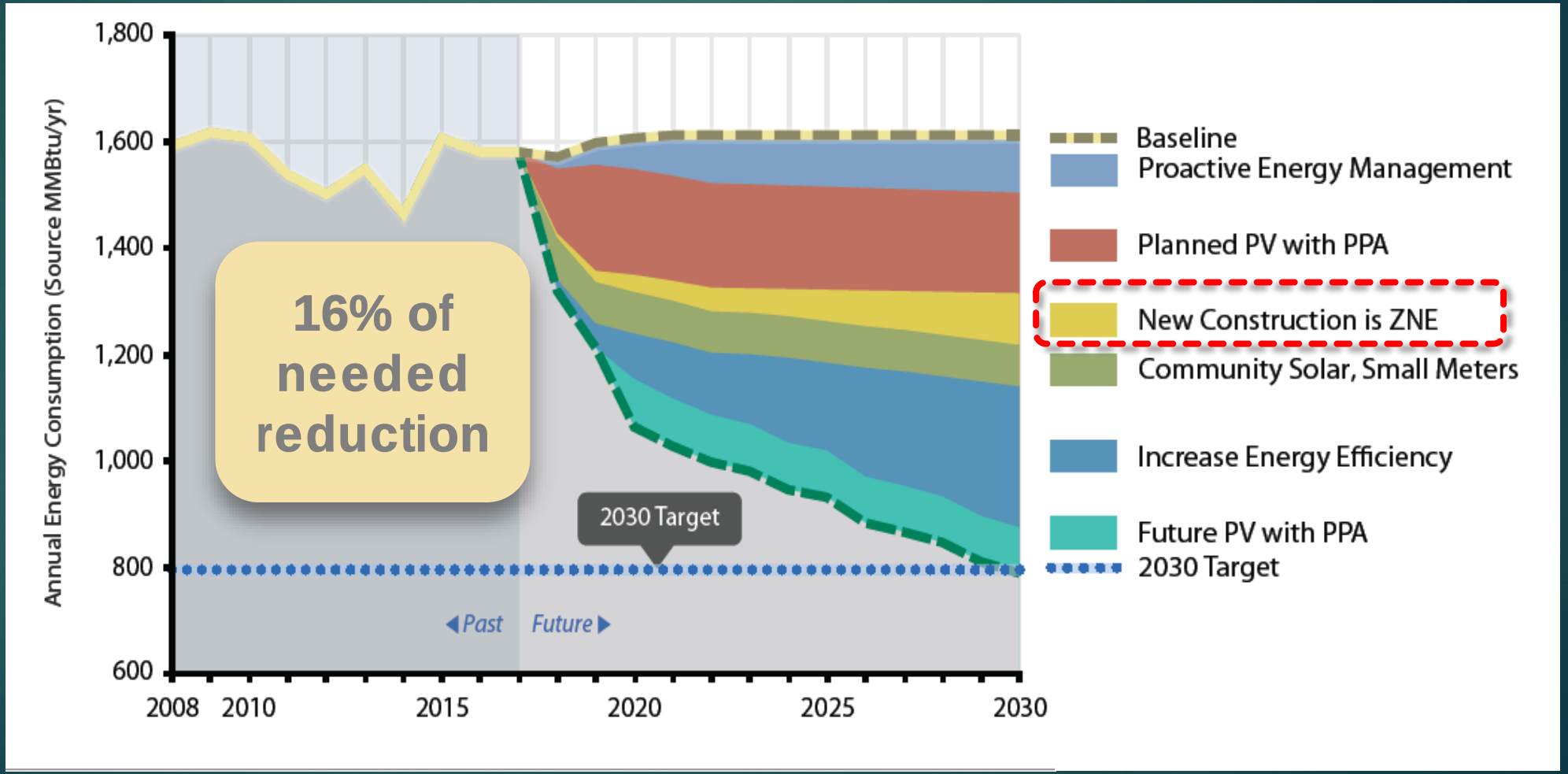
ZNE versus Code Compliant

- **Primary concern – energy efficiency**
  - *Affects building form and technologies*
- **Match with renewables**
  - *Design to maximize PV output*
- **Monitor to manage**
  - *All energy end uses will be submetered*



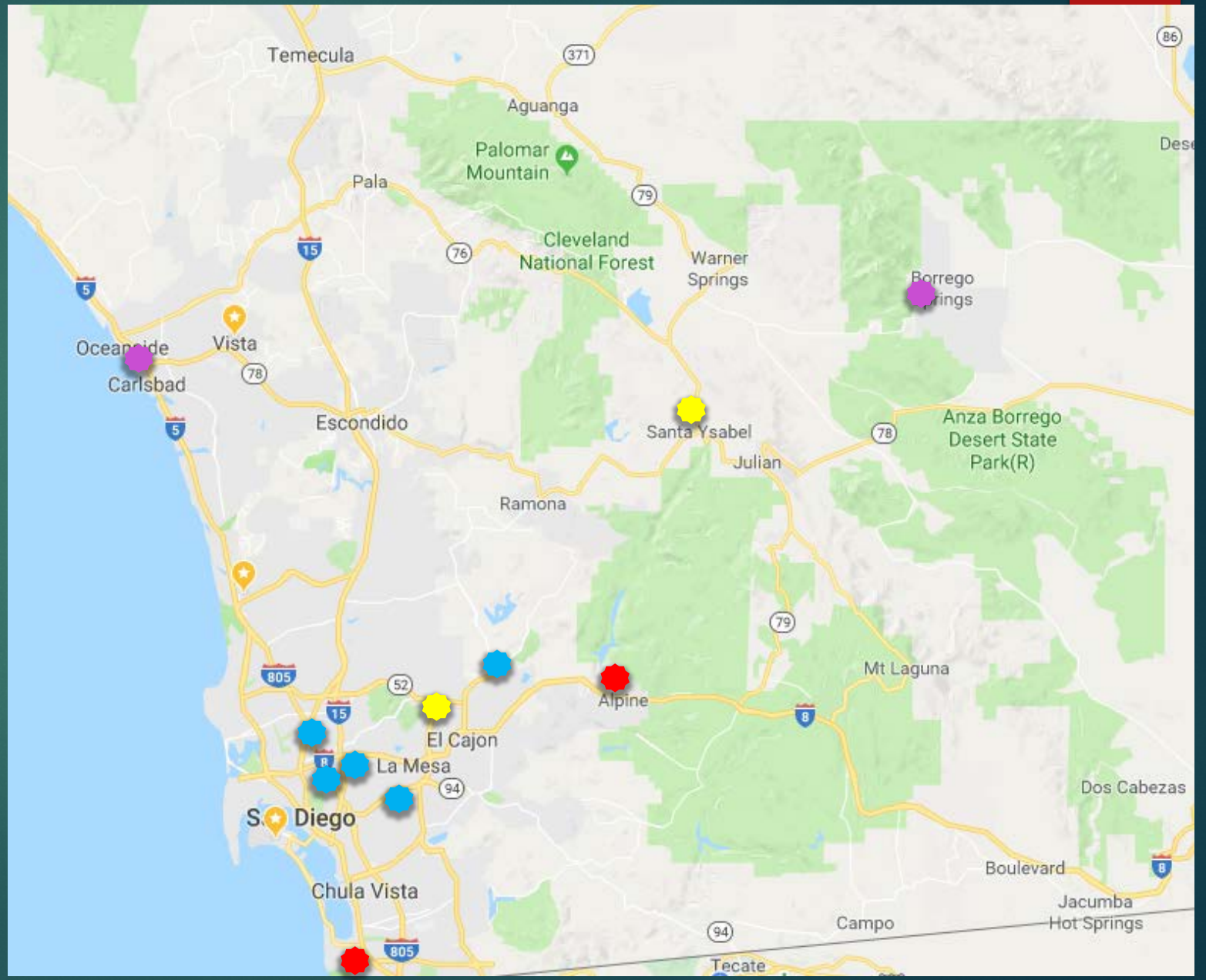
ZNE Portfolio Plan

- Key strategy is ZNE for new construction



ZNE Initiative

- Pilot in 2014 at Alpine Library
- All new construction



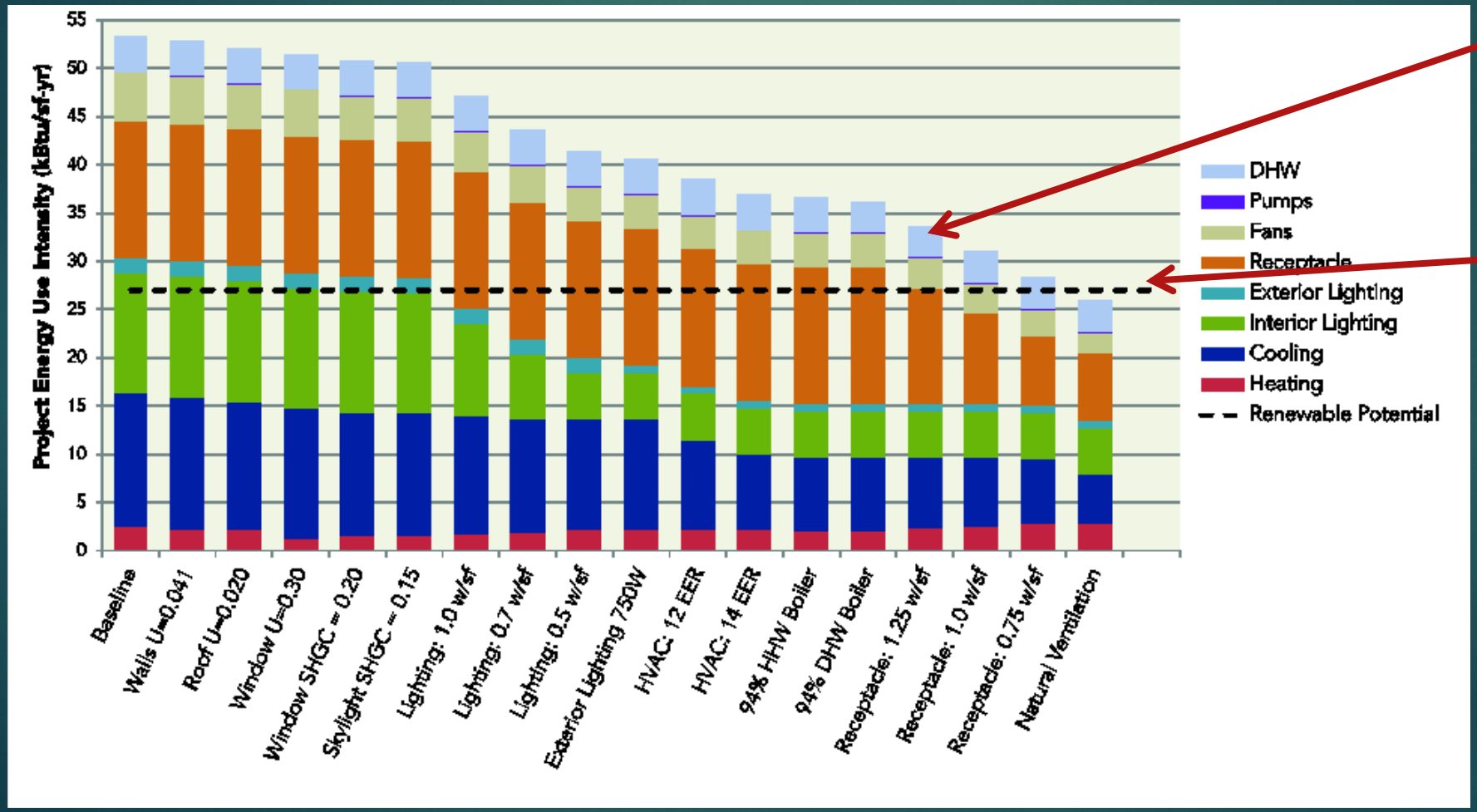
Recipe for ZNE – New Construction

- Study feasibility
- Get the right AEC team
- Use advanced EE technologies
- M & V plan
- Cx
- Track energy performance

Source: FPB Architects

Study Feasibility

- Options modeling

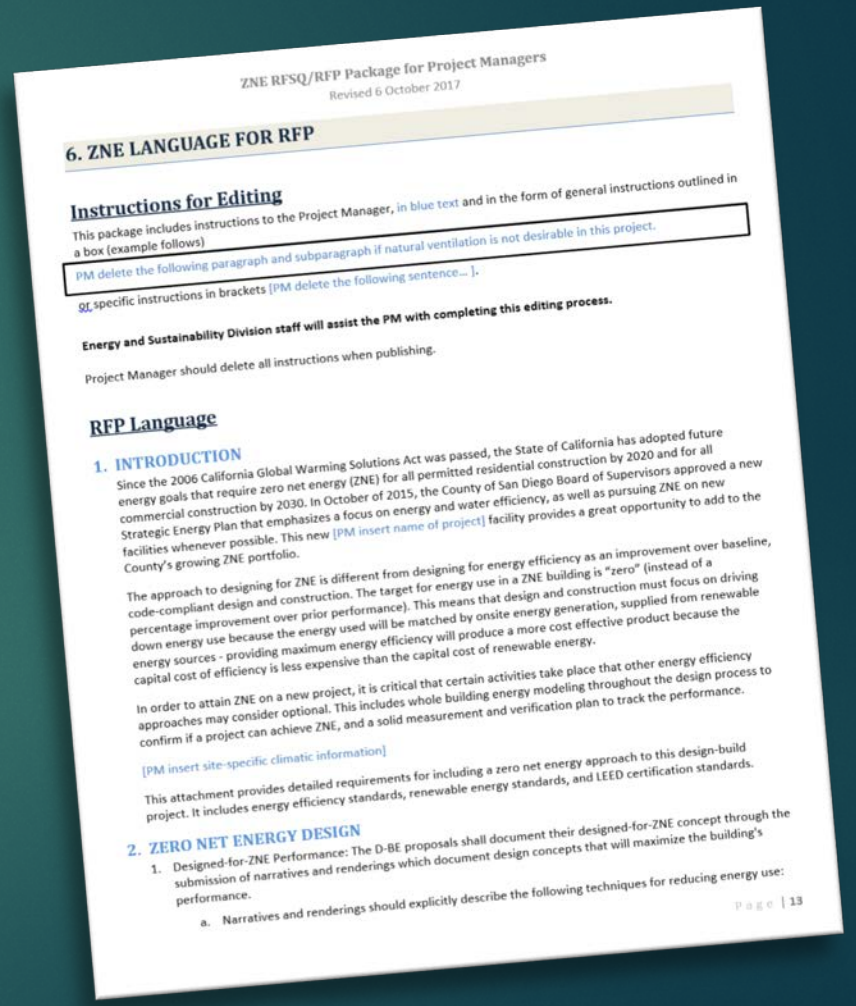


1. Study options to get energy use low
2. Determine how much PV site can support
3. Find affordable and effective match

Source: Brummitt Energy Associates

Get the Right Team

- **Design Build RFP**
  - *Consumption/production info from Feasibility study*
  - *Exceed Title 24 by 20%*
  - *Energy modeling requirements*
  - *Measurement and verification requirements*
- **Use team with prior experience!!**



ZNE RFSQ/RFP Package for Project Managers
Revised 6 October 2017

6. ZNE LANGUAGE FOR RFP

Instructions for Editing

This package includes instructions to the Project Manager, in blue text and in the form of general instructions outlined in a box (example follows)

PM delete the following paragraph and subparagraph if natural ventilation is not desirable in this project.

or specific instructions in brackets [PM delete the following sentence…].

Energy and Sustainability Division staff will assist the PM with completing this editing process.

Project Manager should delete all instructions when publishing.

RFP Language

1. INTRODUCTION

Since the 2006 California Global Warming Solutions Act was passed, the State of California has adopted future energy goals that require zero net energy (ZNE) for all permitted residential construction by 2020 and for all commercial construction by 2030. In October of 2015, the County of San Diego Board of Supervisors approved a new Strategic Energy Plan that emphasizes a focus on energy and water efficiency, as well as pursuing ZNE on new facilities whenever possible. This new [PM insert name of project] facility provides a great opportunity to add to the County's growing ZNE portfolio.

The approach to designing for ZNE is different from designing for energy efficiency as an improvement over baseline, code-compliant design and construction. The target for energy use in a ZNE building is "zero" (instead of a percentage improvement over prior performance). This means that design and construction must focus on driving down energy use because the energy used will be matched by onsite energy generation, supplied from renewable energy sources - providing maximum energy efficiency will produce a more cost effective product because the capital cost of efficiency is less expensive than the capital cost of renewable energy.

In order to attain ZNE on a new project, it is critical that certain activities take place that other energy efficiency approaches may consider optional. This includes whole building energy modeling throughout the design process to confirm if a project can achieve ZNE, and a solid measurement and verification plan to track the performance.

[PM insert site-specific climatic information]

This attachment provides detailed requirements for including a zero net energy approach to this design-build project. It includes energy efficiency standards, renewable energy standards, and LEED certification standards.

2. ZERO NET ENERGY DESIGN

1. Designed-for-ZNE Performance: The D-BE proposals shall document their designed-for-ZNE concept through the submission of narratives and renderings which document design concepts that will maximize the building's performance.
   a. Narratives and renderings should explicitly describe the following techniques for reducing energy use:

Use Advanced Technologies

LED lighting

Go All Electric – It's Cheaper to Build

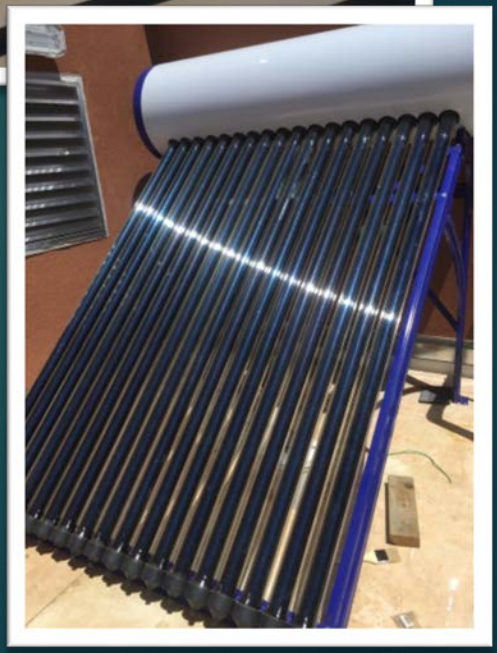
Solar PV

Easily available, industry is familiar

VRF HVAC

Daylight harvesting

Solar thermal



Measurement and Verification

- M&V support to manage process
- M&V plan
  - *Clearly ID metering products and methods*
  - *Assign single point of responsibility*
  - *Document*
- Set up for monitoring

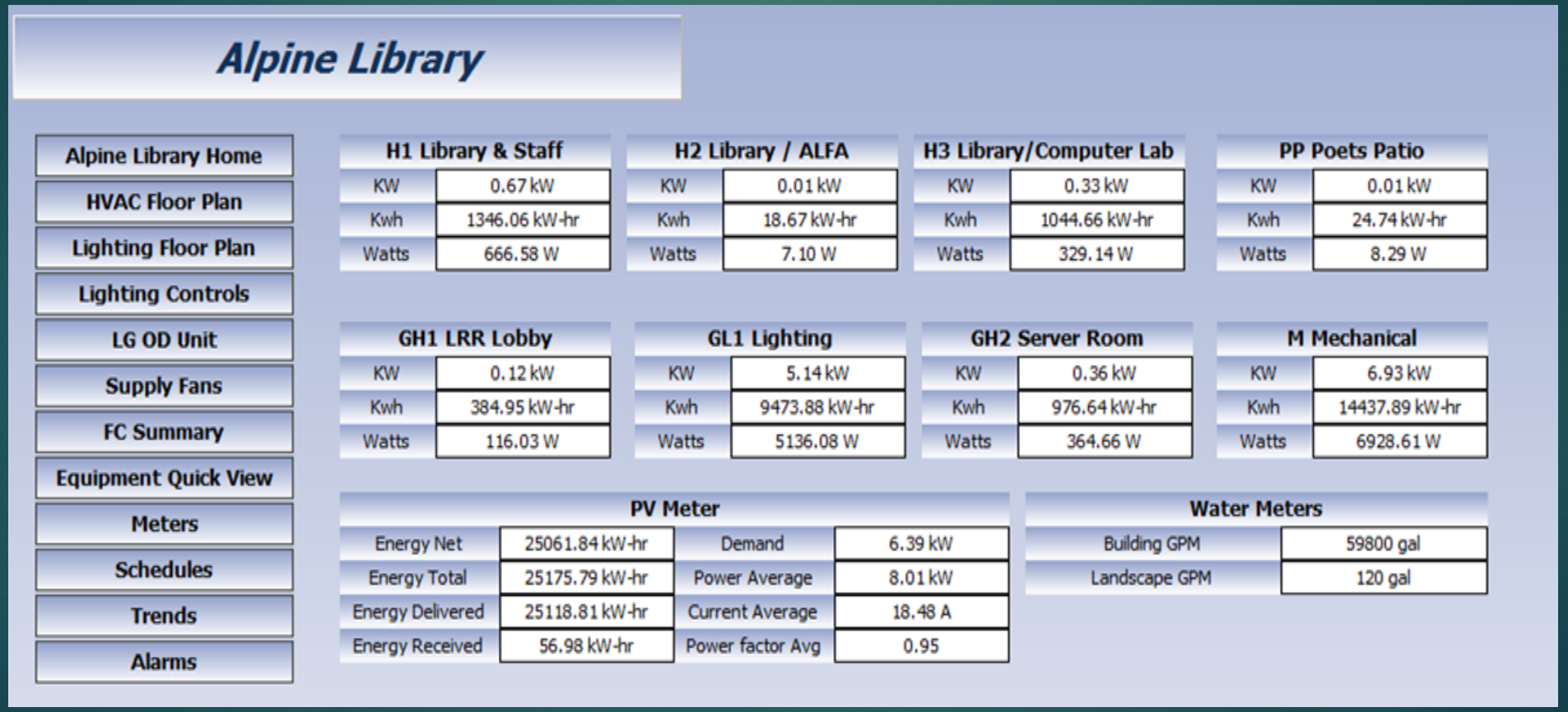
M&V is <u>not</u> common practice and <u>must</u> be managed

Metering

- **New construction**
  - *Code requires disaggregation of end uses*
  - *Panel level metering possible*
  - *Electricity, water, gas, PV*

Metering

- New construction

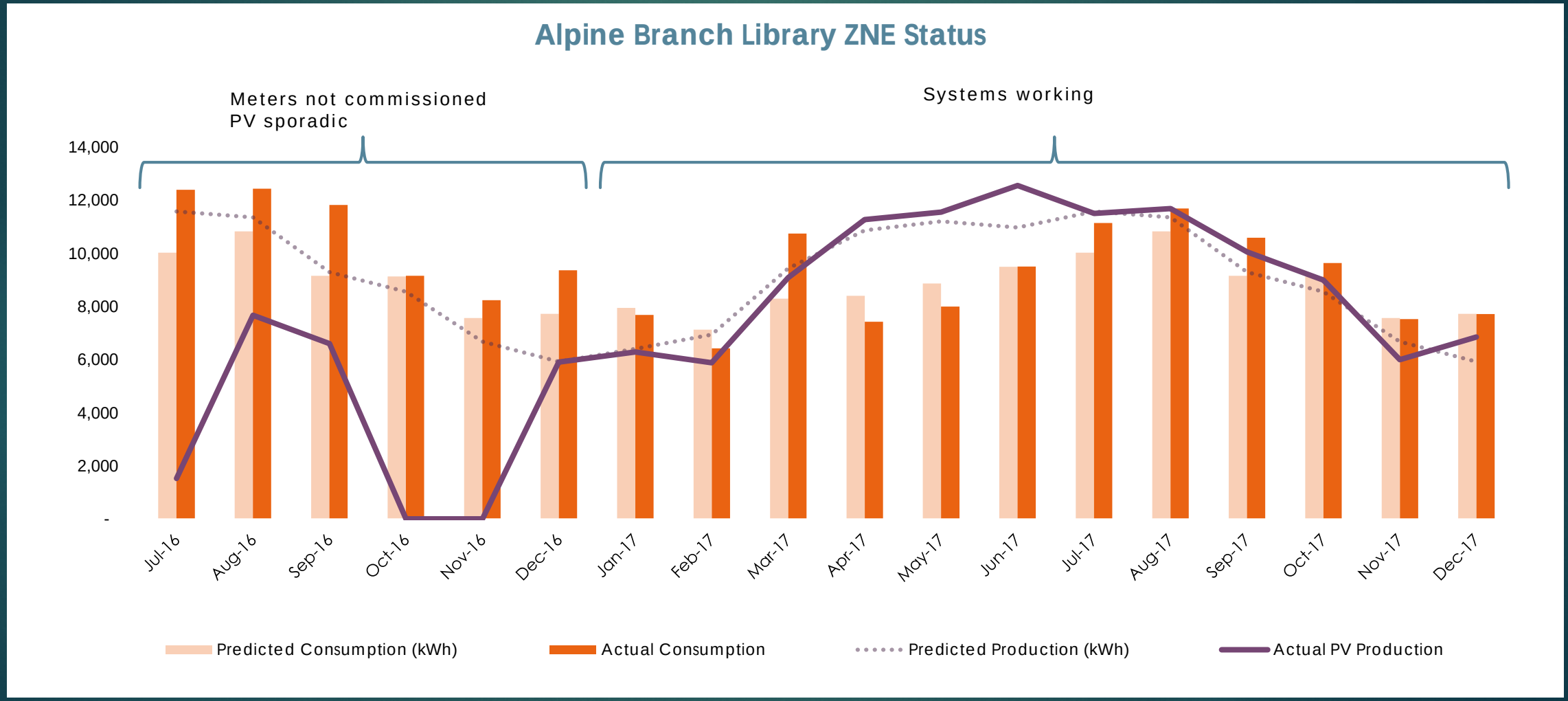


Commissioning

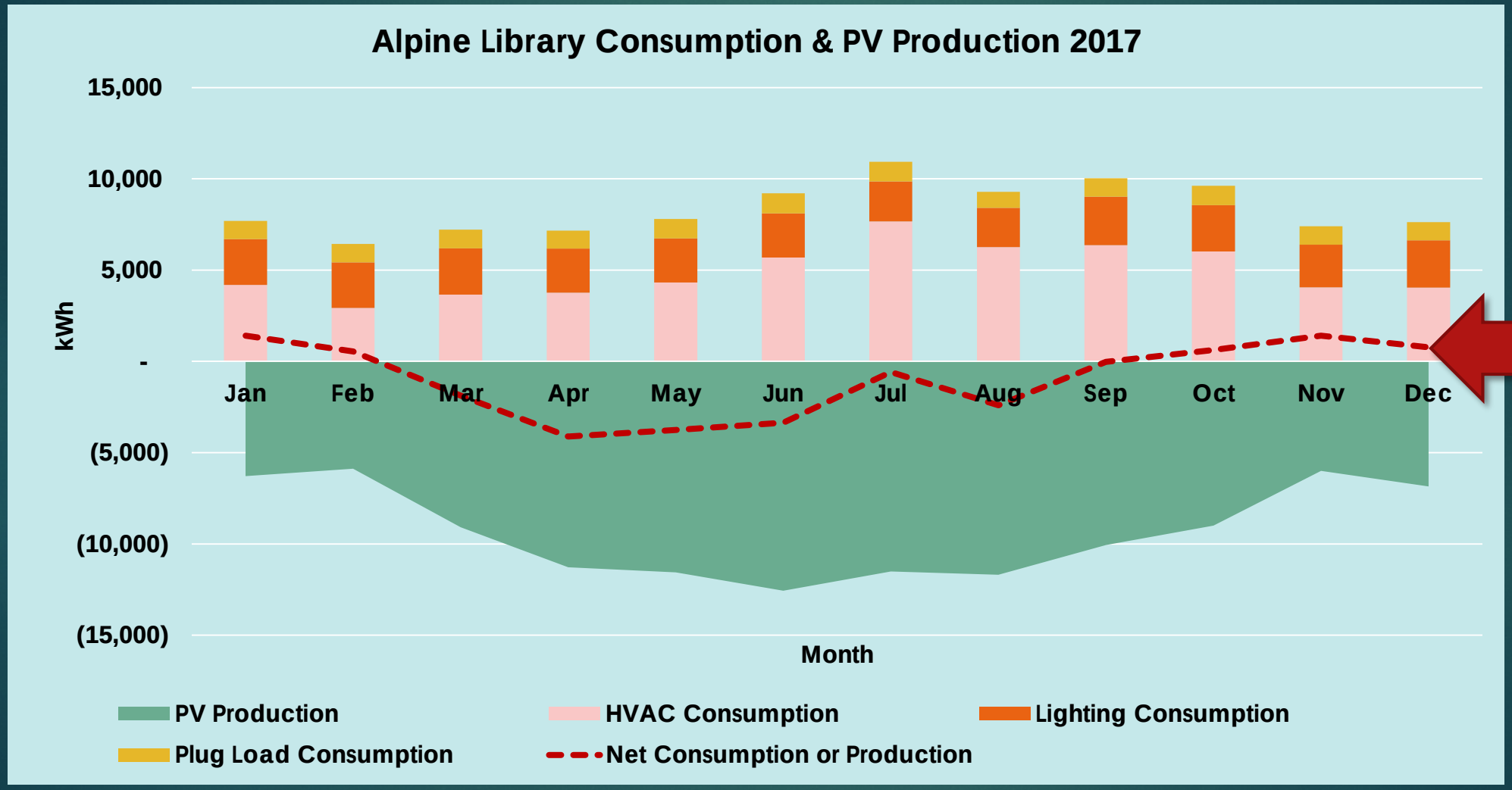
- Independent CxA
- Monitor design process
- Support M&V planning
- Coordinate controls installation
- Don't occupy until Cx is complete

What happens if we don't commission the monitoring system?

Commissioning and Monitoring



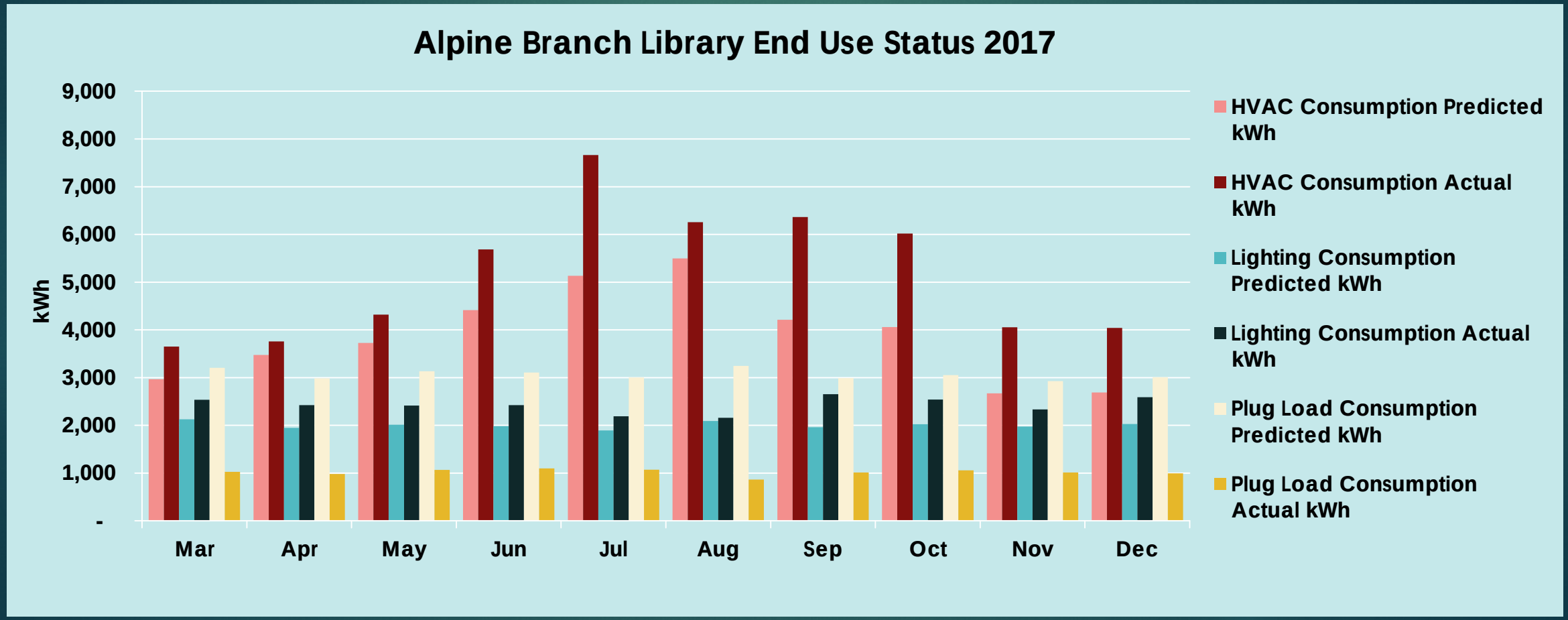
Track Energy Performance



This is the line that get's you certification

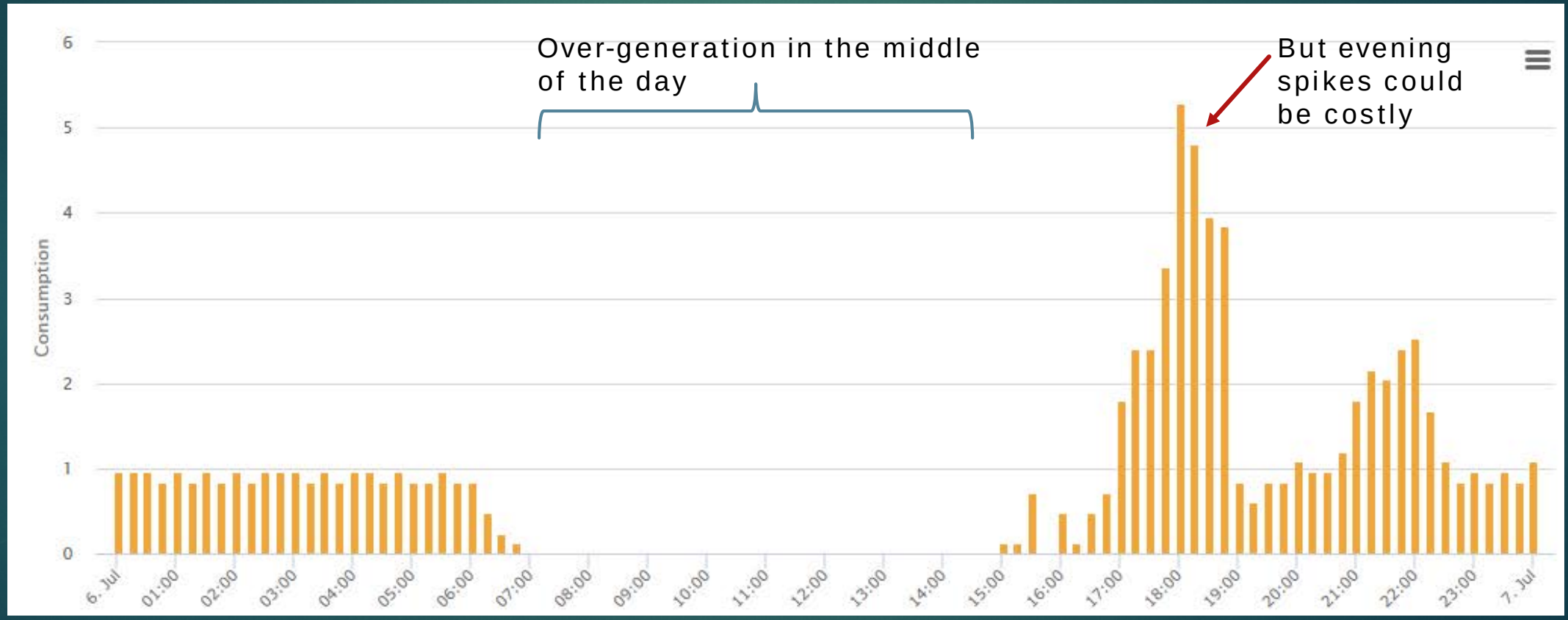
Track Energy Performance

- End uses: predicted vs actual

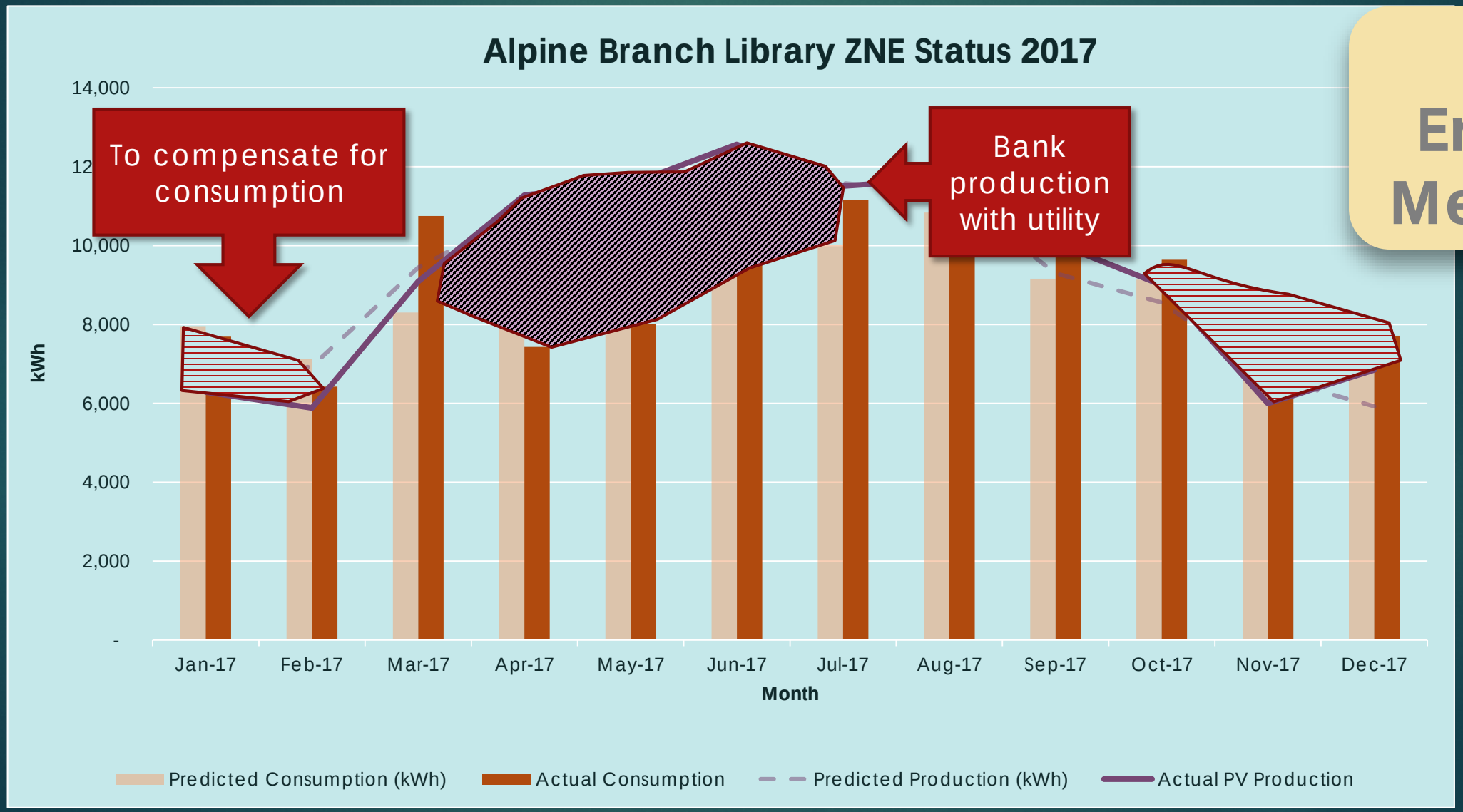


Track Energy Performance - Daily

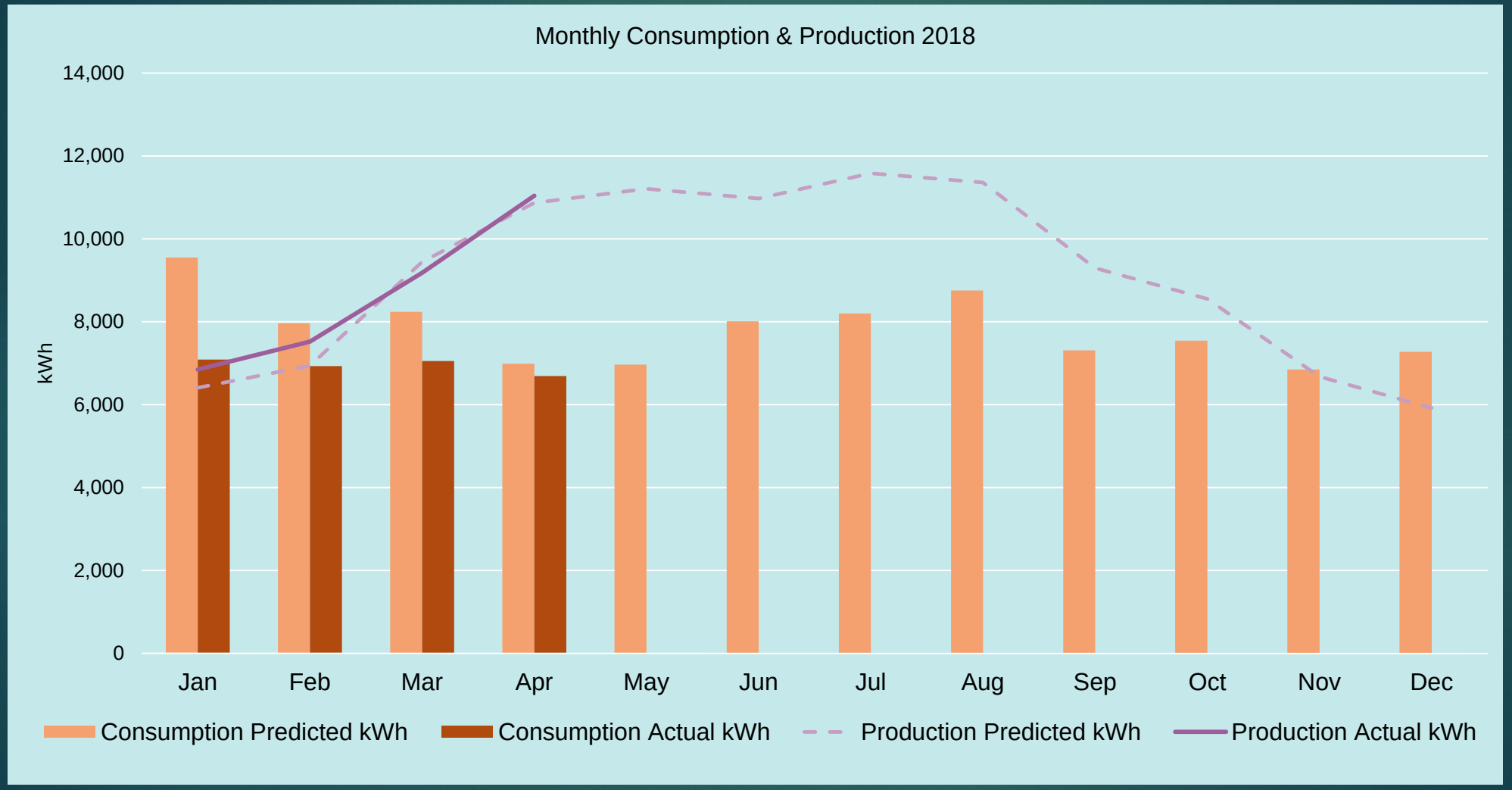
- Net Zero doesn't mean never using the grid



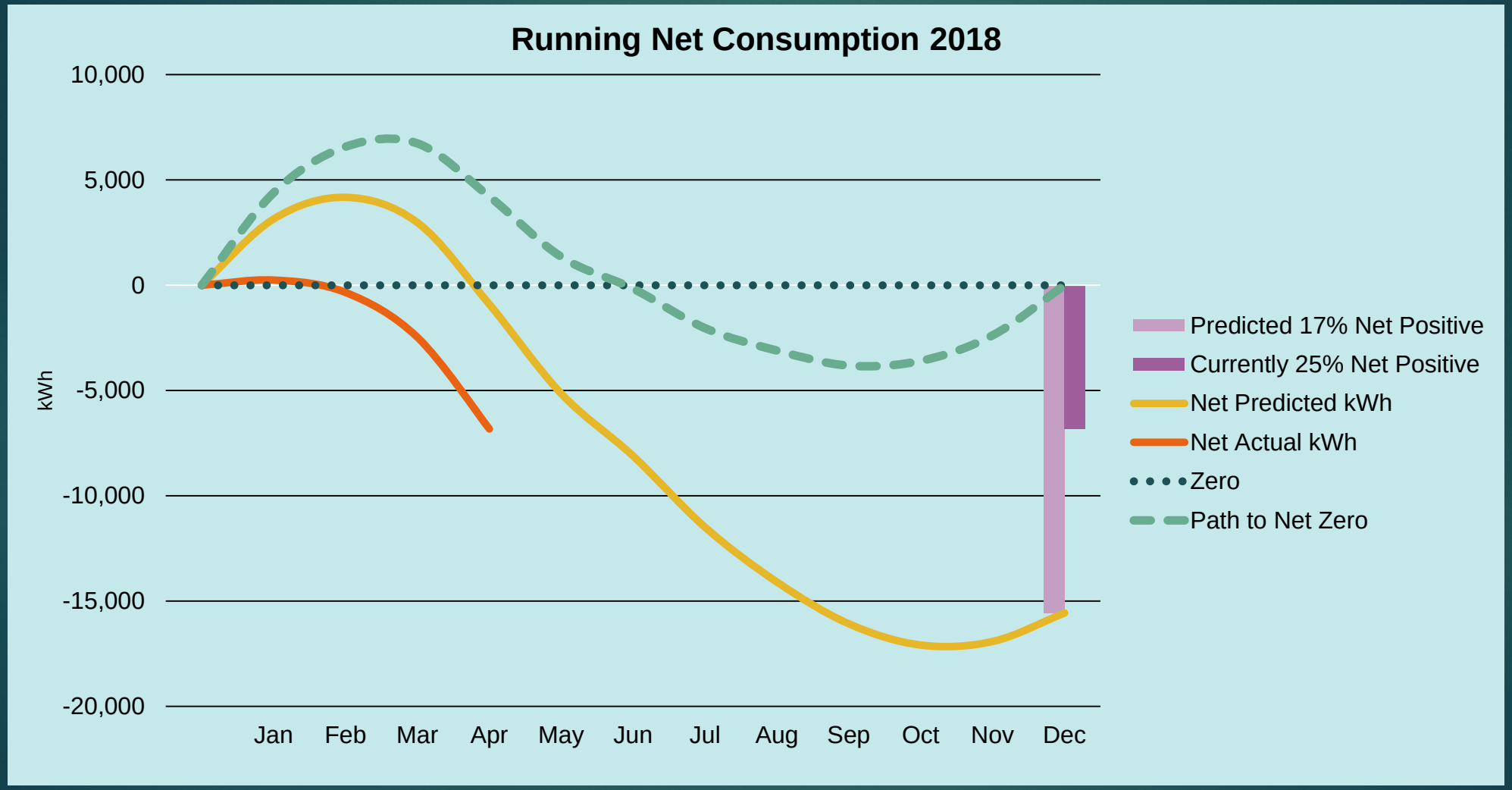
Track Energy Performance -Annual



2018 Calibrated Model

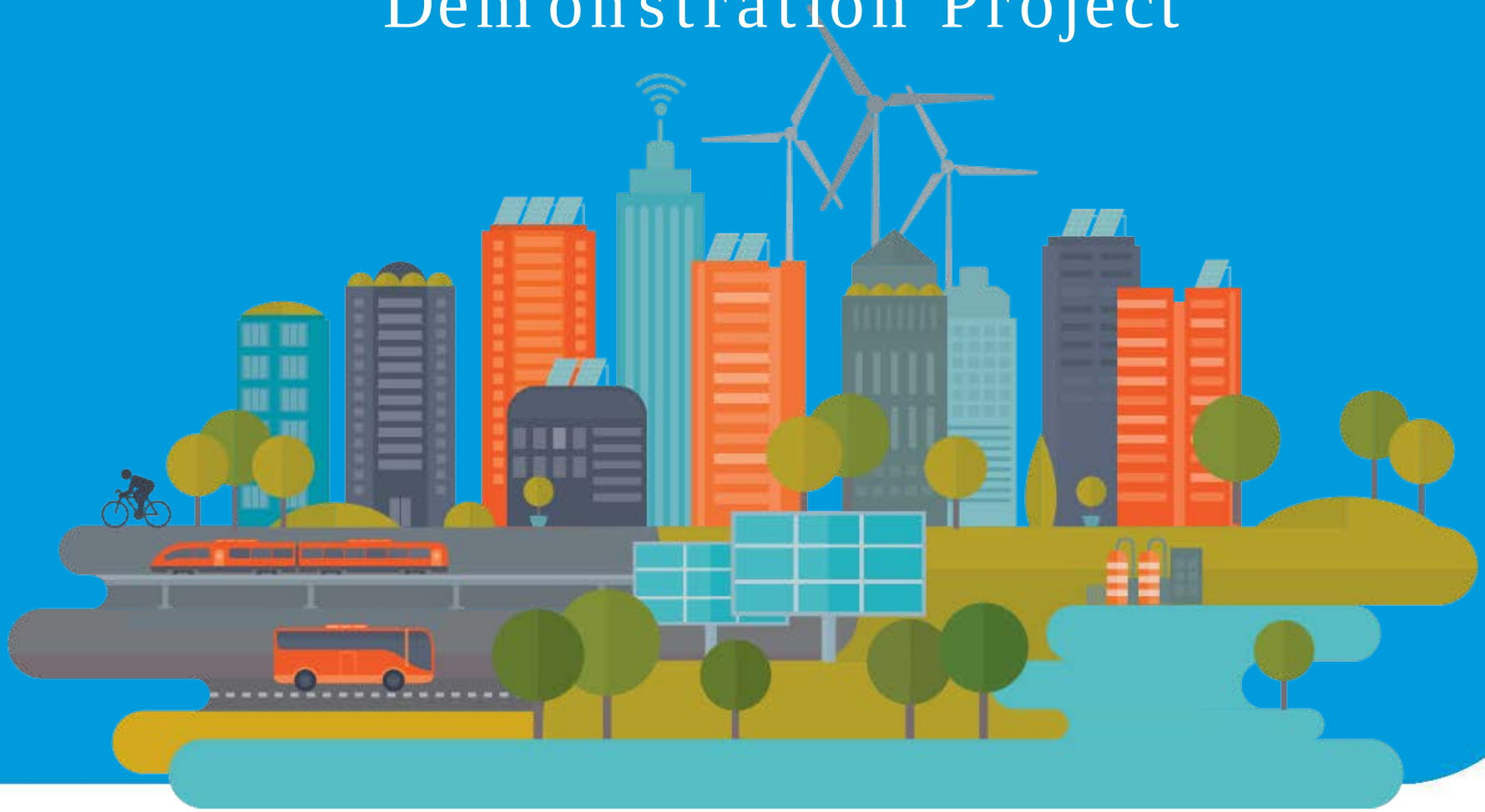


Running Net Consumption



QUESTIONS

Zero Net Energy Demonstration Project



Statewide Energy Efficiency Collaborative
June 20th, 2018

The City of SAN DIEGO

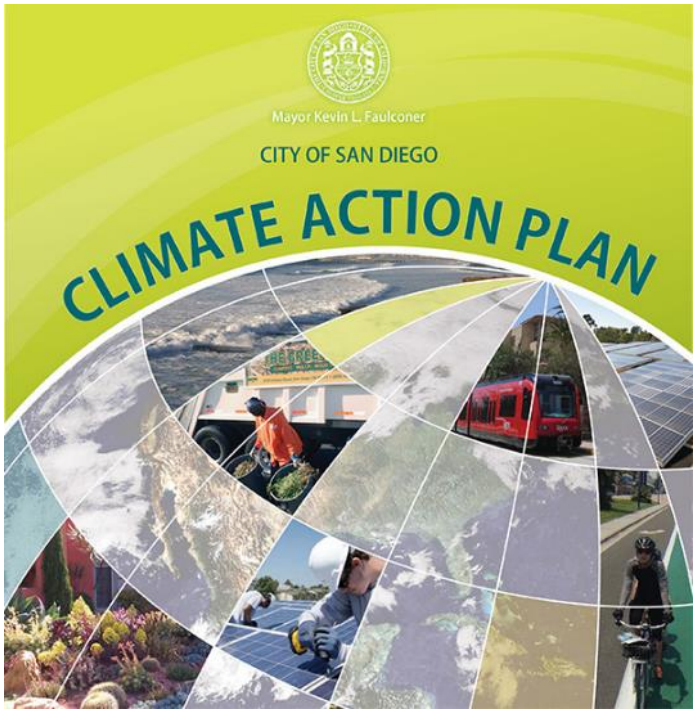
Climate Action Plan

Primary Goal

- Achieve 100% renewable electricity city-wide by 2035.

Action

- Integrate projects and outcomes into City's Roadmap to 100% renewable electricity. Feed results into Choice Aggregation (CCA) or another program that increases the renewable energy supply. Incorporate those outcomes to the Municipal Energy Strategy and apply to the City's energy reduction goals.



Climate Action Plan

- City of San Diego is a national leader in sustainability planning and program implementation with strong support from elected officials.
- Commits $128M+ to climate action in San Diego for FY2018.
- First City to release a sustainability-specific budget.

Source: 2017 Climate Action Plan Annual Report, City of San Diego

Goals for muni bldgs. & local economy

By 2020

- Reduce energy consumption at municipal facilities by 15%
- Reduce daily per capita water consumption by 4 gallons

By 2035

- Reduce energy consumption at municipal facilities by 25%
- Reduce daily per capita water consumption by 9 gallons

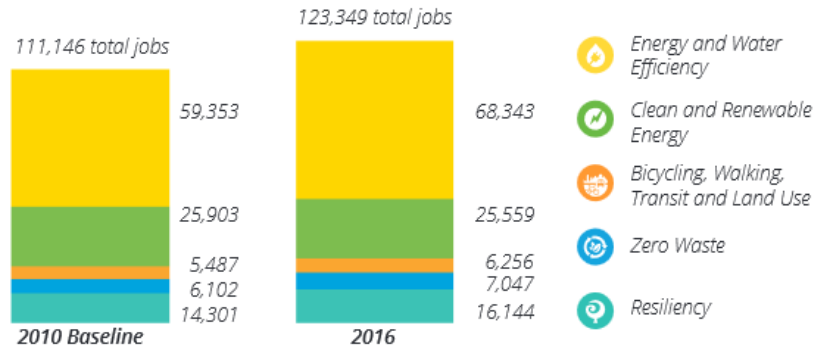
Supporting job creation

+10.9%
Growth in sustainability-related jobs

2010-2016

The City's commitment to sustainability creates jobs in clean technology and climate-related fields for San Diegans.

In 2016, clean technology job levels continued to grow, with the Clean and Renewable Energy sector experiencing the largest annual increase. San Diego's cleantech job concentration is 2.6 times the national average.



Source: 2017 Climate Action Plan Annual Report, City of San Diego

What, Where & Why

Project Objective

- Perform an innovative demonstration on three City of San Diego public libraries utilizing cost-effective energy efficiency technologies combined with building automation, solar photovoltaic (PV) production that will result in integrated demand-side management (IDSM) strategies working to ZNE or near-ZNE performance.

Project Goals

- Create a replicable ZNE blueprint for local governments to achieve ZNE in existing facilities.
- Demonstrate value proposition and technical capacity of IDSM technologies to deliver ZNE in existing facilities.
- Engage visitors, surrounding communities & stakeholders with education & outreach.

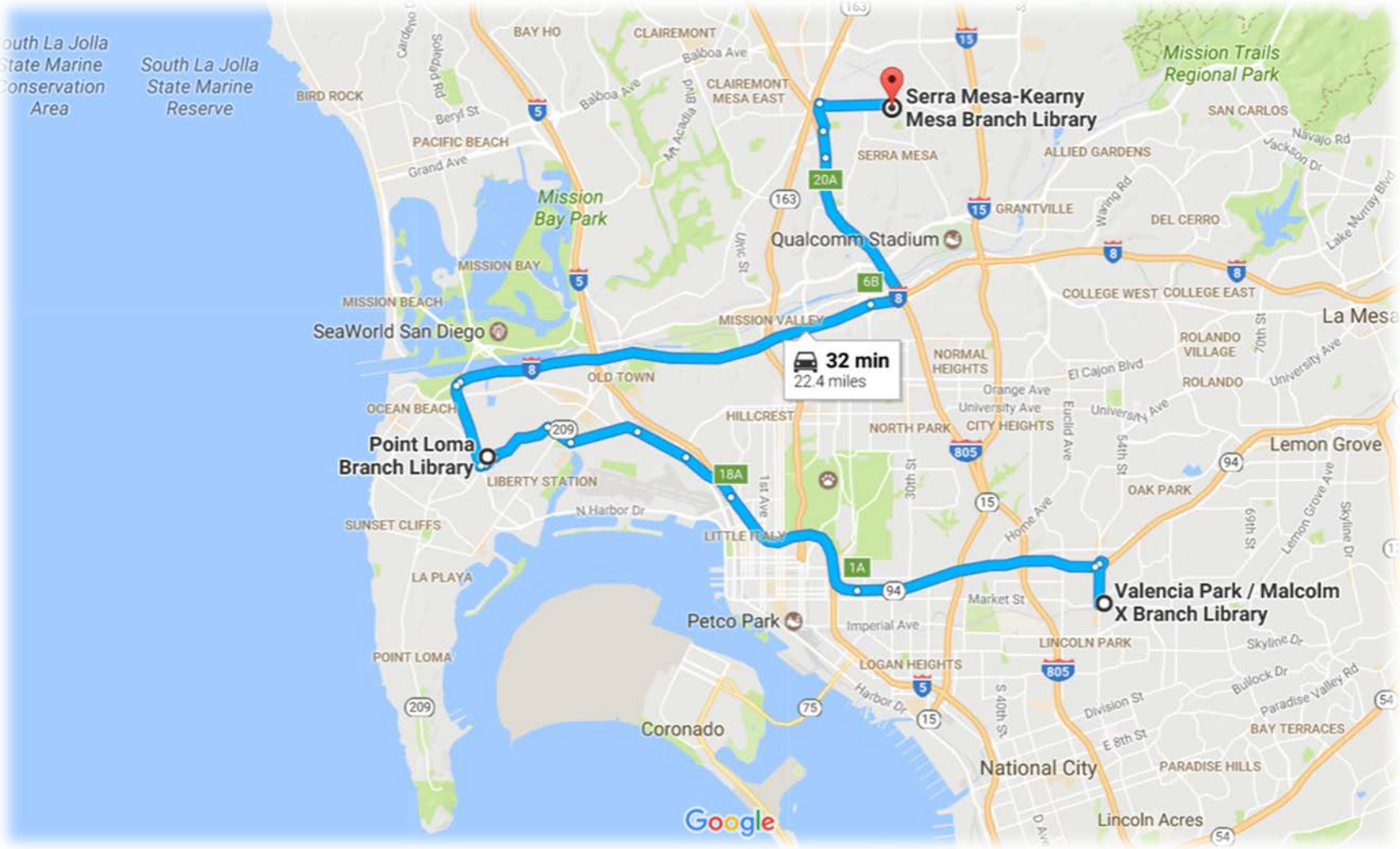
Participating Library Branches

Malcolm X/Valencia Park

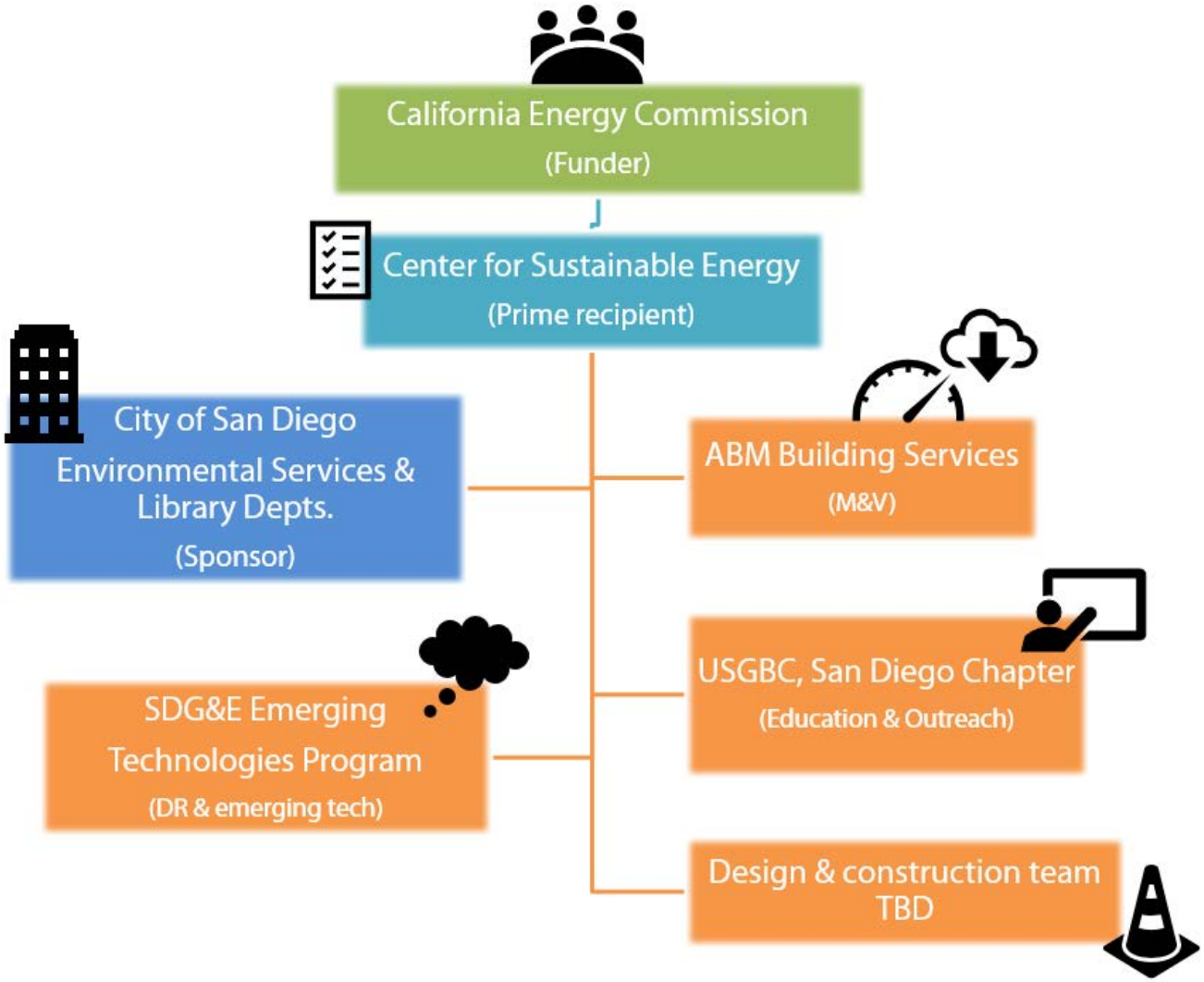
Serra Mesa/Kearny Mesa

Point Loma

Site Map


Serra Mesa-Kearny Mesa Branch Library
Point Loma Branch Library
Valencia Park / Malcolm X Branch Library
32 min
22.4 miles
Qualcomm Stadium
SeaWorld San Diego
Petco Park
Coronado
National City
Mission Bay Park
Mission Trails Regional Park
South La Jolla State Marine Reserve
BIRD ROCK
PACIFIC BEACH
CLAIREMONT
CLAIREMONT MESA EAST
SERRA MESA
ALLIED GARDENS
SAN CARLOS
GRANTVILLE
DEL CERRO
COLLEGE WEST
COLLEGE EAST
La Mesa
MISSION BAY
MISSION BEACH
MISSION VALLEY
OLD TOWN
NORMAL HEIGHTS
ROLANDO VILLAGE
ROLANDO
OCEAN BEACH
HILLCREST
NORTH PARK
CITY HEIGHTS
Lemon Grove
OAK PARK
LIBERTY STATION
SUNSET CLIFFS
LITTLE ITALY
LA PLAYA
POINT LOMA
LOGAN HEIGHTS
LINCOLN PARK
BAY TERRACES
PARADISE HILLS
Lincoln Acres
Google

The SDZN3 Team



What is our ZNE goal?

- EPC-15-085 ZNE definition
  - *"A **Zero-Net-Energy Code Building** is one where the net amount of energy produced by on-site renewable energy resources is equal to the value of the energy consumed annually by the building, at the level of a single 'project' seeking development entitlements and building code permits, measured using the Energy Commission's Time Dependent Valuation metric…*
  - *…A zero-net-energy code building meets an energy use intensity value designated in the Building Energy Efficiency Standards by building type and climate zone that reflect best practices for highly efficient buildings,"* (2013 Energy Commission Integrated Energy Policy Report, CEC)

CEC equation: [Value of modeled energy consumed] – [net modeled energy produced] = ≤0

- How we plan to verify ZNE or near-ZNE
  - Use existing industry standards (i.e., NBI & ILFI).
  - Perform 12-months of post-construction measurement & verification of energy consumption minus energy produced.

Project Phases

- Phase 1 (Q1 2017 – Q3 2018)
  - ✓ ASHRAE Level II Audits x3 **(Task 2)**
  - ✓ Baseline Energy Models x3 **(Task 2)**
  - ✓ Develop Technology/Knowledge Transfer Plan and launch activities **(Task 10)**
    - ✓ Initial Fact Sheet & project website
  - ✓ Pre-Construction Occupant Behavior Surveys **(Task 8)**
  - ✓ Pre-construction (baseline) end-use monitoring **(Task 2)**
  - – Calibrate baseline energy models **(Task 3) – in progress**
  - – Identify energy conservation measures (ECMs) **(Task 4) – in progress**

- Phase 2 (Q3 2018 – Q4 2018)
  - – Design ZNE retrofit plans based on identified ECMs **(Task 5)**
  - – Procure and install identified ECMs **(Task 5)**
  - – Identify and perform Commissioning & RCx on equip. where needed **(Task 6)**

- Phase 3 (Q1 2019 – Q1 2020)
  - – Collect 12 months post-construction M&V data **(Task 7)**
  - – Post-Construction Occupant Behavior Surveys **(Task 8)**
  - – Evaluate project benefits and conduct knowledge transfer **(Task 10)**

Challenges

Understanding emerging technologies across many different disciplines

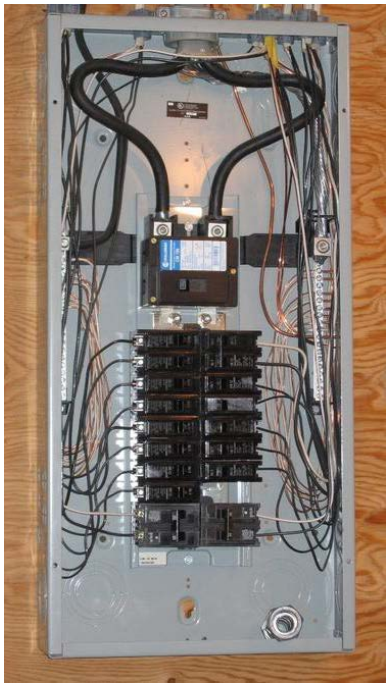
- Sub challenge: Getting through plan check, permitting & inspections in a timely manner

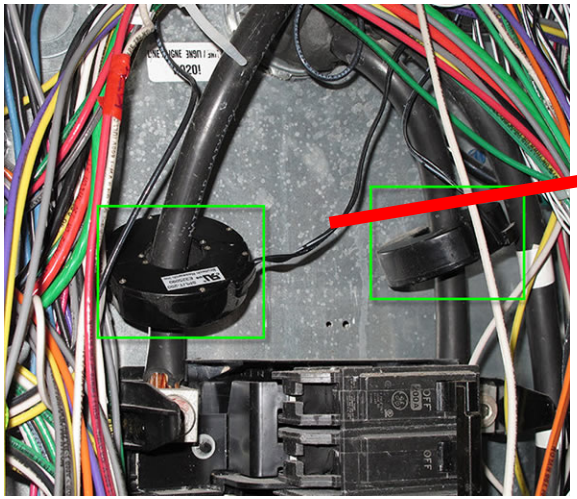
Public / Non-Profit / Private contracting requirements & managing risks for all

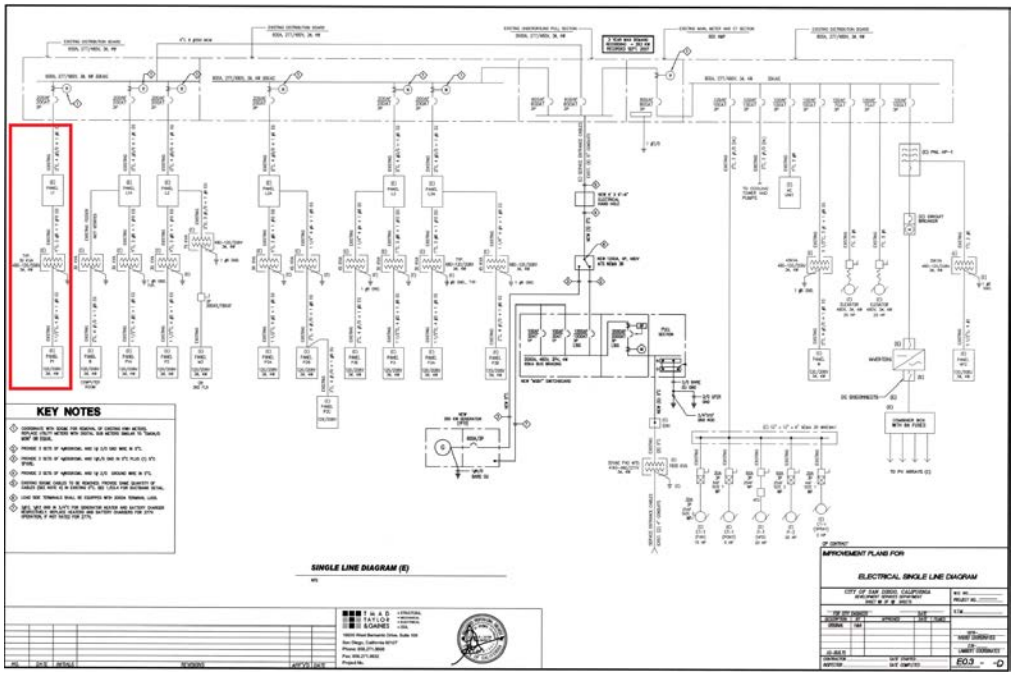
Achieve ZNE or near-ZNE while:

- Libraries built in different code cycles
- Varying controls, equipment and operations
- PV already exists on site

Task 3 – End-use Monitoring







Task 3 – End-use Monitoring

Dashboard | Meters

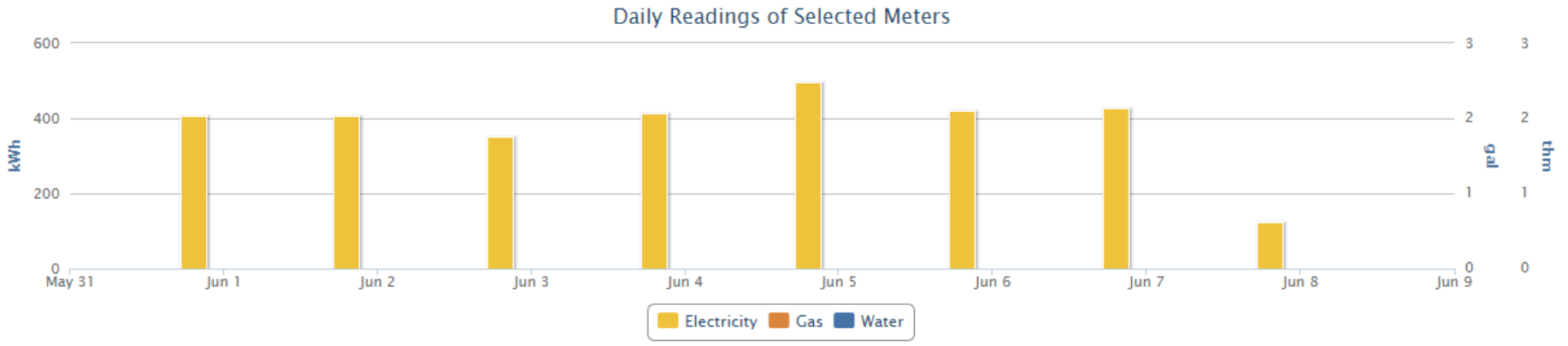
Display Readings from: 06/01/2018 to: 06/08/2018 Show/Hide Energy

Meters

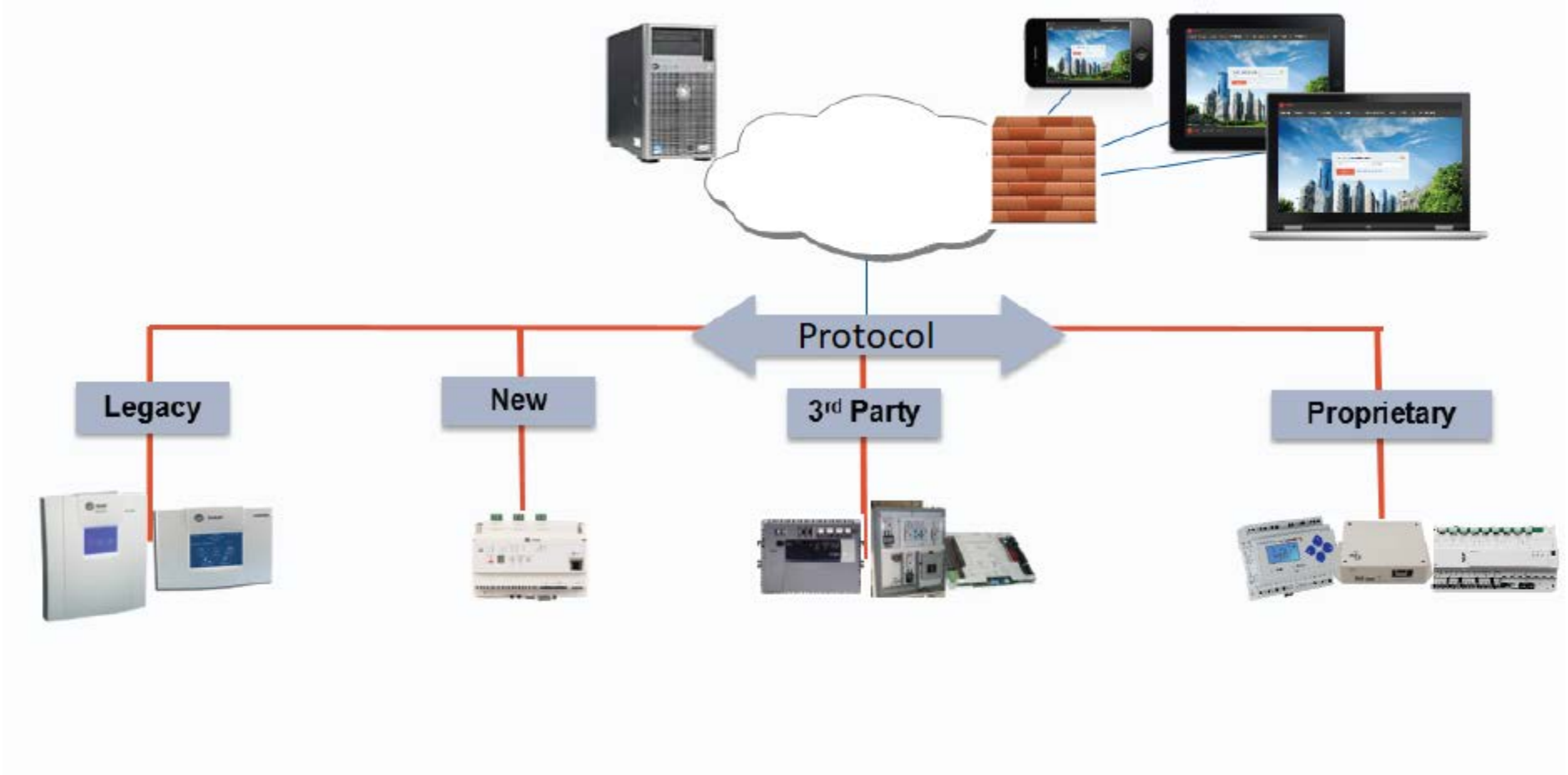
Status	Location	Meter	Cost ($)	Consumption	Unit	Meter Type	Display
Active	Default	Panel DC - AU164610115	28.39	162.200	kWh	Electric	☑
Active	Default	Panel LA - AU164610103	297.18	1,698.200	kWh	Electric	☑
Active	Default	Panel OD - AU151910381	91.42	522.400	kWh	Electric	☑
Active	Default	Panel PA - AU164610008	40.18	229.600	kWh	Electric	☑
Active	Default	Panel PB - AU164610054	41.35	236.300	kWh	Electric	☑

Setup | Details | Hide | Unhide

Page 1 of 1 50 View 1 - 8 of 8

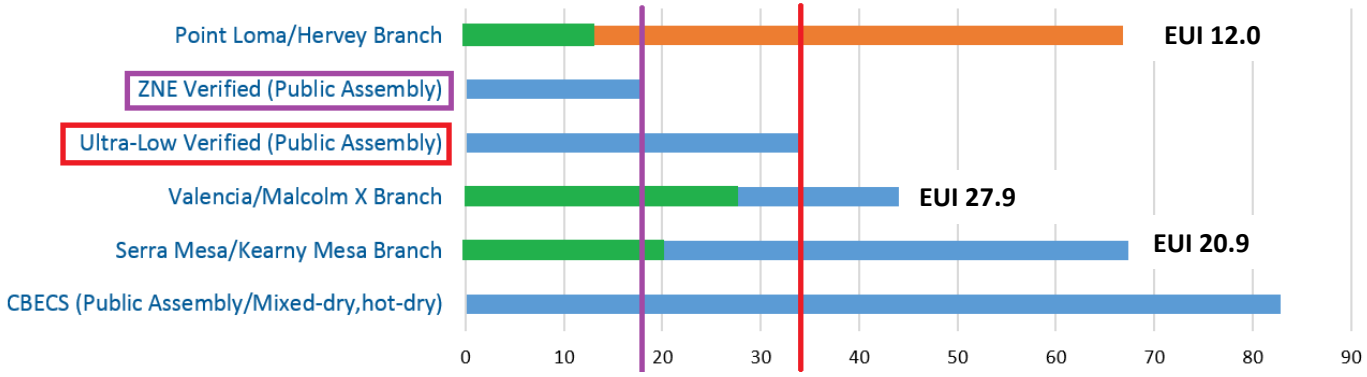


Task 3 – Technology & Data Stack

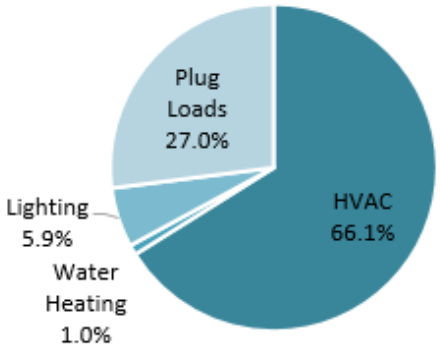


ASHRAE Audit Findings

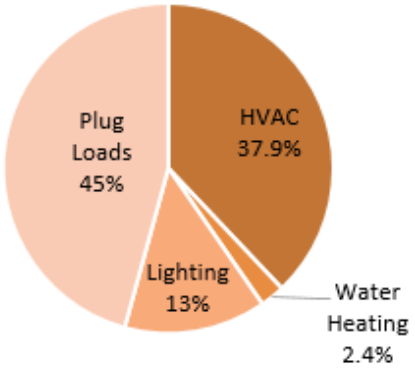
Libraries EUI Compared to Various Averages (kBtu/ft^2)



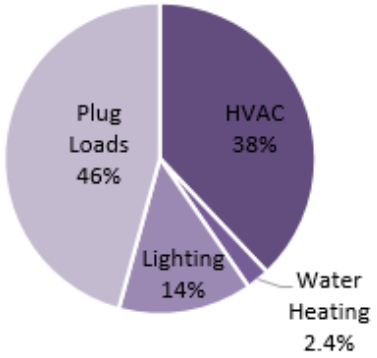
Modeled kBtu by End Use



Malcolm X/Valencia Park
(192 kW PV System)



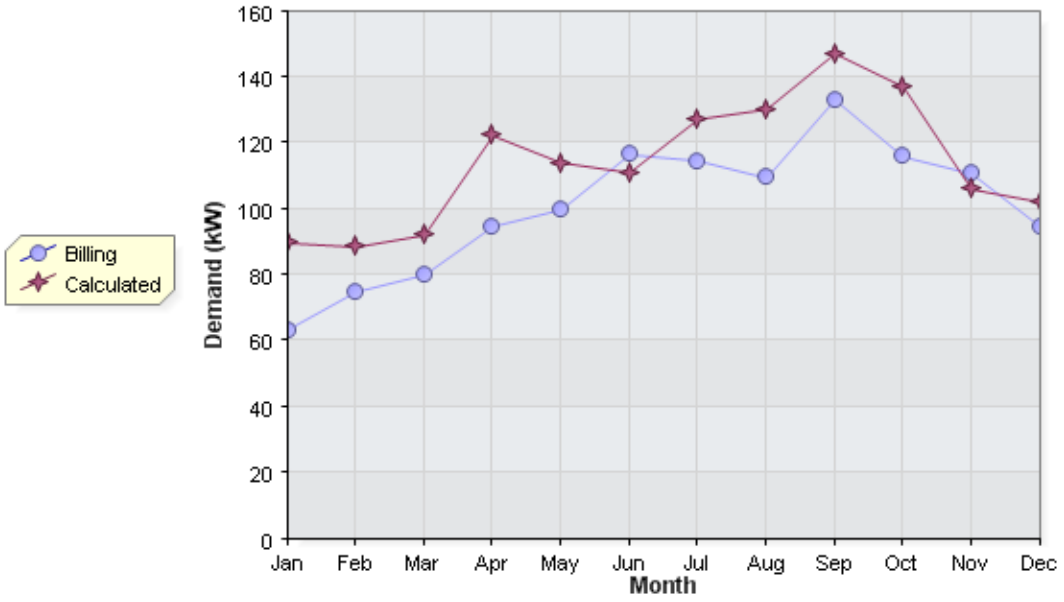
Serra Mesa/Kearny Mesa
(132 kW PV System)



Point Loma
(48 kW PV System)

Task 3 – Energy Modeling

- Using EnergyPro Modeling Software to complete baseline & calibrated energy models for each library.
- For calibrated energy models: analyzing utility bills, using Energy Pro weather data, and baseline data from Task 2
- Example: Valencia Park/Malcolm X Library (calibrated model)



Adjusted interior lighting from 100% to 75% of the time
Adjusted receptacle from 100% to 75% time
Adjusted exterior lights from 100% to 85% time
Changed the occupant # to more sf./occup. = decreasing # of people
To make electric cost equal, calculated (baseline) cost would have to increase

Task 8 – Behavior Analysis

Survey objectives

- Pre-construction
  - To understand what energy-saving behaviors library occupants are currently engaging in and what frequency.
  - To understand what motivates occupants to engage in energy-saving behaviors.
  - To understand occupants' comfort levels.
- Post-retrofit (Q1 2019)
  - To understand what energy-saving behaviors library occupants are engaging in after construction.
  - To understand what motivates occupants to engage in energy-saving behaviors.
  - To understand if the occupants' comfort expectations are being met
  - Compare results from the first survey.

Target Audience: Library staff and volunteers

Task 10 – Knowledge Transfer

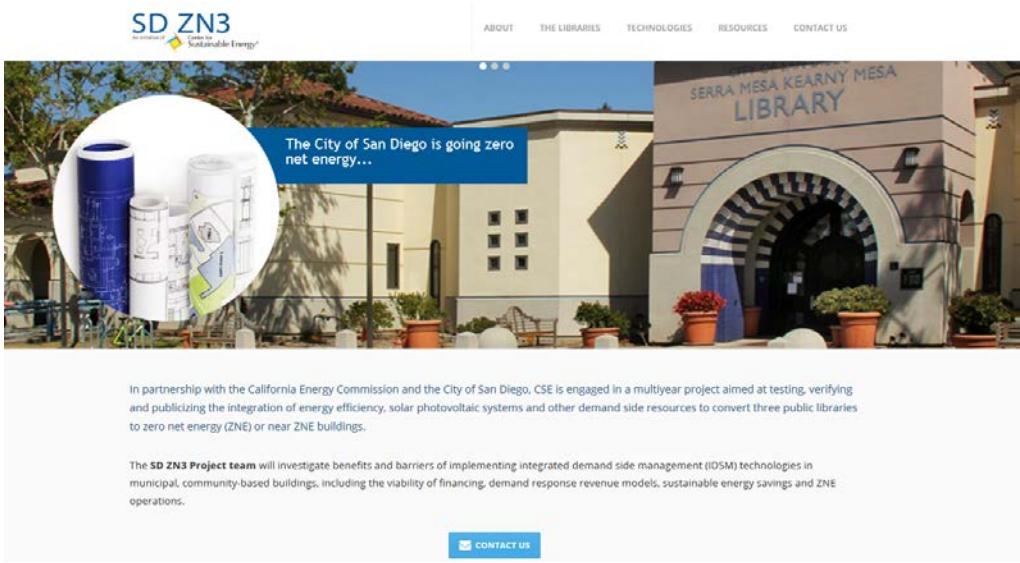
SDZN3 Website Content

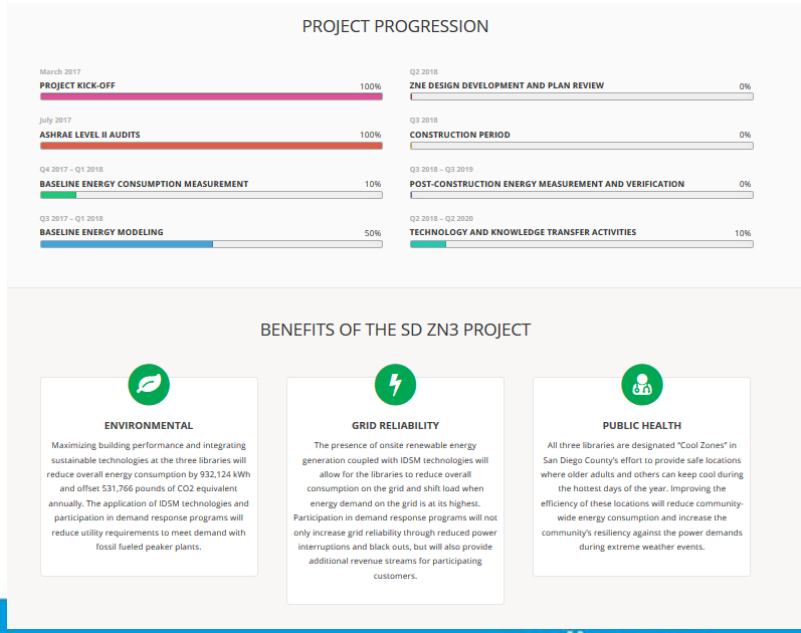
- Project progression & status
- Site-specific building characteristics
- Links to past CSE webinars on ZNE
- Technologies glossary & FAQs
- Inquiry submittal portal

Upcoming Content

- M&V reporting/ energy consumption dashboard
- Site-specific ECMs
- Add deliverables to report and webinar repository
- Enhance terminology glossary & FAQs
- Testimonials, etc.

Link: www.energycenter.org/sdzn3





Q & A

Bryan Olson, City of San Diego
OlsonB@sandiego.gov