

Tools and Tactics to Justify ZNE Municipal Retrofits: The City of San Diego “ZN3” Project

Presented by the Center for Sustainable Energy (CSE), San Diego Gas & Electric and the San Diego Green Building Council

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Center for
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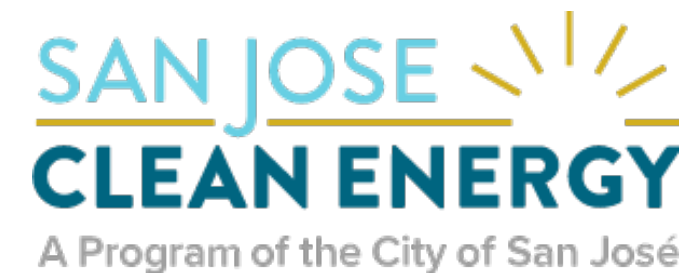
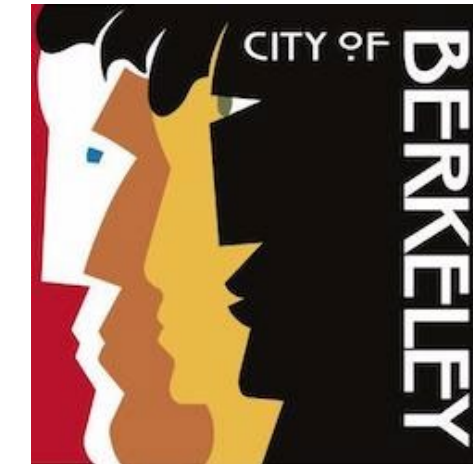
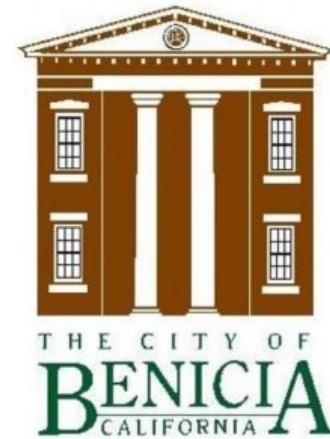




LOCAL GOVERNMENT
**SUSTAINABLE
ENERGY COALITION**

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About CSE

A mission-driven 501(c)(3) nonprofit organization

Offering scalable clean energy program administration and technical advisory services for more than 20 years.

A national footprint, headquartered in San Diego, CA

Regional offices:

CA: Los Angeles, Oakland, Sacramento, MA: Boston, NY: Brooklyn, Stony Brook

185+ dedicated, mission-driven employees

Managing ~50 projects and programs

National programs | Statewide incentive projects | Region-specific solutions

Today's Agenda



SD ZN3 Project, Modeling and Design Overview

Kristin Larson, CSE



Utility Incentives and Available Programs

Tyler Sybert, SDG&E



Energy Dashboard and Visitor Engagement Activities

Josh Dean, SD Green Building Council

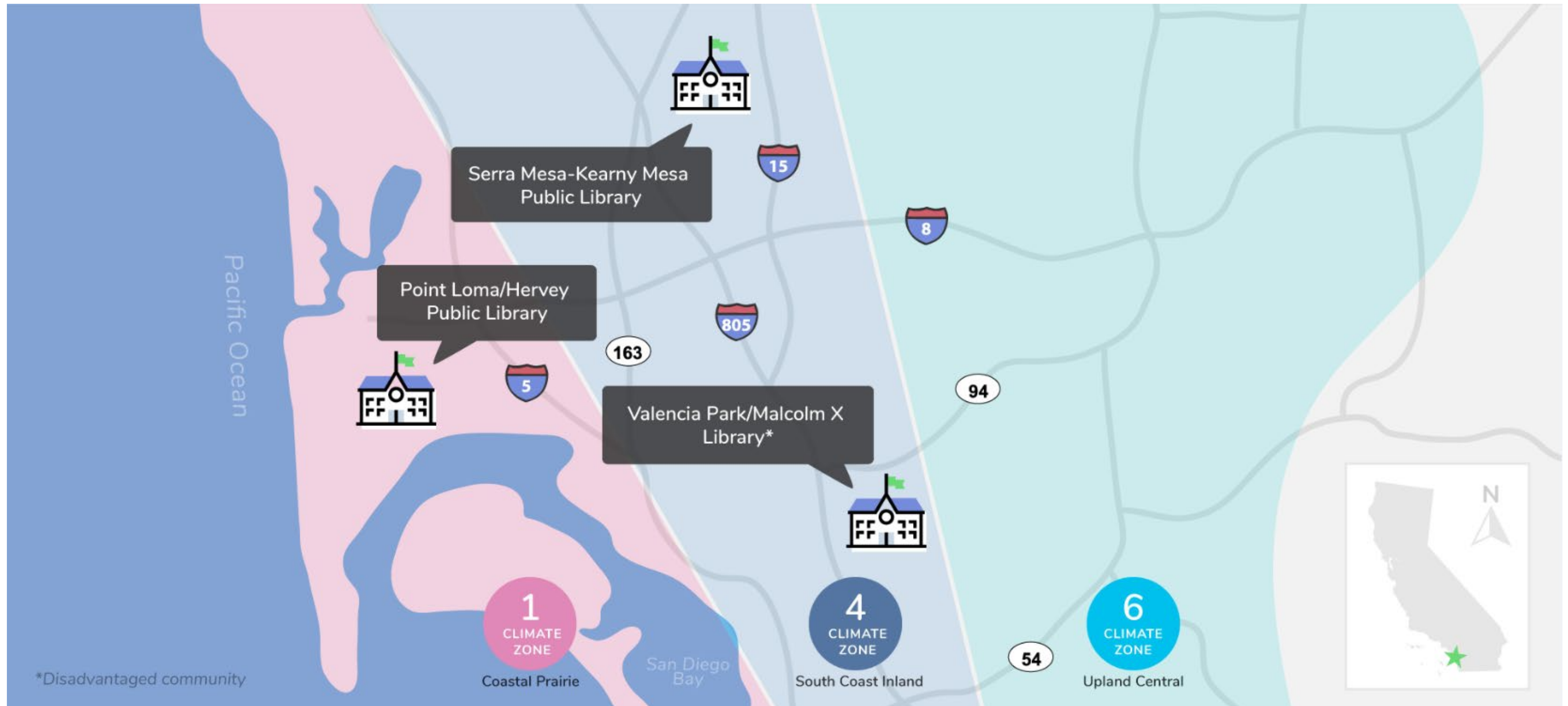
SD ZN3 Project, Modeling and Design Overview

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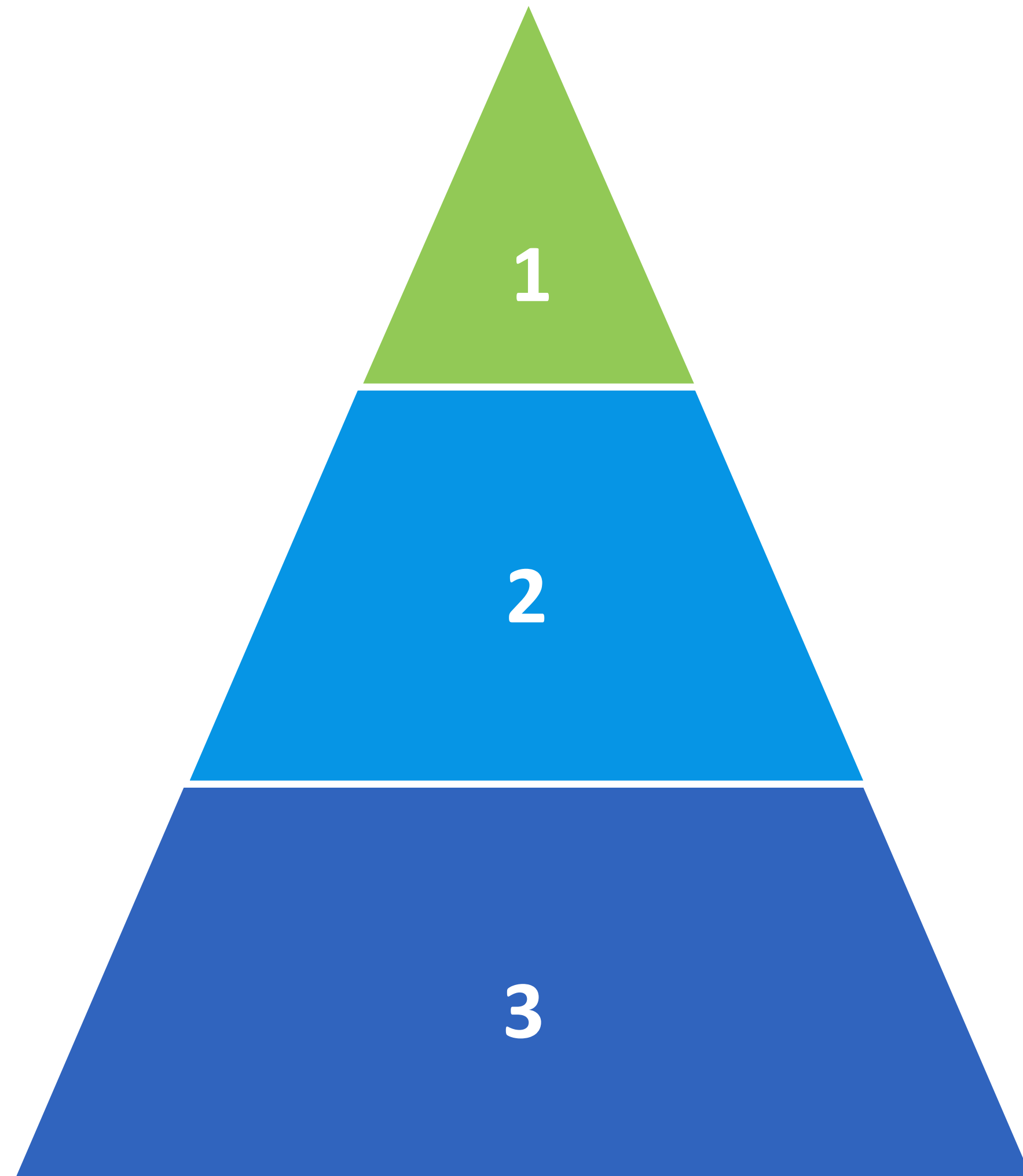
Project Summary

Three City of San Diego public libraries are undergoing an integrated demand-side management demonstration to achieve ZNE through cost-effective energy efficiency upgrades, on-site renewable generation, enhanced building automation, pre- & post-installation monitoring, and occupant behavior analysis in order to provide a blueprint that shows ZNE is possible in existing municipal buildings.

Project Sites



Zero Net Energy Goals



SD ZN3 Project

Achieve ZNE or near-ZNE at three existing libraries.

Achieve maximum energy efficiency savings through cost-effective demand-side management technology testing and building monitoring.

Demonstrate the City's ability to deploy this initiative outside of traditional capital improvement processes.

Create a replicable blueprint for other municipalities

City of San Diego

Reduce energy consumption at municipal facilities by 15% by 2020 and by 25% by 2035.

California

50% of new major renovations to state buildings will be ZNE by 2025.

50% of commercial buildings will be retrofit to ZNE by 2030.

Project Team



Project 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

The project is also evaluating ZNE site and ZNE source results.

Getting to Zero



Phase 1: Pre-retrofit

1. Perform building energy audits.
2. Identify & install end-use monitoring equipment needs.
3. Collect baseline end-use data.
4. Create energy models.
5. Perform pre-retrofit behavior analysis.
6. Identify, assess & design Energy Conservation Measures (ECMs), including pre-commercial technologies.



Phase 2: Construction

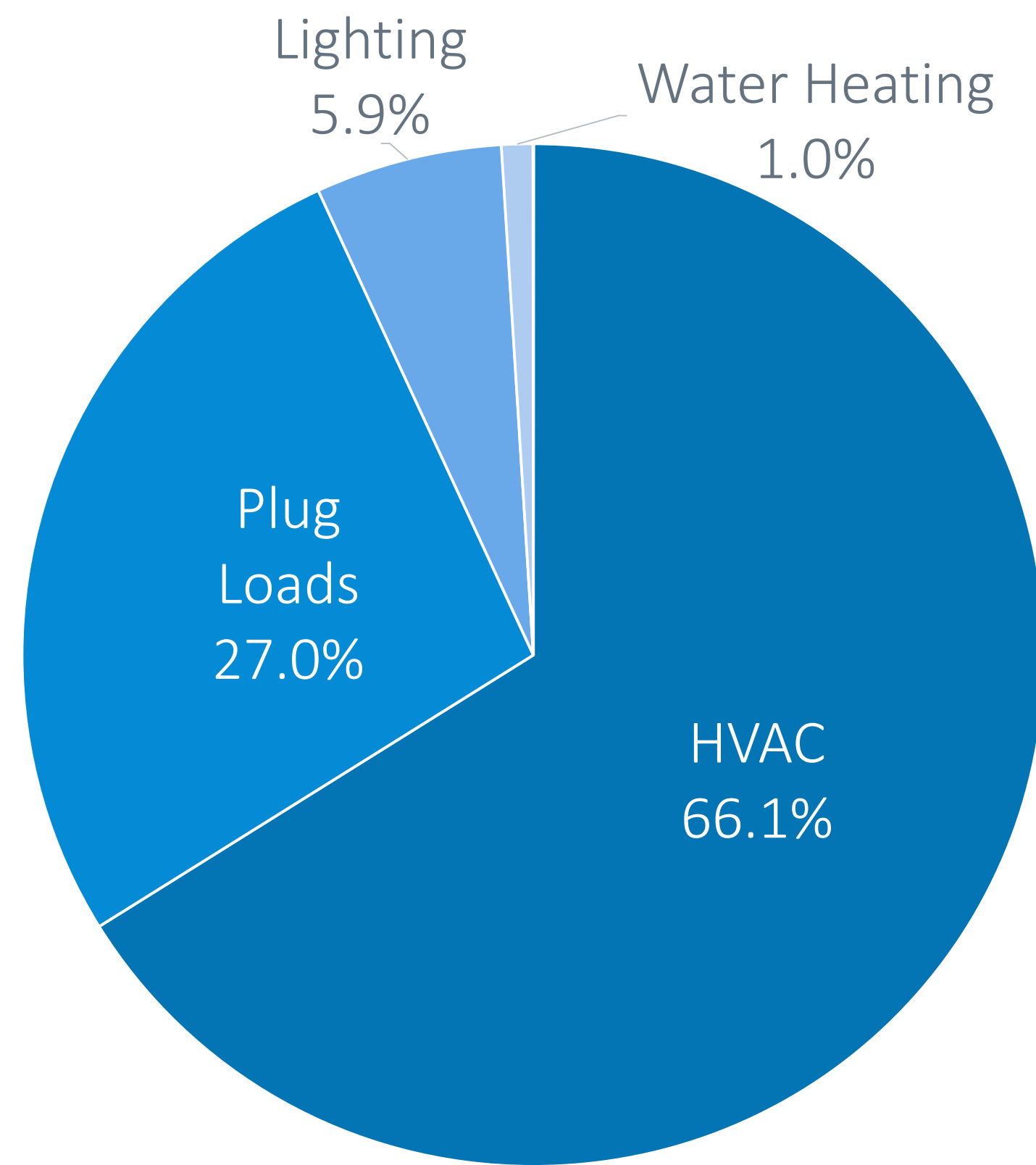
7. Select installation contractors.
8. Apply for permits.
9. Procure equipment.
10. Notify library occupants and patrons.
11. Install ECMs.
12. Perform Commissioning (Cx) & Retrocommissioning (RCx).
13. Integrate new & existing systems into building management system.



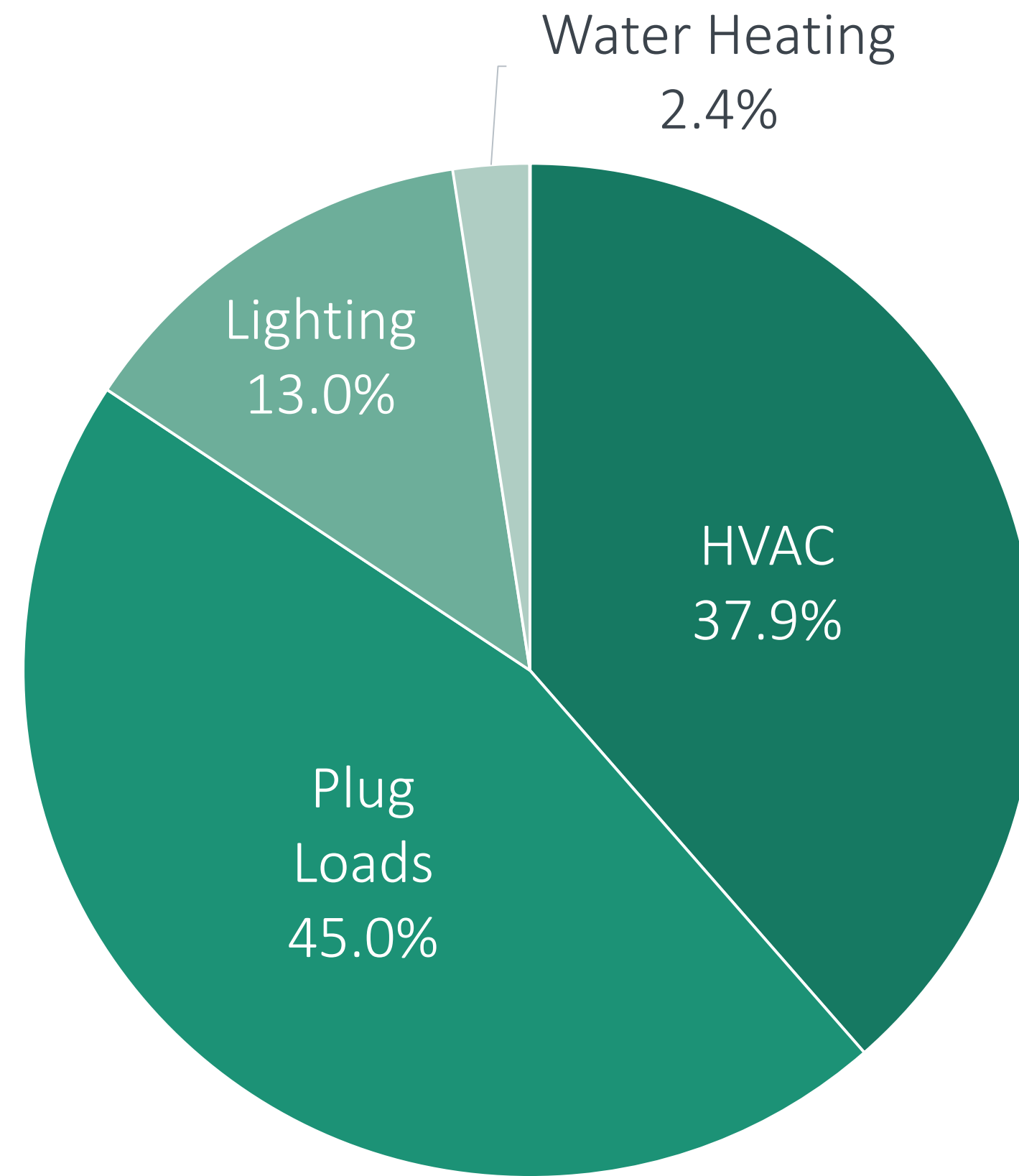
Phase 3: Post-retrofit

14. Collect 12 months of measurement and verification data.
15. Educate & train facility operators.
16. Complete post-retrofit occupant behavior analysis.
17. Evaluate project results and benefits.

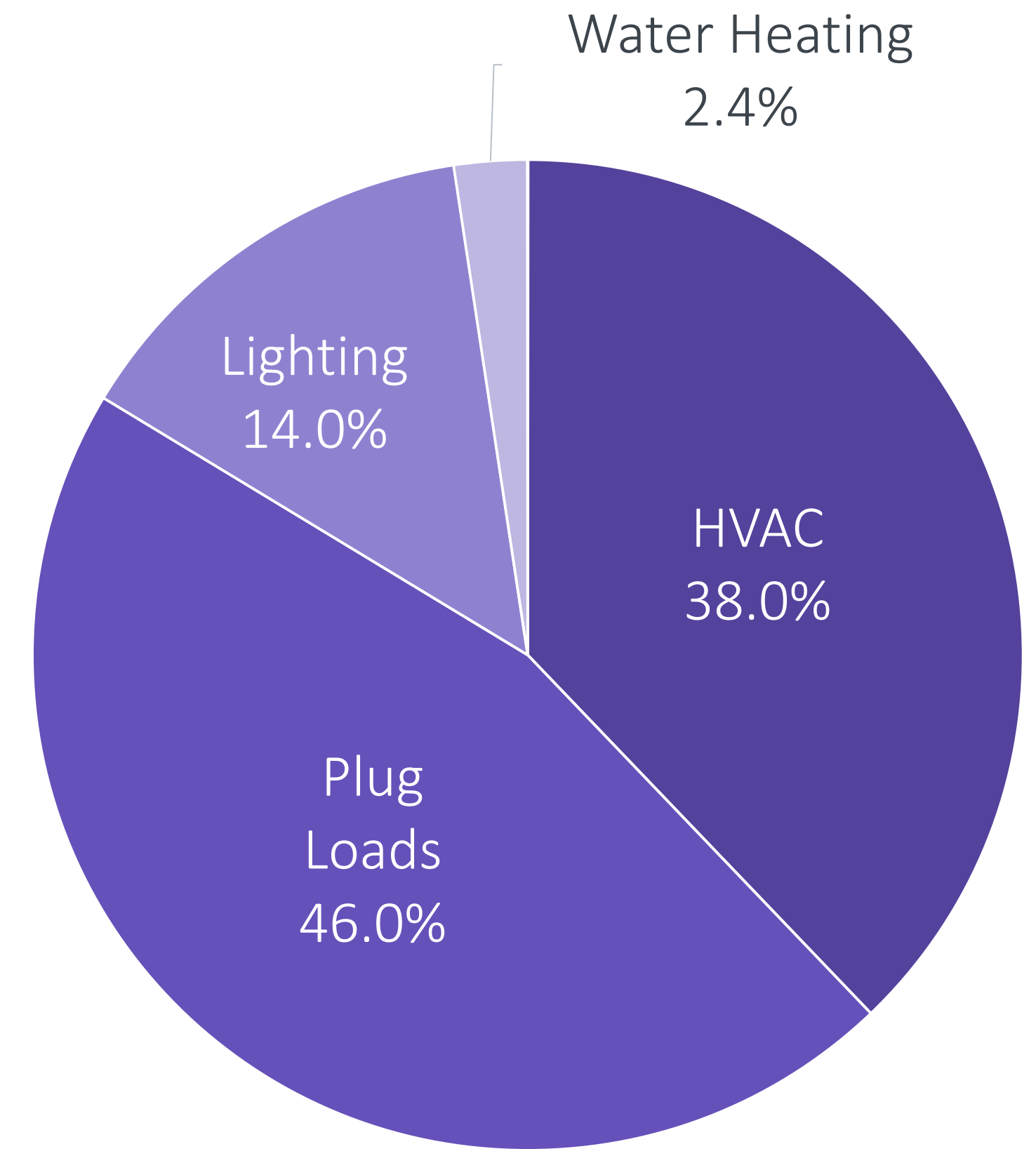
ASHRAE Audit Findings: Kbtu by End Use



Valencia Park/Malcolm X Library

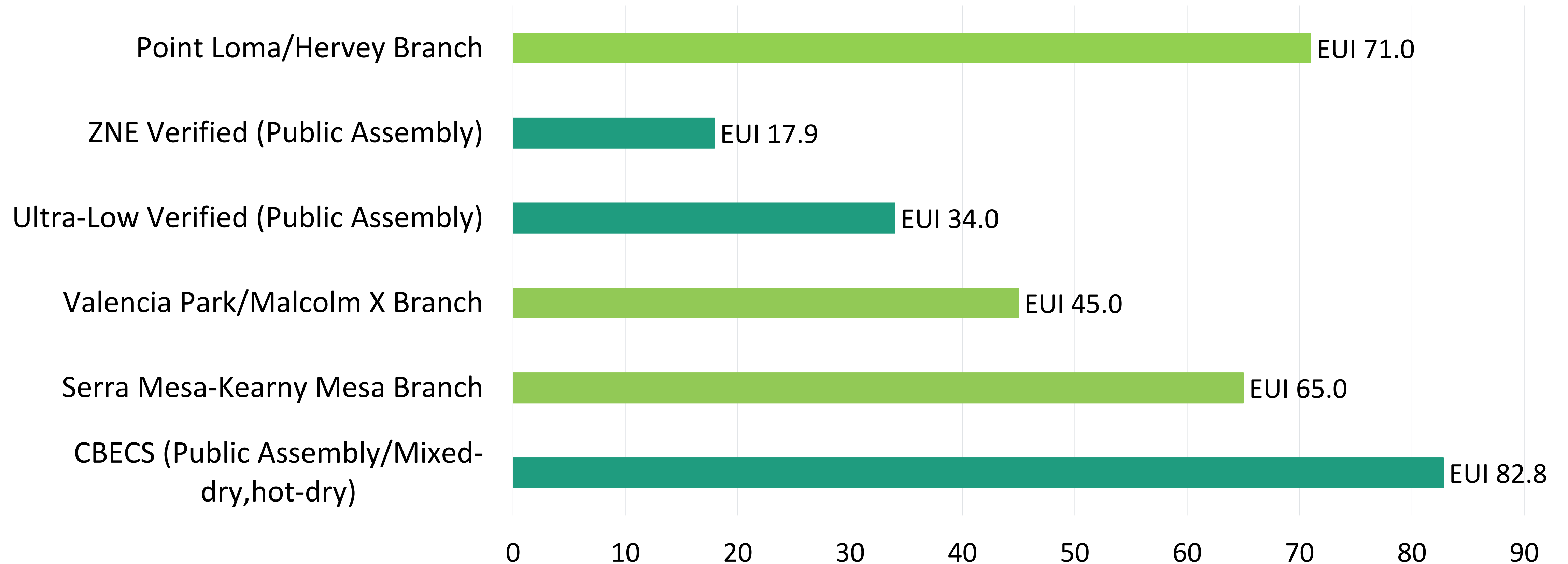


Serra Mesa-Kearny Mesa Library



Point Loma/Hervey Library

ASHRAE Audit Findings: Pre-Retrofit EUI Comparison



Integrated Demand-Side Management and Solar PV

HVAC Controls

Heating, ventilation and air conditioning (HVAC) controls include sensing and control devices that compare and adjust the actual temperature and air flow to a target state. Automatic setback thermostats program this process, providing both comfort and convenience without using unnecessary energy.

LED Lighting and Lighting Controls

Light-emitting diode (LED) products are more versatile, last longer and are 90% percent more efficient than incandescent lightbulbs. LEDs work by passing an electrical current through a microchip, which illuminates the tiny light sources, resulting in visible light.

Energy End-use Monitoring Equipment

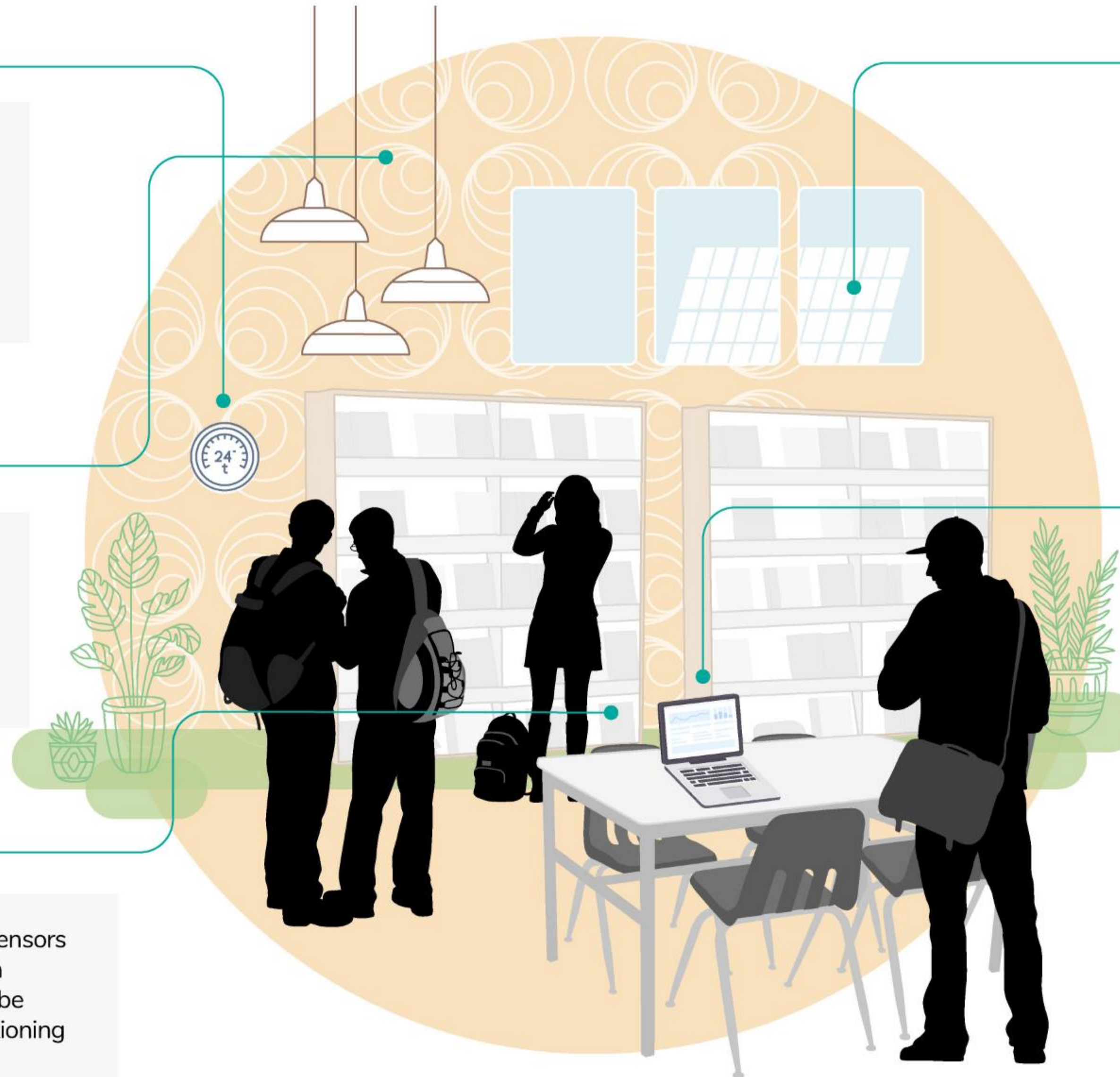
Energy end-use monitoring systems are measurement sensors that track energy consumption patterns of a building at a granular level. The installed sensors allow energy use to be broken down between heating, ventilation and air conditioning (HVAC), lighting, office equipment and other usages.

Solar photovoltaic

Solar photovoltaic (PV) systems, also referred to as solar electric systems, capture sunlight energy and convert it into electricity. PV systems can be used to power everything in your home from lights and appliances to an electric vehicle.

Building Automation Systems

A building automation system (BAS) allows for the centralized control and monitoring of mechanical and electrical equipment, resulting in improved overall efficiency, lower operating costs and increased safety. BAS controls are usually implemented in large-scale projects with extensive mechanical and electrical systems that would be difficult to coordinate manually.



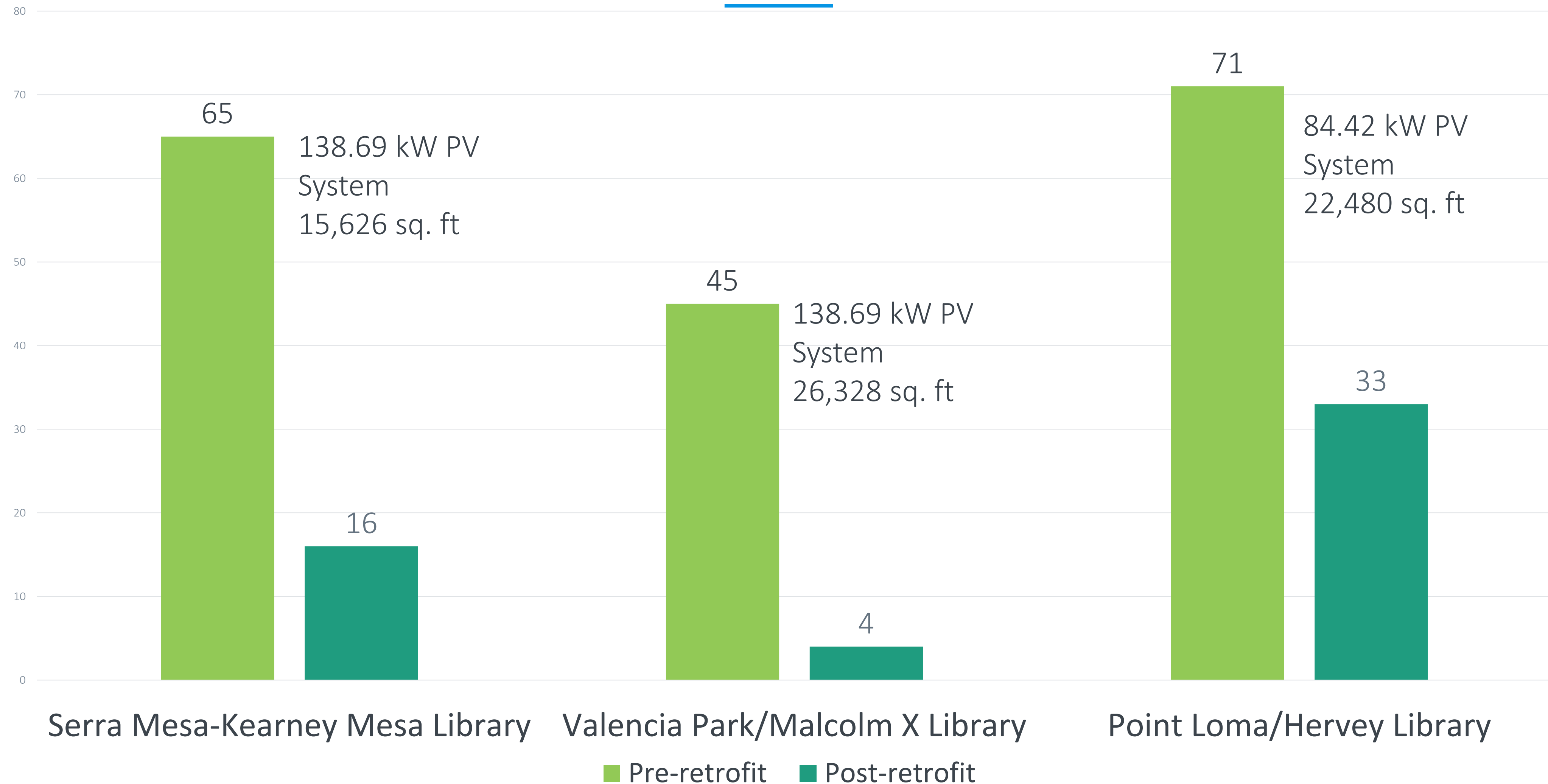
Path to ZNE (Energy Conservation Measures)

Energy Conservation Measure	Electricity Savings (kWh/yr.)	Total Energy Savings (kBtu/yr.)	Electricity Savings (\$)	Peal Demand Savings (kW)	Est. Installation Costs.* (\$)
Lighting Retrofit	160,662	548,179	21,864	39.1	580,927
Lighting Controls	24,528	83,690	2,908	6.5	150,000
HVAC Controls + Tridium Building Automation	38,813	135,365	7,124	33.3	195,000
Plug Load Optimization: BertBrain Plug Load Manager**	14,002	47,775	1,485	4.3	10,000
Building Envelope: Window Film and Weatherization	1,699	6,090	274	0.7	7,000
Total	239,704	821,099	\$33,655	83.9	\$942,927

* Does not include design, energy modeling and construction management costs

** Pre-commercial technology

Pre- & Post-Retrofit + PV EUI Comparison (kBtu/ft²)



Lessons for Future Building ZNE Projects



Research Value of SD ZN3

Showcases a public, private and nonprofit partnership

Tests and implements integrated project delivery and contracting.

Retrofits existing buildings

Evaluates unique building characteristics.

Integrates emerging devices with building automation system

Tests pre-commercial plug load management device integration.

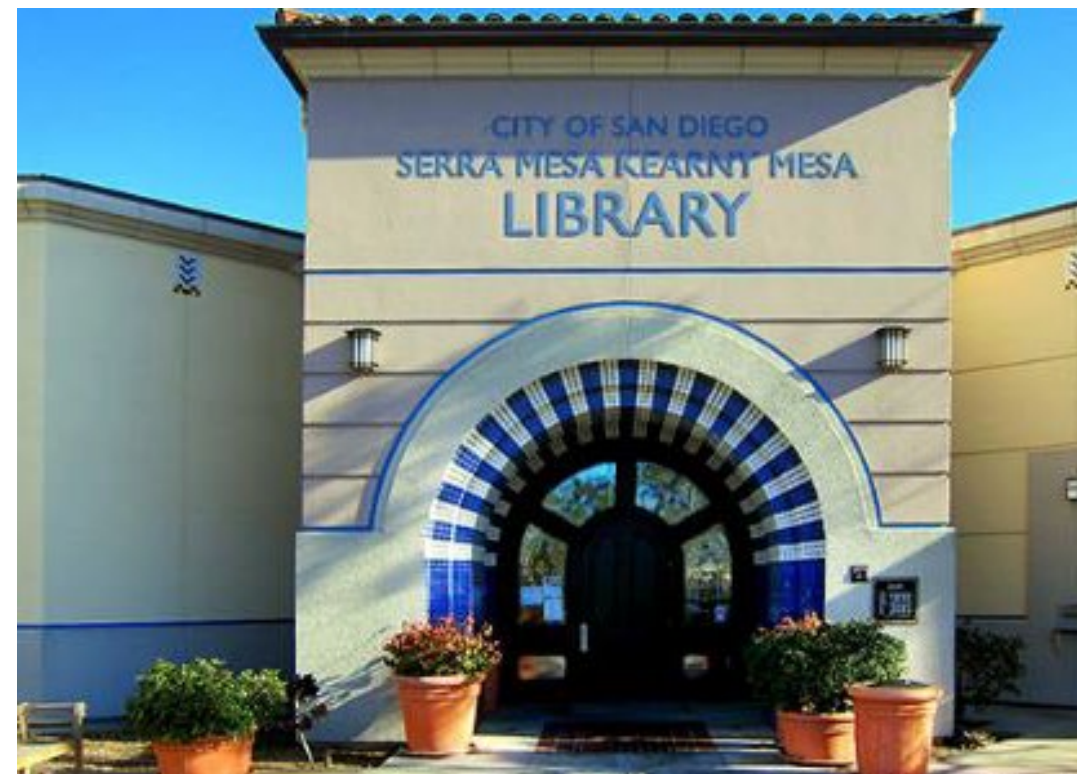
Evaluates behavior impact

Provides pre- and post-retrofit behavior surveys.

Creates a replicable blueprint

Helps create a blueprint for other local governments going ZNE.

Next Steps



Construction

Final Report

Fall 2019 – Winter 2020

Spring 2020 – Spring 2021

Spring 2021

Measurement + Verification

Check out project updates and resources at www.energycenter.org/sdzn3

Utility Incentives, Available Programs and Looking Ahead

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SDG&E Business Plan Application: The Commercial Sector

1

Transform tenant energy savings into asset value for property owners.

2

Provide a simple, yet comprehensive, customized energy management solution for the hard-to-reach small commercial segment.

3

Create an online platform to facilitate cross-promotion and encourage engagement.

4

Expand the platform's scope and capabilities to encourage customers to advance along the energy adoption curve.

5

Transition statewide Heating, Ventilation, and Air Conditioning ("HVAC") program to work with manufacturers on more efficient design.

6

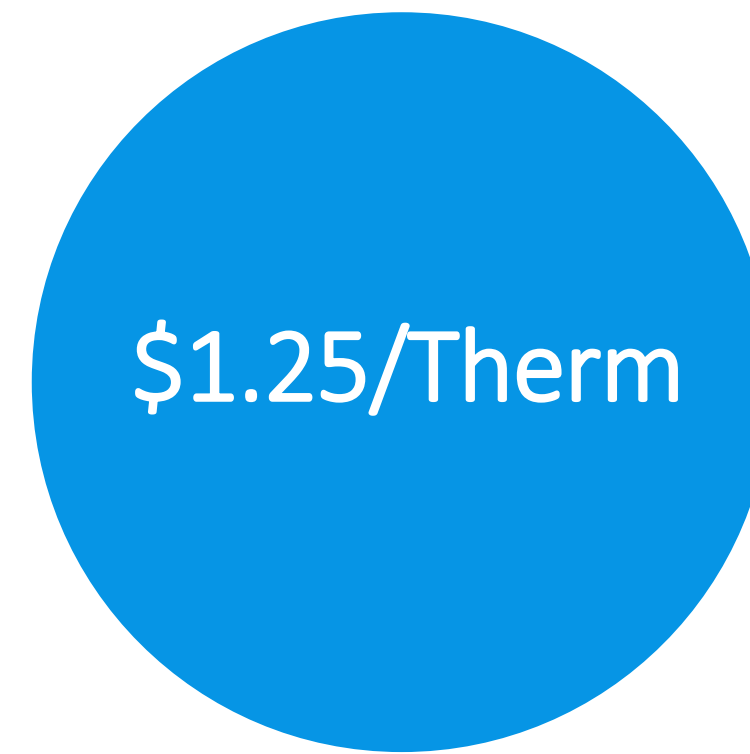
Explore the expansion of various procurement vehicles and intervention strategies to find targeted, deeper, or incremental savings

Energy Efficient Business Incentives (EEBI)

Incentive Rates



Electric



Gas



Peak Reduction

Benefit for financial incentives for retrofitting existing equipment or installing new high-efficiency equipment

Before Applying for EEBl

The More You Save, The More You Earn

Up to 50% of your project cost or 100% of the allowable incentive amount

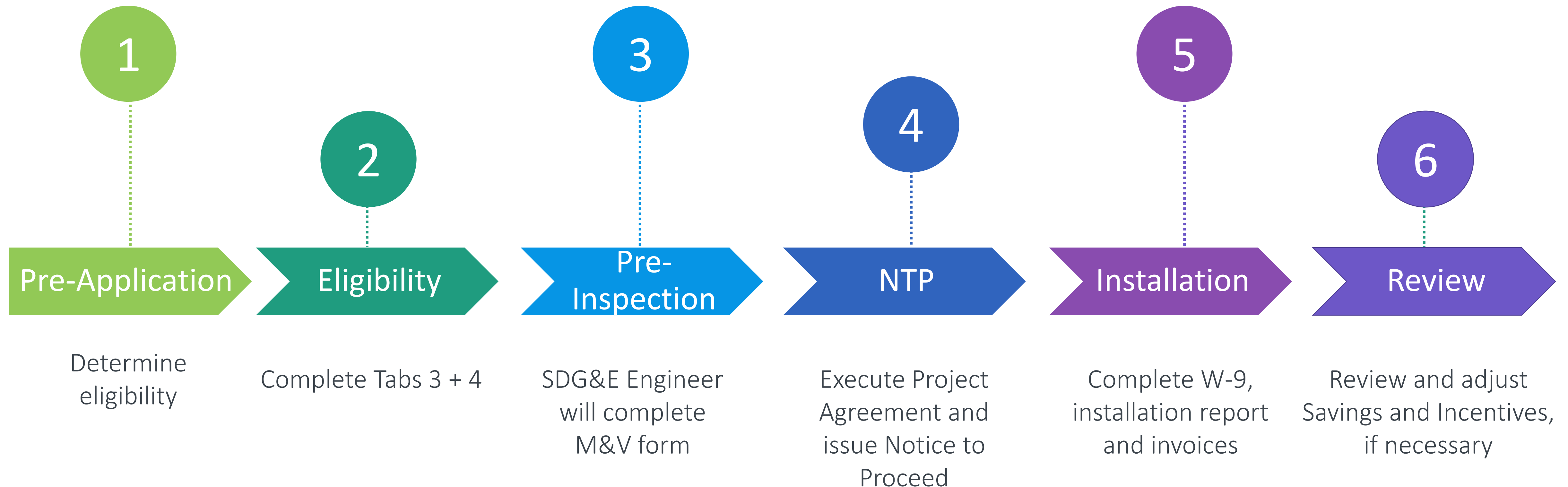
Must receive Notice to Proceed (NTP) first

NTP is sent after EEBl Project Agreement is executed. Businesses can then purchase or install equipment

Submit documents

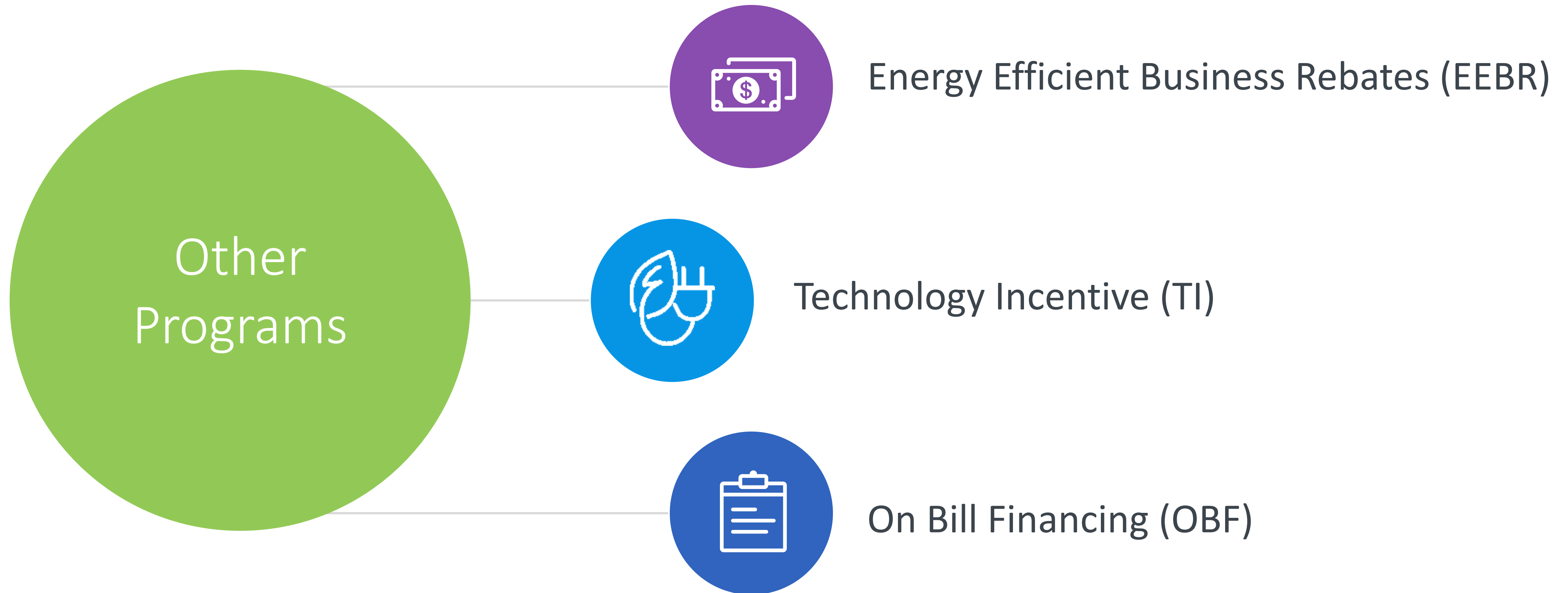
Submit all project documents to your assigned account executive (AE if applicable) and BusinessEnergySavings@sdge.com

Applying for EEBI Incentives



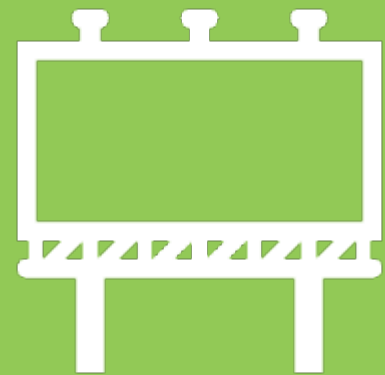
Detailed steps and additional resources can be found at SDGE.com/EEBI

Additional Incentive Opportunities



SD ZN3 Challenges

EEBI Program



Grant Funding Delay



Cool Zone Limitations



Other Available SDG&E Tools



Energy Innovation Center

- Provide customers with tools to become more energy efficient
- Offer workshops and classes
- Provide steps to energy efficiency/ZNE



Emerging Technology Program (ETP)

- Evaluate the performance of emerging or underutilized EE/DR technologies and solutions that could potentially be transferred to customer programs to adopt as measures.
- Fund field assessment of emerging EE/DR technologies and solutions at suitable customer sites.

Changing energy behaviors through occupant engagement dashboards

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SD ZN3 Library Retrofit Project



Serra Mesa – Kearney
Mesa Library



Point Loma/Hervey
Branch Library



Valencia
Park/Malcom X
Library

What is Zero Net Energy (ZNE)?



Definitions

Source, TDV, campus / site, etc...



ZNE Building

A building that produces as much, or more, renewable energy on-site as it consumes over the course of a year.



Time Dependent Valuation (TDV)

Focuses on the 'value' of energy consumed at the building site while factoring in an economic multiplier to account for the differing costs of grid production throughout the day. (Title 24)

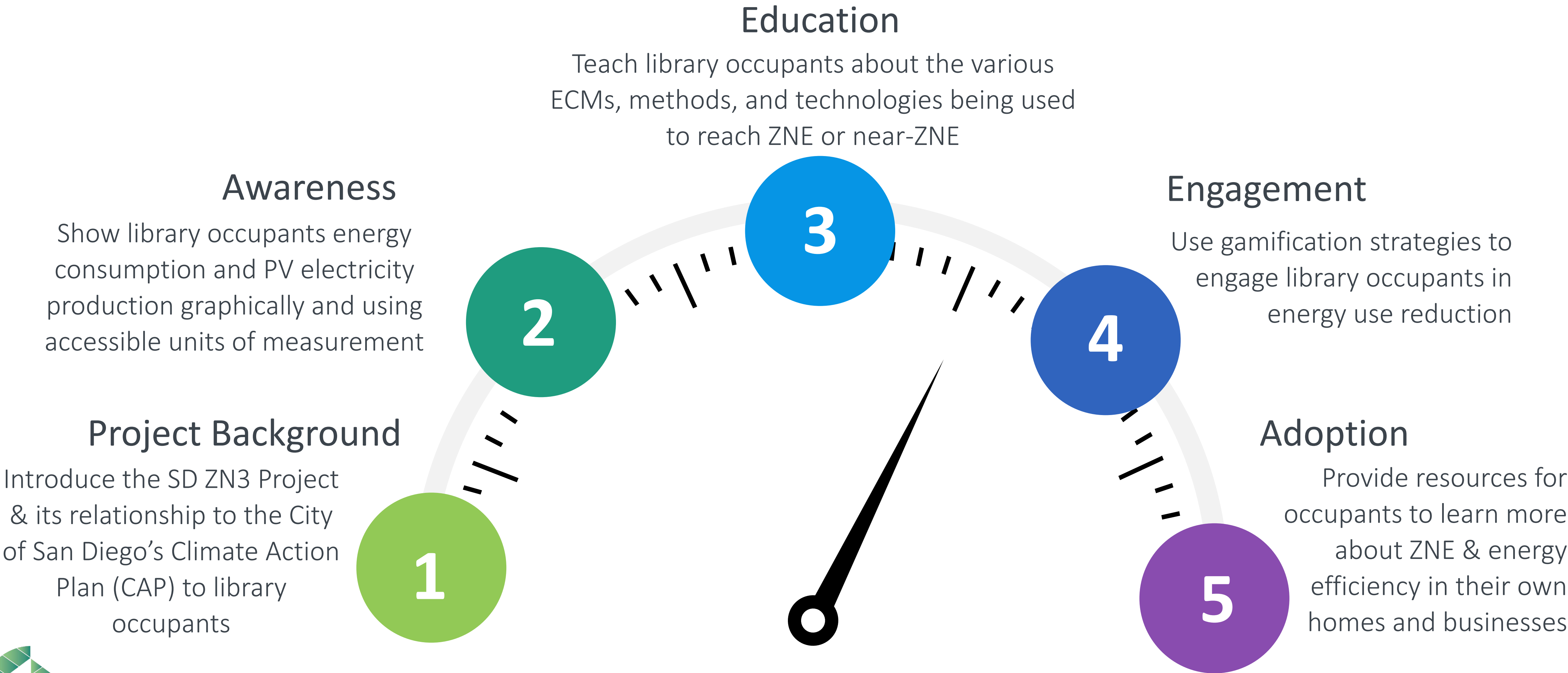
Behavior Change

Goals

- Build staff awareness of SDZN3 sustainability project and goals
- Encourage participation in sustainable projects and achievement of desired goals
- Advocate and model sustainable practices

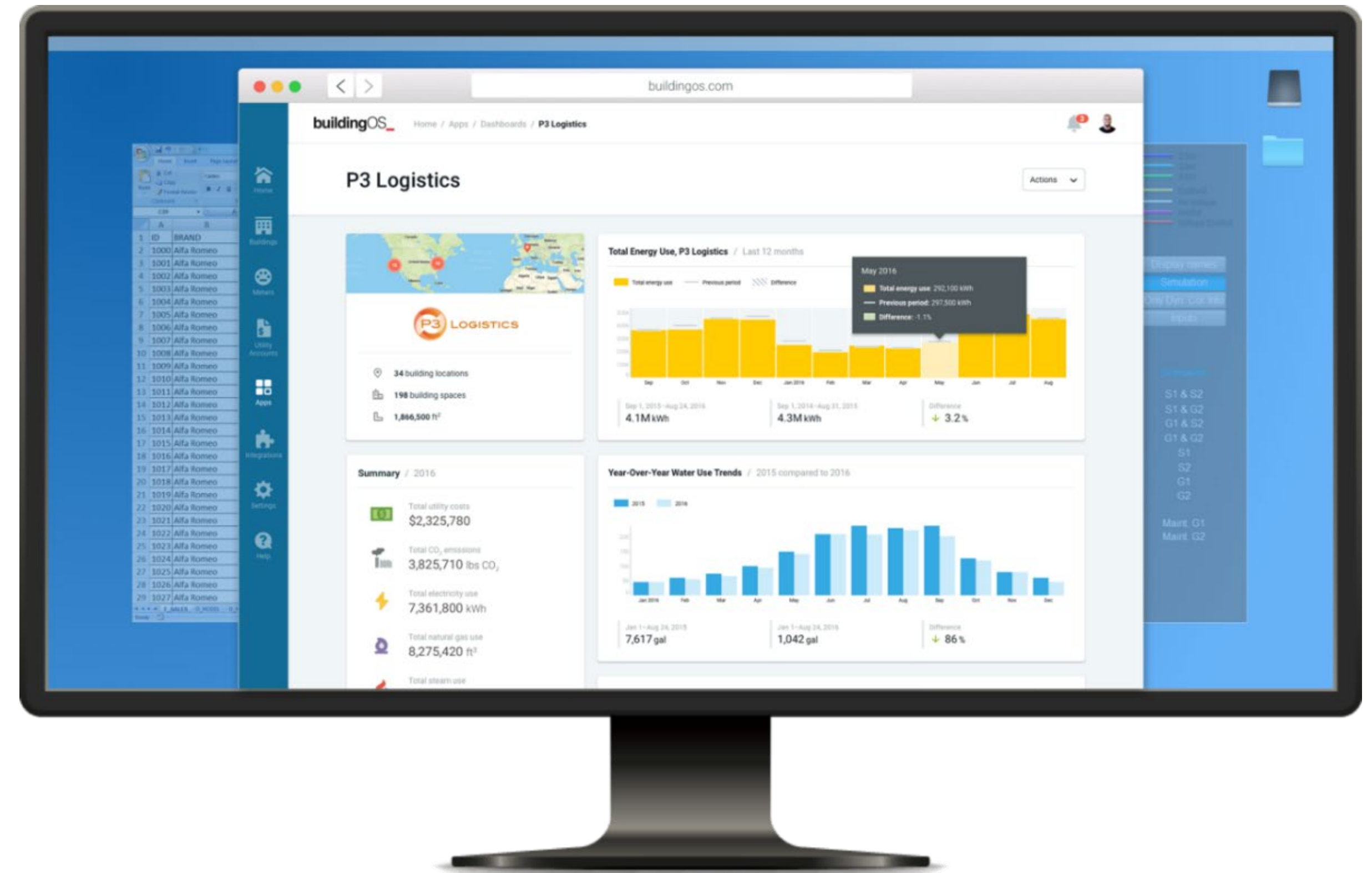


Community Engagement Dashboard & Kiosk Goals



Project Background

Introduce the SD ZN3 Project & its relationship to the City of San Diego's Climate Action Plan (CAP) to library occupants.



Awareness

Show library occupants energy consumption and PV electricity production graphically and using accessible units of measurement.



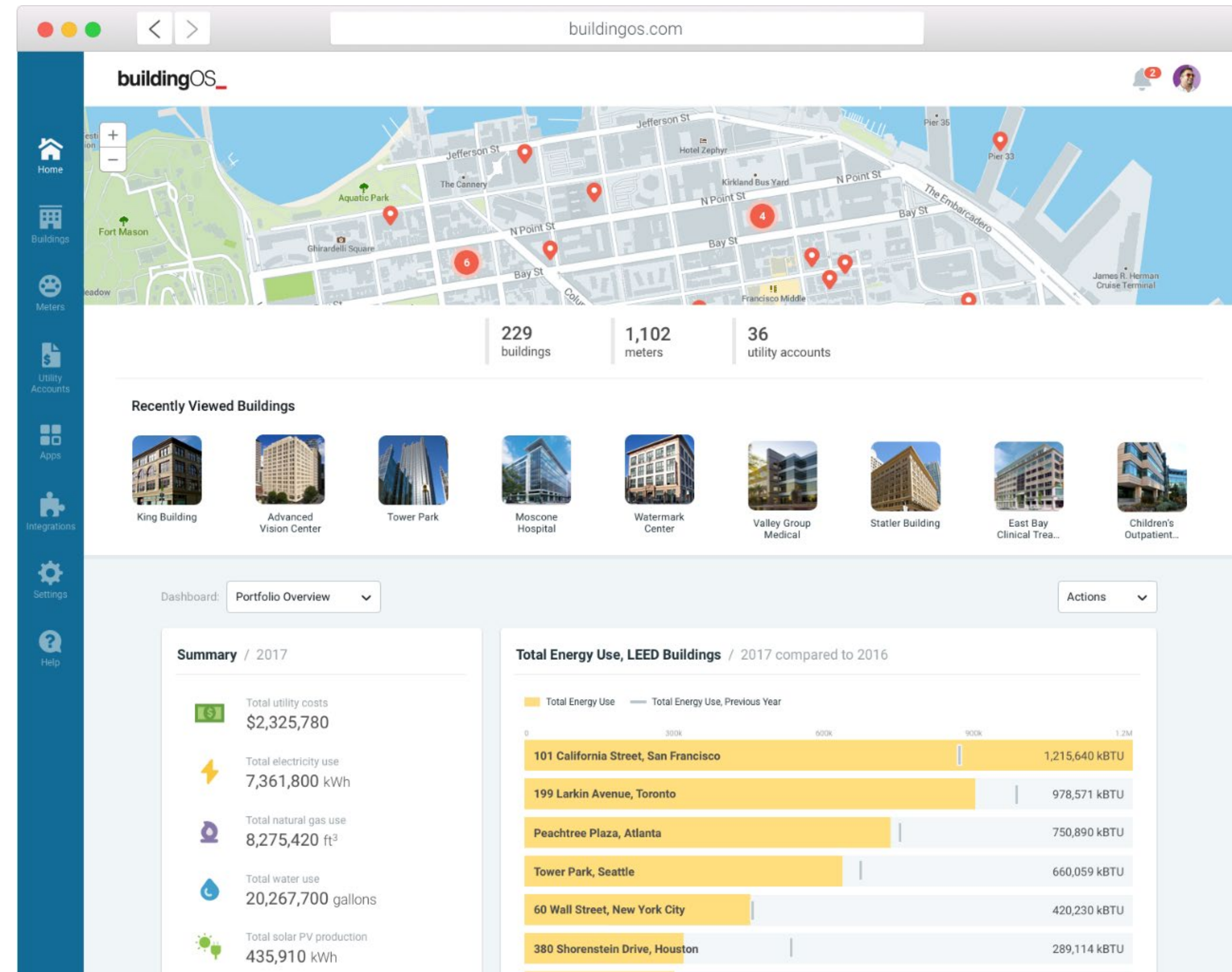
Education

Teach library occupants about the various ECMs, methods, and technologies being used to reach ZNE or near-ZNE.



Engagement

Use gamification strategies to engage library occupants in energy use reduction



Adoption

Provide resources for occupants to learn more about ZNE & energy efficiency in their own homes and businesses



What Can Library Staff & Visitors Do?

Adopt Energy Efficiency at Home

Participate in energy
conservation measures at
home.

1

Learn More

Explore other SD ZN3
projects

2

Follow the Project

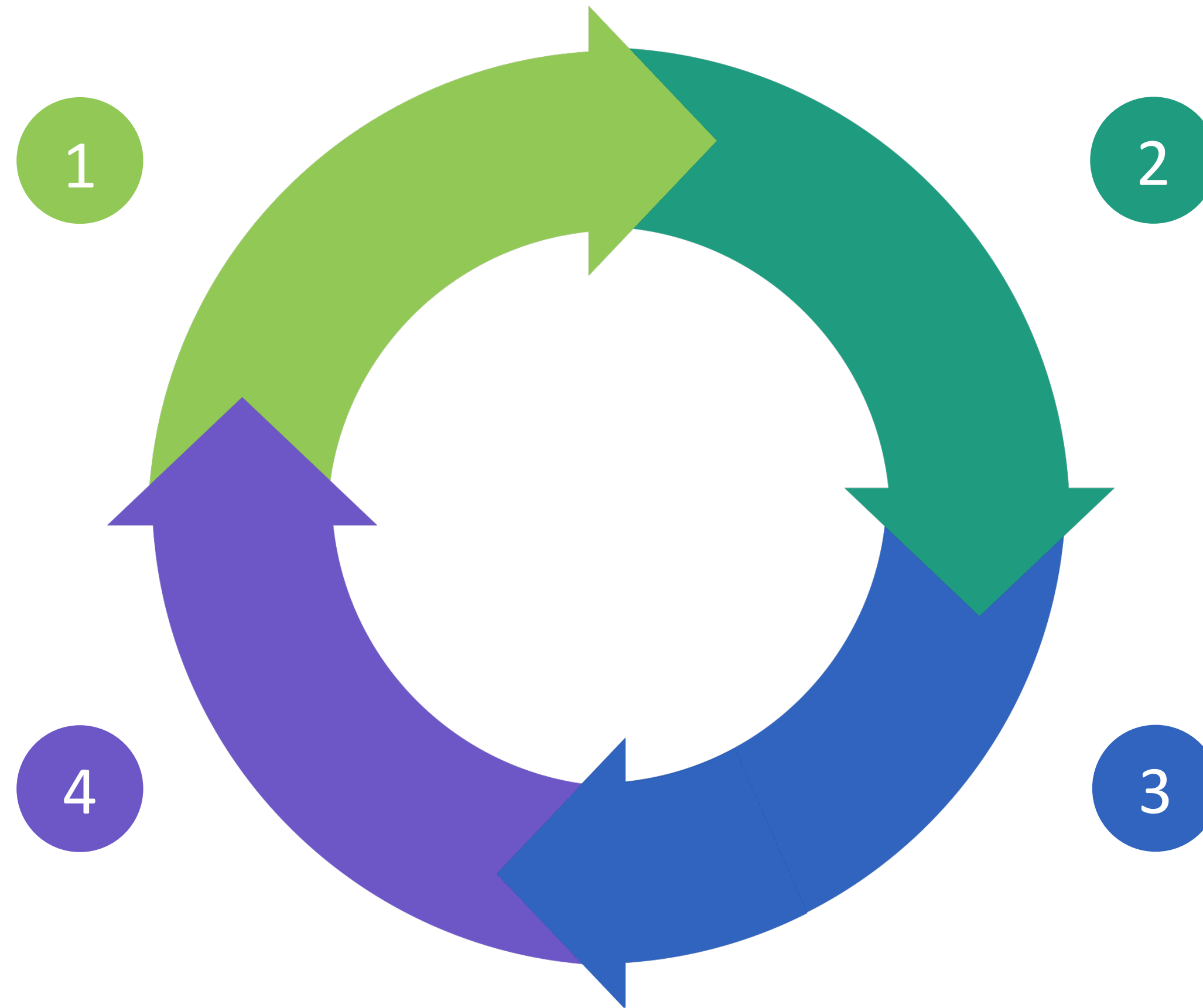
Monitor SD ZN3 project
progress online and in-
person

3

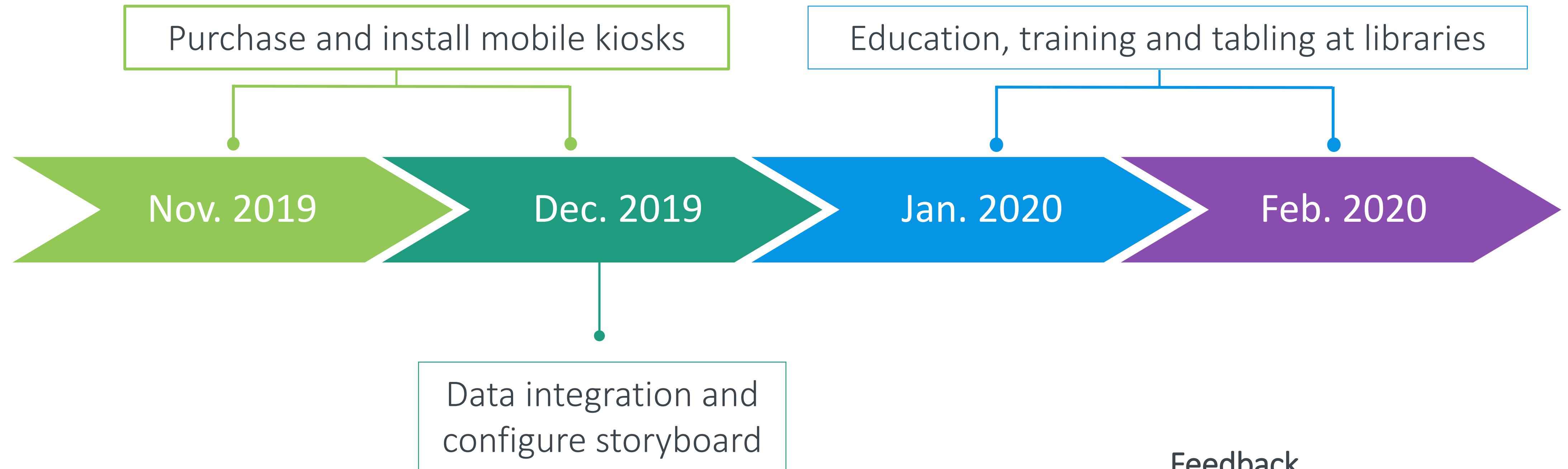
Provide Feedback

Post-project survey
participation

4



Community Engagement Next Steps



Feedback

- Monitoring dashboard user analytics
- Analyze post-project survey results to evaluate behavior change, increased awareness

Questions?



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