Zero Net Energy Small Commercial Buildings

Creating Equitable Access to Cost Effective Retrofits

Sept 2-3, 2020

Small Commercial ZNE Retrofits

Technical Barriers to Deep Energy Efficiency Adoption:

- Lack of access to comprehensive, cost-evaluative information about how to achieve energy targets
- Proportionally high cost of professional services to identify energy savings opportunities

Goal: Develop and demonstrate a replicable, integrated ***whole-building retrofit package that enables small commercial*** multi-floor office spaces to achieve energy use intensities **equivalent to *ZNE through cost-effective, underutilized technologies and controls*.**

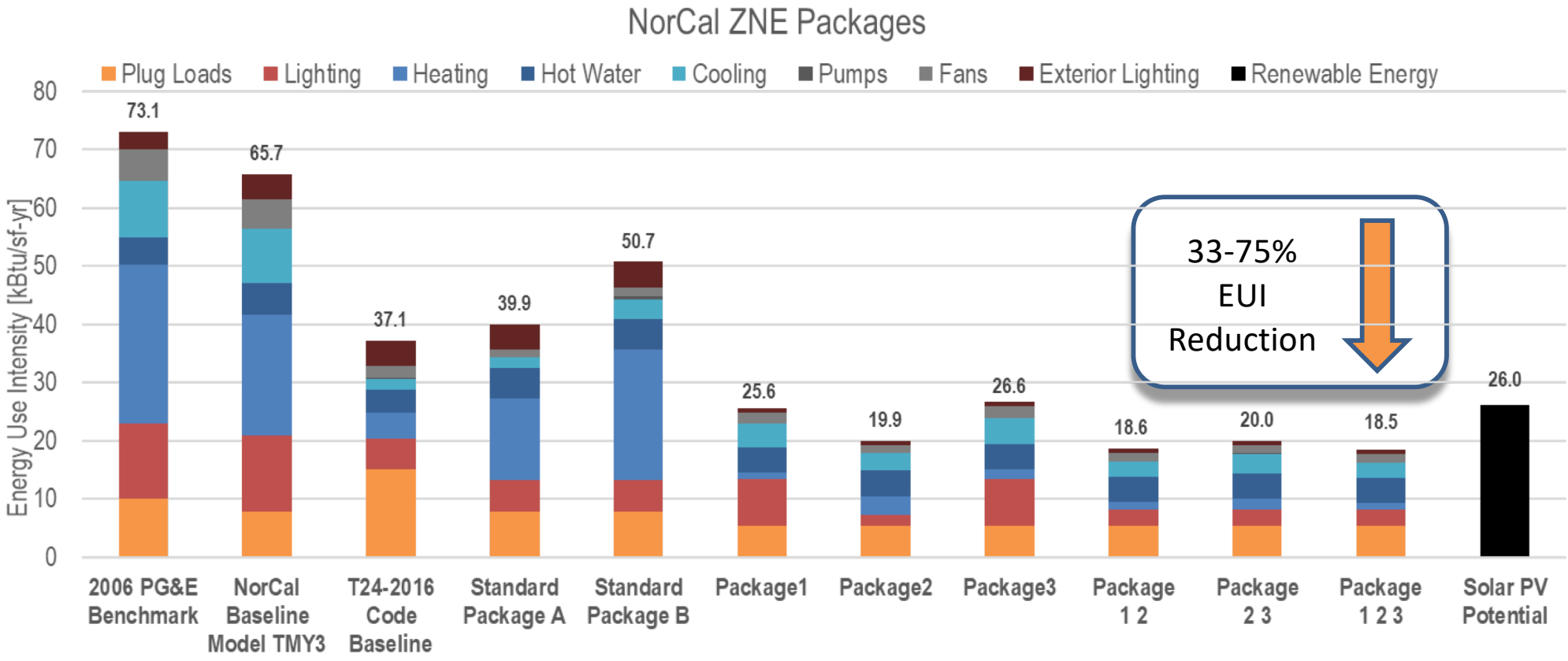
ZNE Retrofit Packages – Sample Energy Efficiency Measures

Shared EEMs
Replace HVAC System with Single Zone packaged heat pump system. VAV Fan, Cooling COP = 3.3. For envelope and lighting focused packages
DHW with electric instantaneous & low flow fixtures
Replace exterior lighting. 50 bulbs at 50 W each
Replace interior lighting - LED upgrade or de-lamping. 0.8 W/sf connected load at 90% diversity. For envelope and HVAC focused packages.
Plug Load Reduction - Reduce by 30% from 0.77 W/sf to 0.54 W/sf connected load; 90% diversity factor.

Sample HVAC Pkg EEMs
Dedicated Outside Air System (DOAS) with energy recovery ventilator (enthalpy wheel) and VAV fan
Variable Refrigerant Flow (VRF) heat pump. Rooftop unit with indoor refrigerant fan coils. Refrigerant heat recovery system.
Demand Controlled Ventilation CO_2 Sensors

ZNE Retrofit Packages

Results with different combinations of ZNE retrofit packages



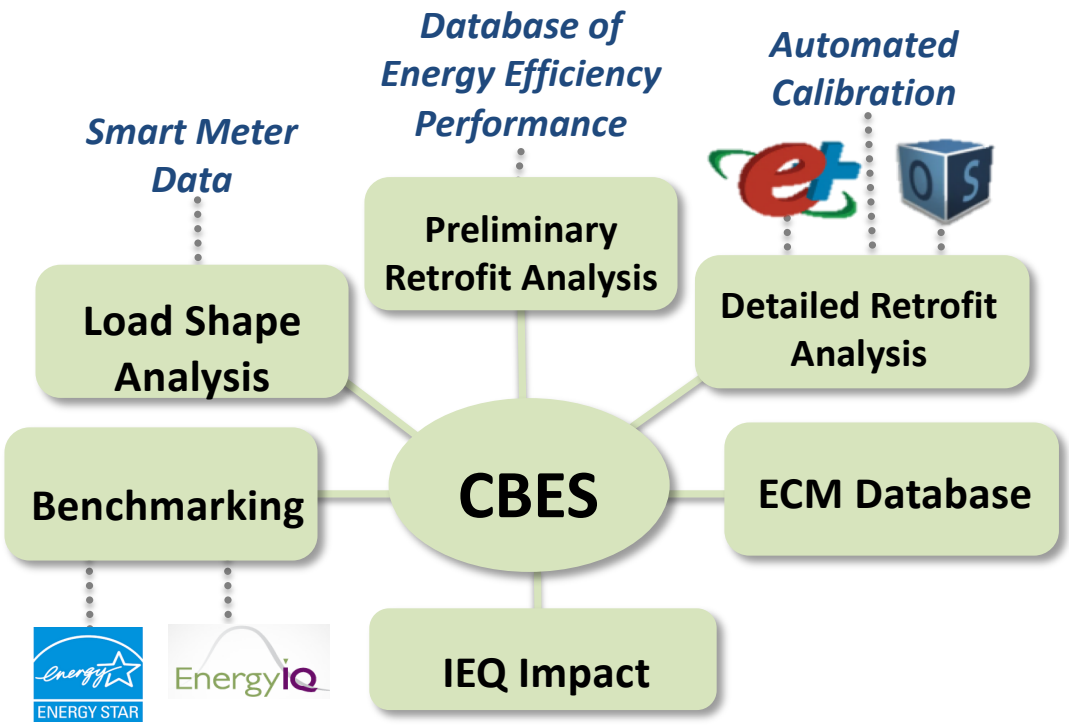
	Package1	Package2	Package3	Package 1 2	Package 2 3	Package 1 2 3
% Incremental Cost over Standard A Retrofit	44%	7%	-26%	60%	-2%	45%
% Incremental Cost over Standard B Retrofit	36%	2%	-30%	52%	-7%	38%
IRR - Over Standard A Retrofit	-5%	54%	CAPITAL POS	-4%	CAPITAL POS	1%
IRR - Over Standard B Retrofit	-3%	182%	CAPITAL POS	-3%	CAPITAL POS	3%

Small Commercial Building Energy Saver Tool (CBES.lbl.gov)

Simple web-based **software toolkit**

Identifies operational improvements and retrofits

Includes guidance so that users can **maintain indoor environmental quality**.



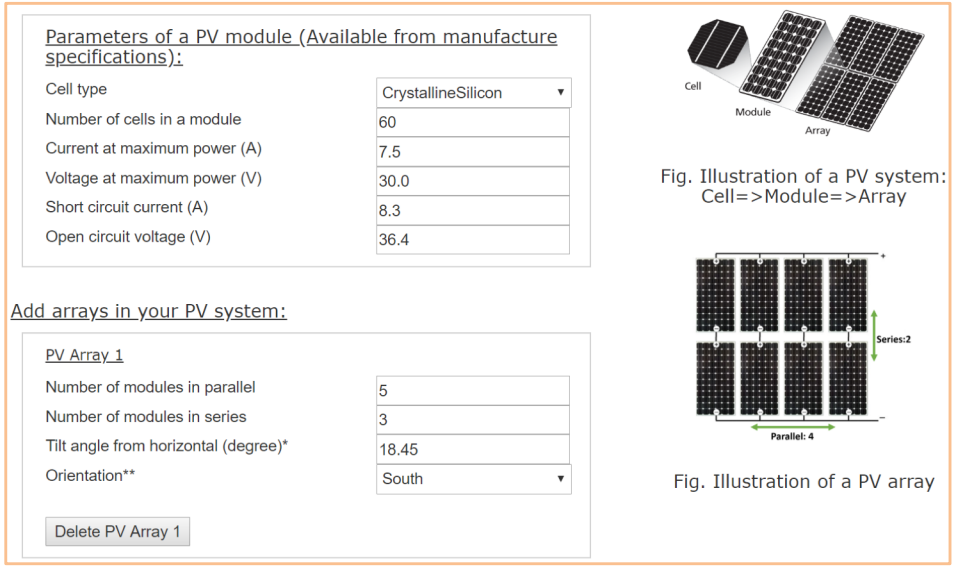


Fig. Illustration of a PV system: Cell=>Module=>Array

Fig. Illustration of a PV array

CBES Photovoltaics system input screen (Src: CBES Web app)

R&D 100 AWARDS

FLEXLAB® Testing

Performance validation

Provides guidance on technology implementation for savings persistence.

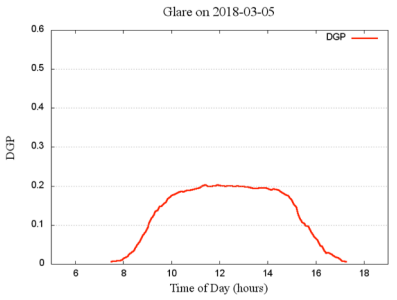
ZNE Package Verification

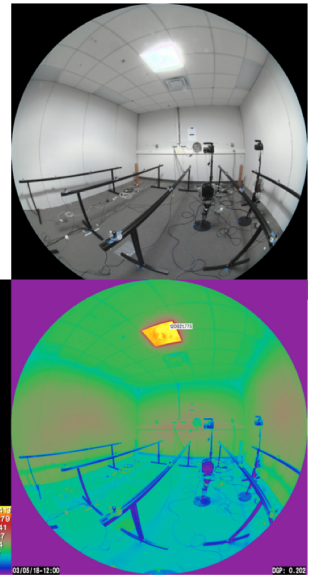
- Energy – 25-80% energy savings seasonally, for south & west orientations
- Thermal and visual comfort verified

EEM Verification

- Tubular Daylighting Device (TDD). Average 55% EUI reduction (Feb 10 - Mar 11, 2018)
  - 2 Manufacturers – Solatube, Velux
  - 2 Dome Configurations – clear, prismatic
  - 2 Diffusers – prismatic, fresnel
  - 2 different sizes – 22” dia, 14” dia

FLEXLAB at Berkeley Lab. FLEXLAB@lbl.gov





Thank you!

https://buildings.lbl.gov/zne-small-commercial-retrofits

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