



Brad Liljequist, AICP, LEED AP
Director, Net Zero Energy + Living
Community Challenge



**LIVING
BUILDING
CHALLENGE**



**INTERNATIONAL
LIVING FUTURE
INSTITUTE** SM



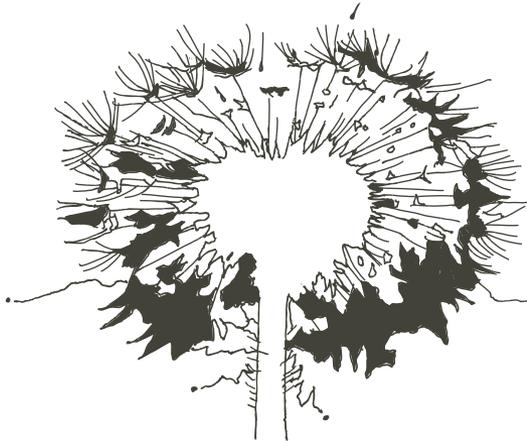
**LIVING
BUILDING
CHALLENGE**



**LIVING
COMMUNITY
CHALLENGE**



**LIVING
PRODUCT
CHALLENGE**



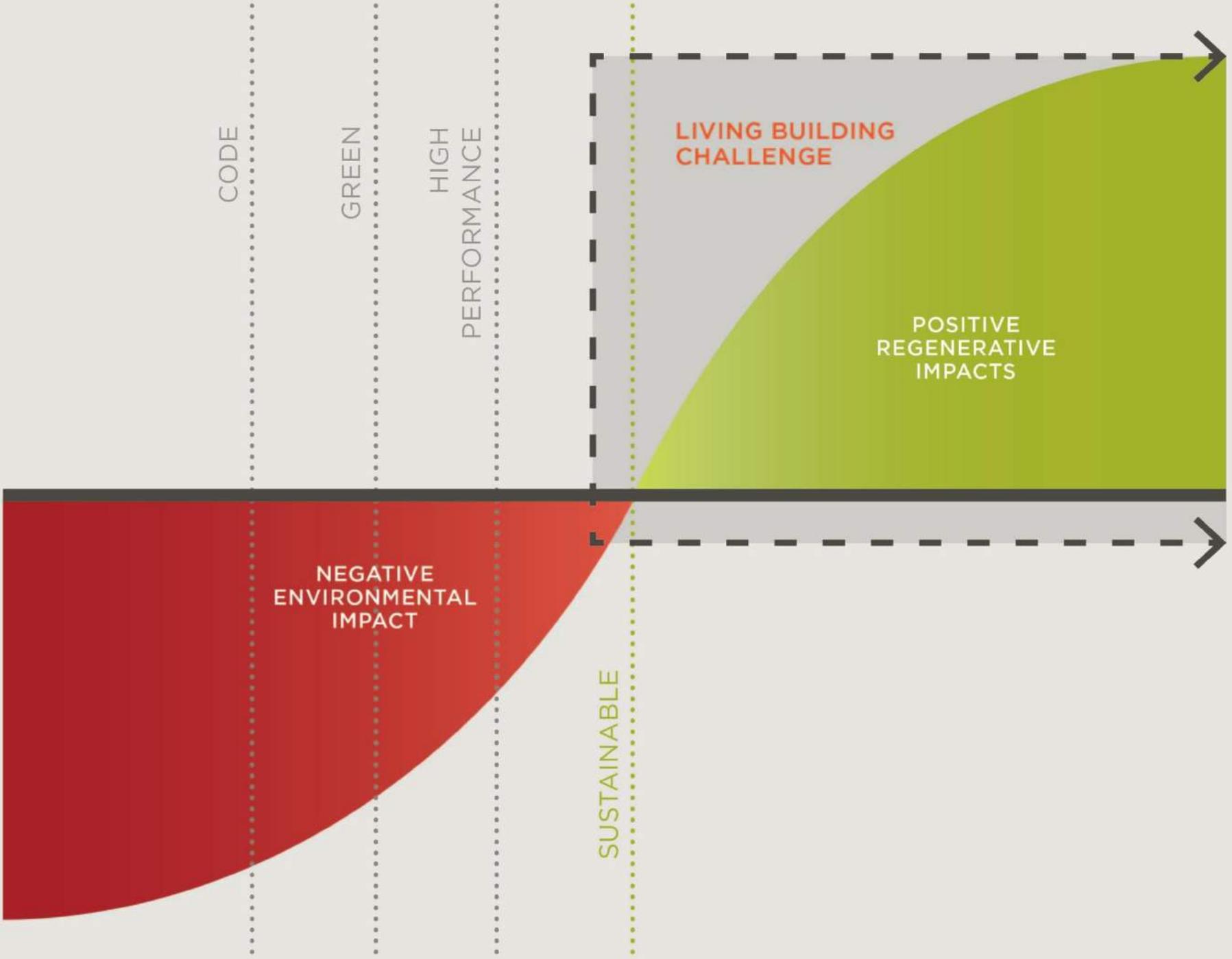
INTERNATIONAL
LIVING FUTURE
INSTITUTESM

Declare.

REVEAL.



Just.



CODE

GREEN

HIGH
PERFORMANCE

LIVING BUILDING
CHALLENGE

POSITIVE
REGENERATIVE
IMPACTS

NEGATIVE
ENVIRONMENTAL
IMPACT

SUSTAINABLE



LIVING
BUILDING
CHALLENGE™

FULL CERTIFICATION

All Imperatives are mandatory

Certification is based on actual performance



PETAL CERTIFICATION

Three Petals or more

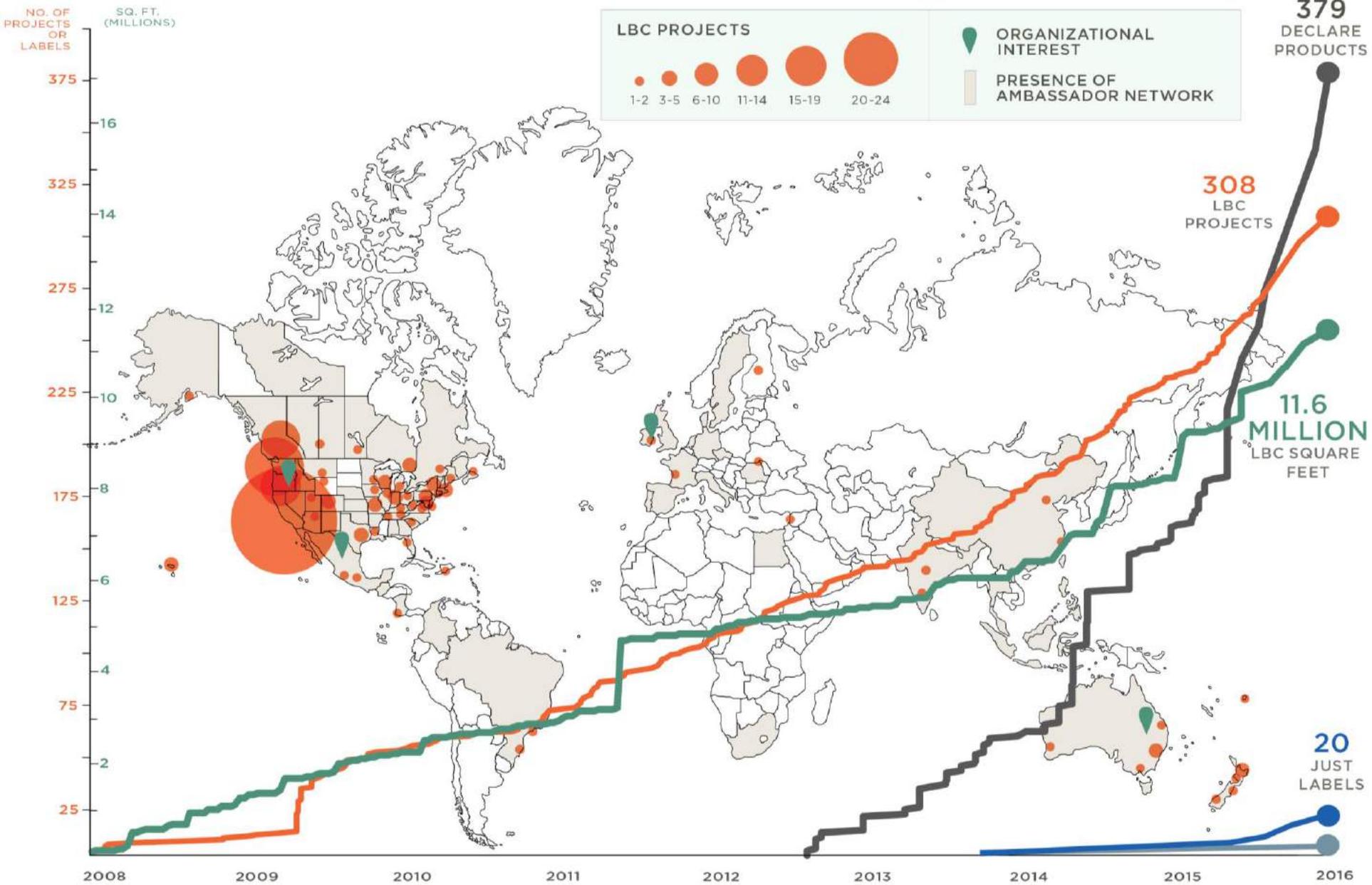
One of which must be either Water, Energy or the Materials Petal &
01: Limits to Growth
20: Inspiration + Education



NET ZERO ENERGY BUILDING CERTIFICATION

Four Imperatives

01: Limits to Growth
06: Net Positive Energy (100% only)
19: Beauty + Spirit
20: Inspiration + Education



A GLOBAL MOVEMENT
(updated Dec. 2015)



NETZERO

ENERGY BUILDING
CERTIFICATIONSM

PROVEN PERFORMANCE / INDEPENDENT AUDITS / TRANSPARENT RESULTS

WWW.LIVING-FUTURE.ORG/NETZERO



LIVING
BUILDING
CHALLENGE™

2.1

SMITH BECHTEL ENVIRONMENTAL
CLASSROOM | WEST WHATELY, MA

CERTIFIED 2.1



**LIVING
BUILDING
CHALLENGE**

1.3

TYSON LIVING LEARNING CENTER | EUREKA, MO

1.3 CERTIFIED

Photograph by Joe Angeles



DPR CONSTRUCTION REGIONAL OFFICE

| PHOENIX, ARIZONA

NZEB CERTIFIED



LIVING
BUILDING
CHALLENGE

HAWAII PREPARATORY ACADEMY ENERGY LAB

| WAIMEA, HAWAII

LIVING CERTIFIED

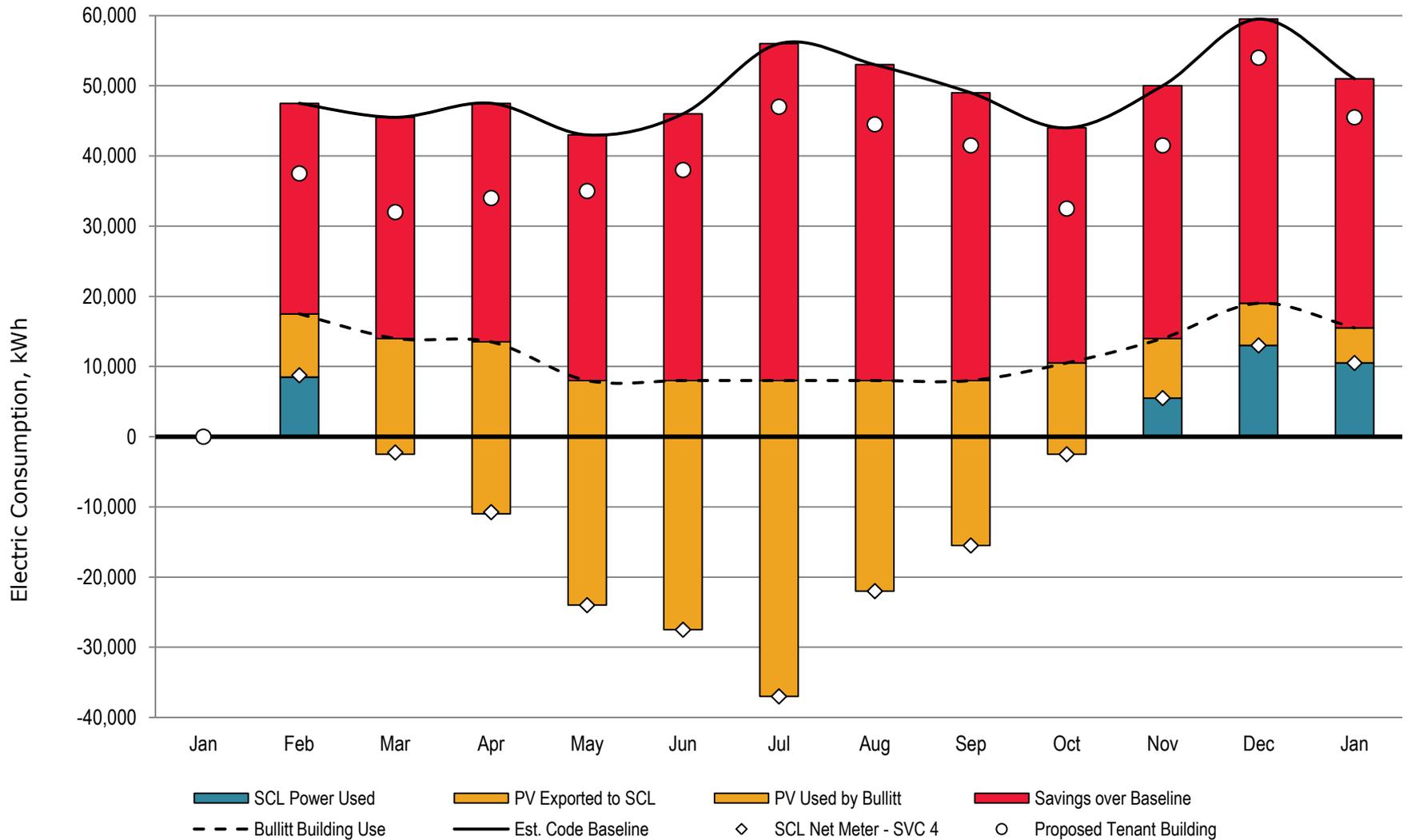




**LIVING
BUILDING
CHALLENGE**

BULLITT CENTER | SEATTLE, WA

PURSUING LIVING CERTIFICATION



YEAR ONE ENERGY USE & PRODUCTION

BULLITT CENTER

Seattle City Light & University of Washington Integrated Design Lab (UWIDL)



**LIVING
BUILDING
CHALLENGE**

1.3

OMEGA CENTER | **RHINEBECK, NY**

LIVING CERTIFIED 1.3

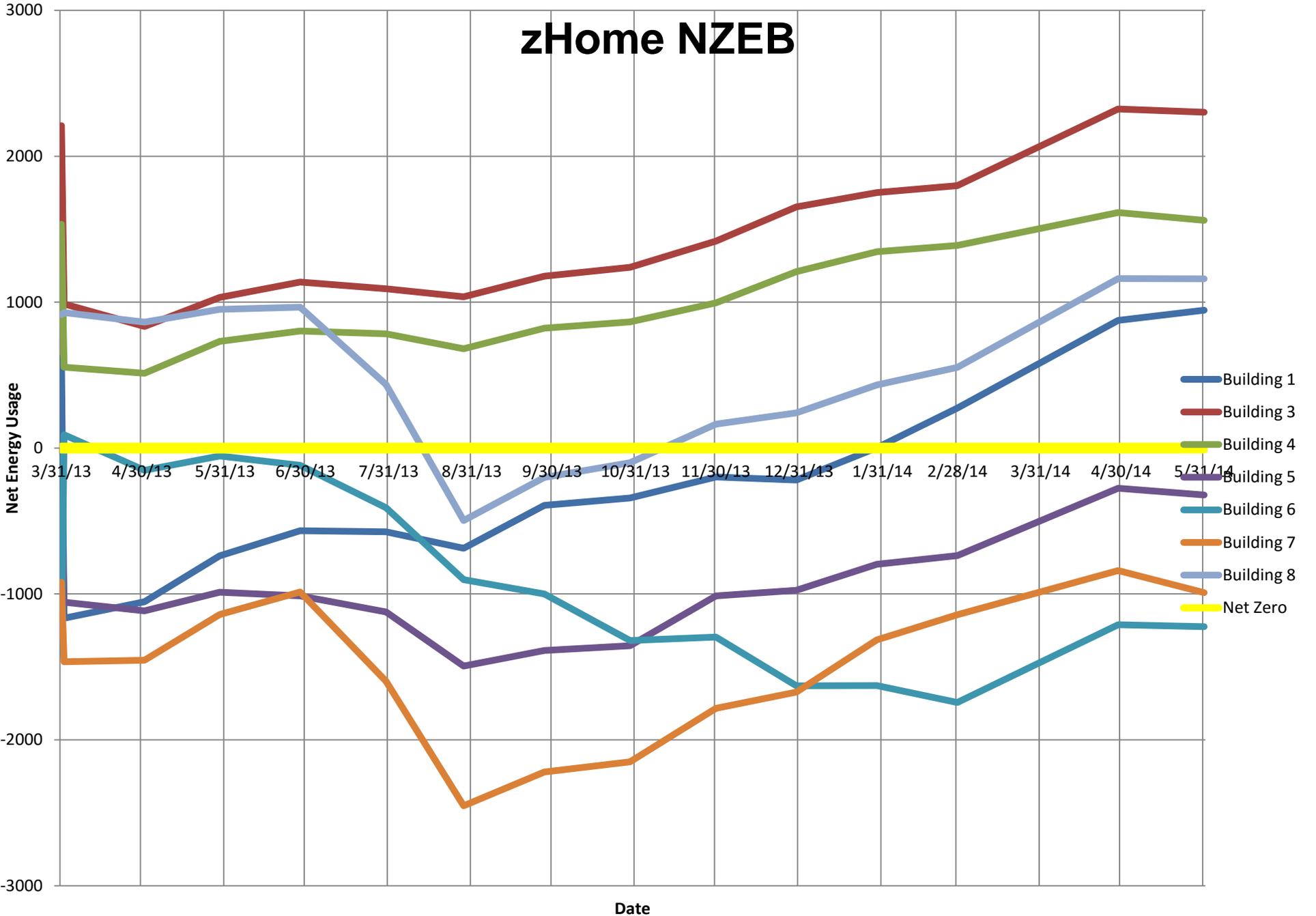


**LIVING
BUILDING
CHALLENGE**
2.1

zHome | **ISSAQUAH, WA**

PETAL CERTIFIED

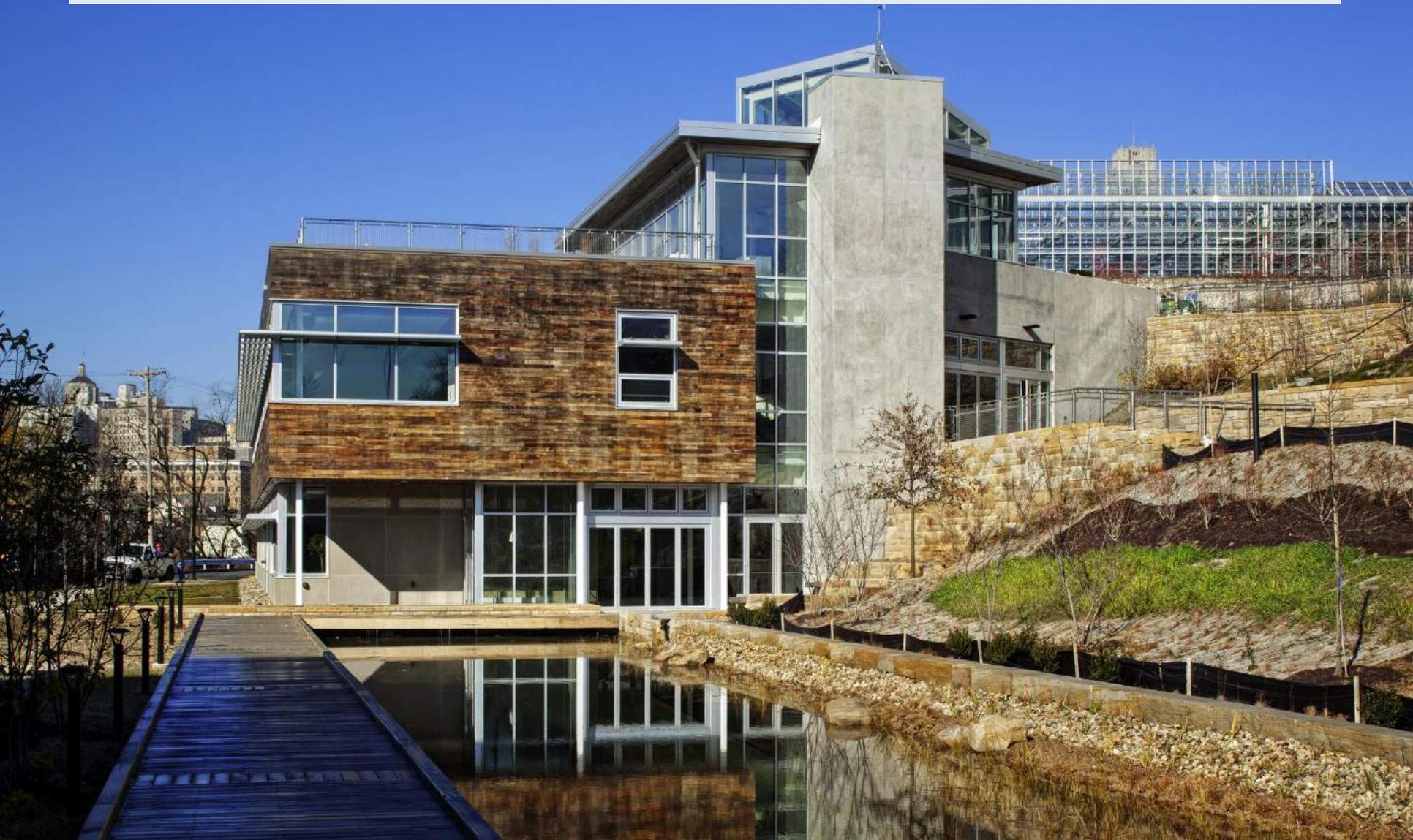
zHome NZEB





PHIPPS CONSERVATORY | PITTSBURGH, PA

NET ZERO ENERGY CERTIFIED | PURSUING LIVING CERTIFICATION





**LIVING
BUILDING
CHALLENGE**

2.0

BERTSCHI SCHOOL SCIENCE WING | **SEATTLE,
WA**

LIVING CERTIFIED 2.0



SACRED HEART LIBRARY | **ATHERTON, CA**

NET ZERO ENERGY CERTIFIED





WEST BERKELEY PUBLIC LIBRARY | BERKELEY, CA

NET ZERO ENERGY BUILDING CERTIFIED



Photograph by David Wakely



MISSION ZERO HOUSE | ANN ARBOR, MI

NET ZERO ENERGY CERTIFIED





HOOD RIVER MIDDLE SCHOOL | HOOD RIVER, OR
HIGH SCHOOL SCIENCE FACILITY





DAVID BAKER ZERO COTTAGE | **SAN FRANCISCO, CA**

NET ZERO ENERGY CERTIFIED



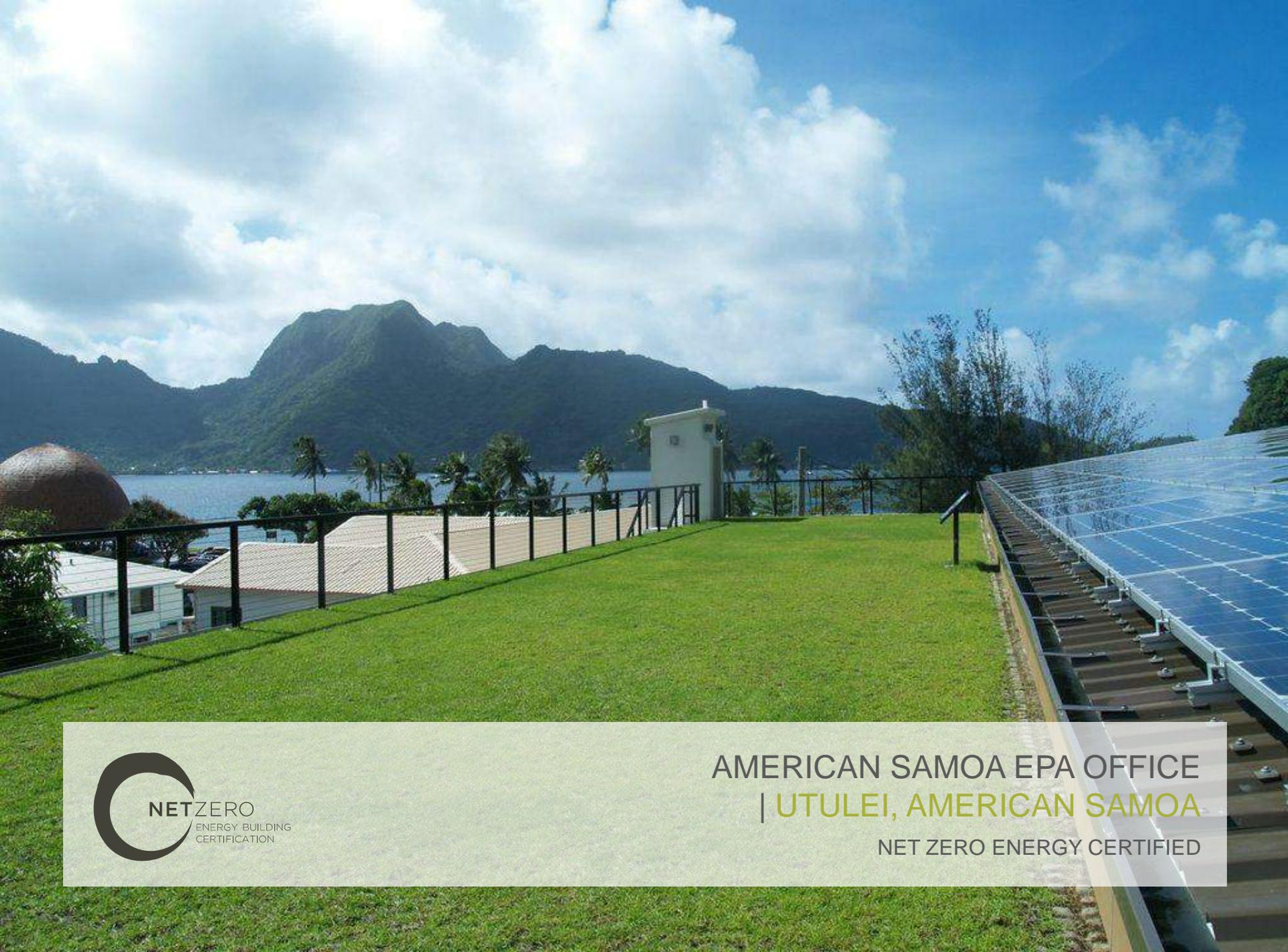
PACKARD FOUNDATION HQ | **LOS ALTOS, CA**

NET ZERO ENERGY CERTIFIED



IDeAs Z2 DESIGN FACILITY | **SAN JOSE, CA**

NET ZERO ENERGY CERTIFIED



AMERICAN SAMOA EPA OFFICE
| UTULEI, AMERICAN SAMOA

NET ZERO ENERGY CERTIFIED



DPR CONSTRUCTION REGIONAL OFFICE
SAN FRANCISCO, CALIFORNIA

NZEB CERTIFIED



WILLOWBROOK HOUSE | **AUSTIN, TX**

NET ZERO ENERGY CERTIFIED



ZERO ENERGY HOUSE | **AUCKLAND, NEW ZEALAND**

NET ZERO ENERGY CERTIFIED



MADRONA HOUSE
BELLINGHAM, WASHINGTON
NZEB CERTIFIED



NETZERO
ENERGY BUILDING
CERTIFICATION™

BALLARD NZE HOUSE
SEATTLE, WASHINGTON

NZEB CERTIFIED



SUSTAINABLE DREAMS
EDMONDS, WASHINGTON

NZEB CERTIFIED



SUMMIT OAKS – NORTHAMPTON, MA
TRANSFORMATIONS

An architectural rendering of a modern, multi-story building with a distinctive facade of white and green hexagonal panels. The building is situated on a city street with a sidewalk, trees, and people walking. The sky is clear blue. A semi-transparent white box in the lower-left corner contains the text "ARTISTS FOR HUMANITY BOSTON, MA".

ARTISTS FOR HUMANITY
BOSTON, MA

BUILDINGS DON'T USE ENERGY, PEOPLE USE ENERGY





INTEGRITY



THE POWER OF ZERO:

LEARNING FROM THE WORLD'S LEADING NET ZERO ENERGY BUILDINGS

BRAD LILJEQUIST

WITH JASON F. MCLENNAN BRENDAN COOK JESS CHAMBERLAIN ADAM PAUL AMRHEIN

	SINGLE FAMILY NEW 	RETROFIT 	MULTI-FAMILY 	LOW RISE OFFICE 	MID & HIGH RISE OFFICE 	EDUCATIONAL 	INSTITUTIONAL 	HEALTHCARE 
HOT HUMID	Zero Energy House 	Willowbrook 				HPA 	AS-EPA 	
MIXED HUMID						Tyson 		
HOT DRY				DPR Phoenix 				
MIXED DRY				Integral Office 				
TEMPERATE	Eco-sense Residence 		zHome 	Packard Foundation HQ 		Bertschi School 	Painter's Hall 	
COLD						Omega Institute 		
VERY COLD / SUB ARCTIC								

REVEAL.

THE ENERGY EFFICIENCY LABEL

Project Name: Vestas America HQ

Project Owner: Gerding Edlen

Architect: GBD Architects

MEP Engineer: Glumac

Building Type: Commercial Office

Location: Portland, OR

Climate Type: Marine

Square Footage: 162,759

Time stamp: 2015-2017

EUI —
(kbtu/SF/yr)



Energy use compared to average building of its type

55%

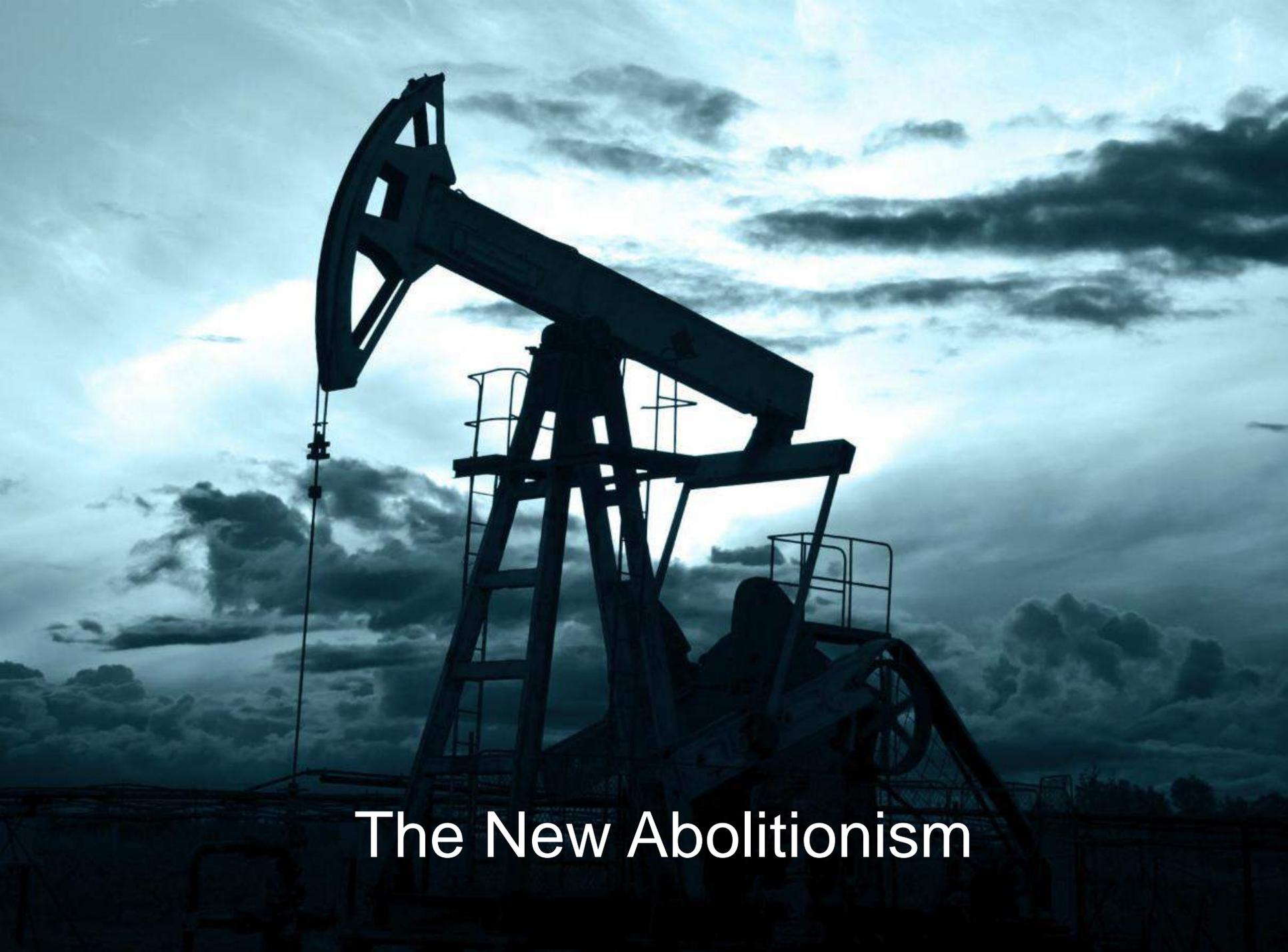
reduction from baseline
ASHRAE 90.1 - 2010

+9%

renewable production
% of energy use

INTERNATIONAL LIVING FUTURE INSTITUTE™ living-future.org

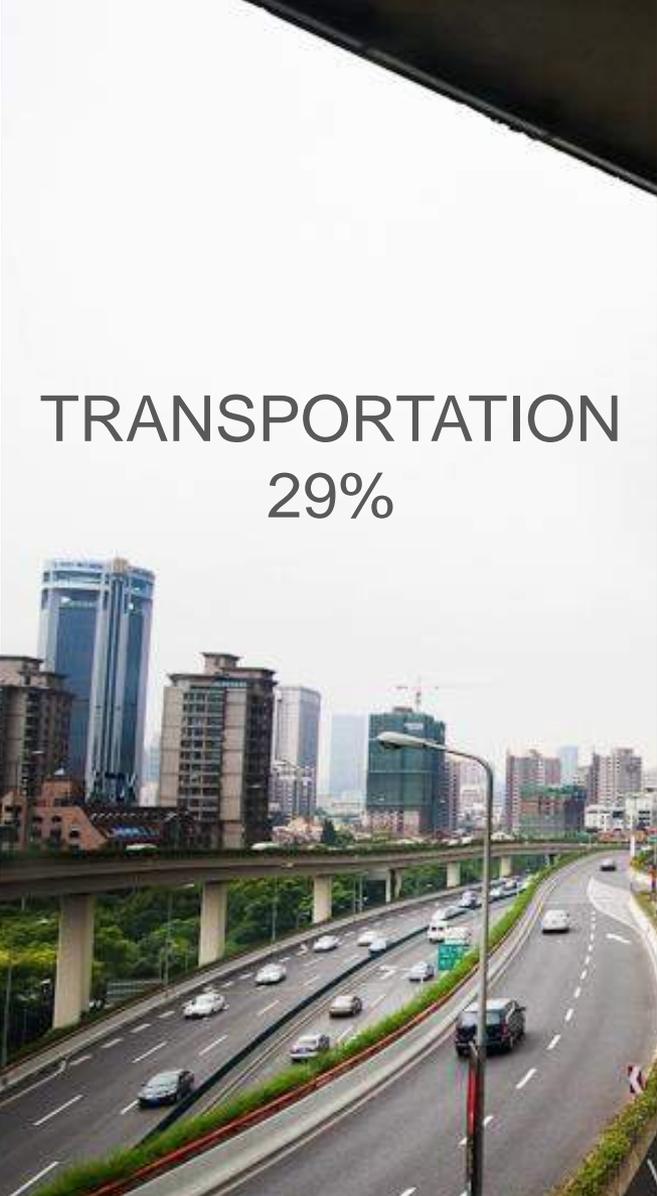




The New Abolitionism



INDUSTRY
30%



TRANSPORTATION
29%



BUILDING
41%
(Residential 22%)
(Commercial 19%)

UNITED STATES ENERGY USE BY SECTOR

What does good look like?



What is the end game?



The end of incrementalism

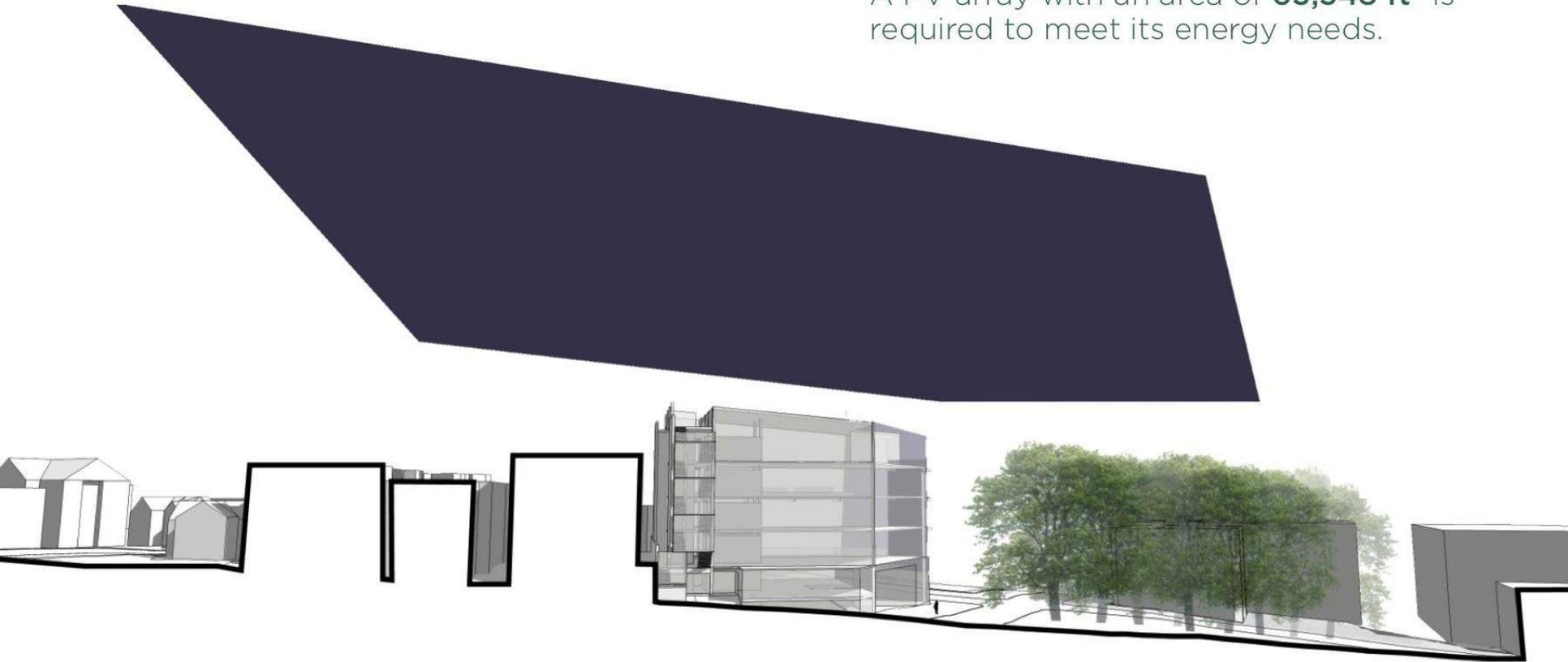


Creating an
alternative
narrative of
deep solutions



A typical building of this size has an **Energy Use Intensity of 72** kBtu/ft²/year.

A PV array with an area of **63,348 ft²** is required to meet its energy needs.



Action

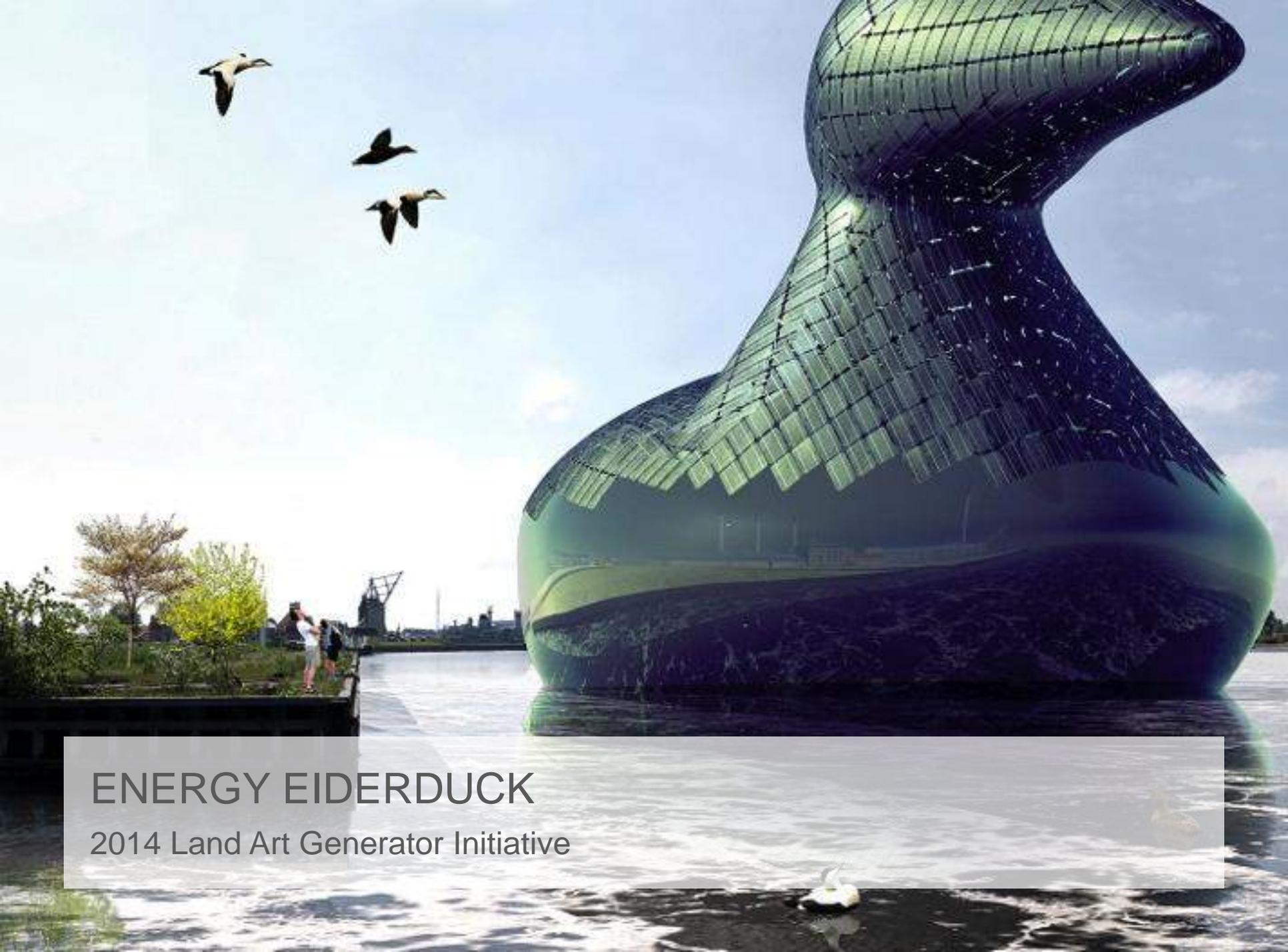




Beauty & Biophilia



PLAY - the return of the right brain



ENERGY EIDERDUCK

2014 Land Art Generator Initiative

10,000 people visit a townhome development



Net zero energy — a disruptive idea



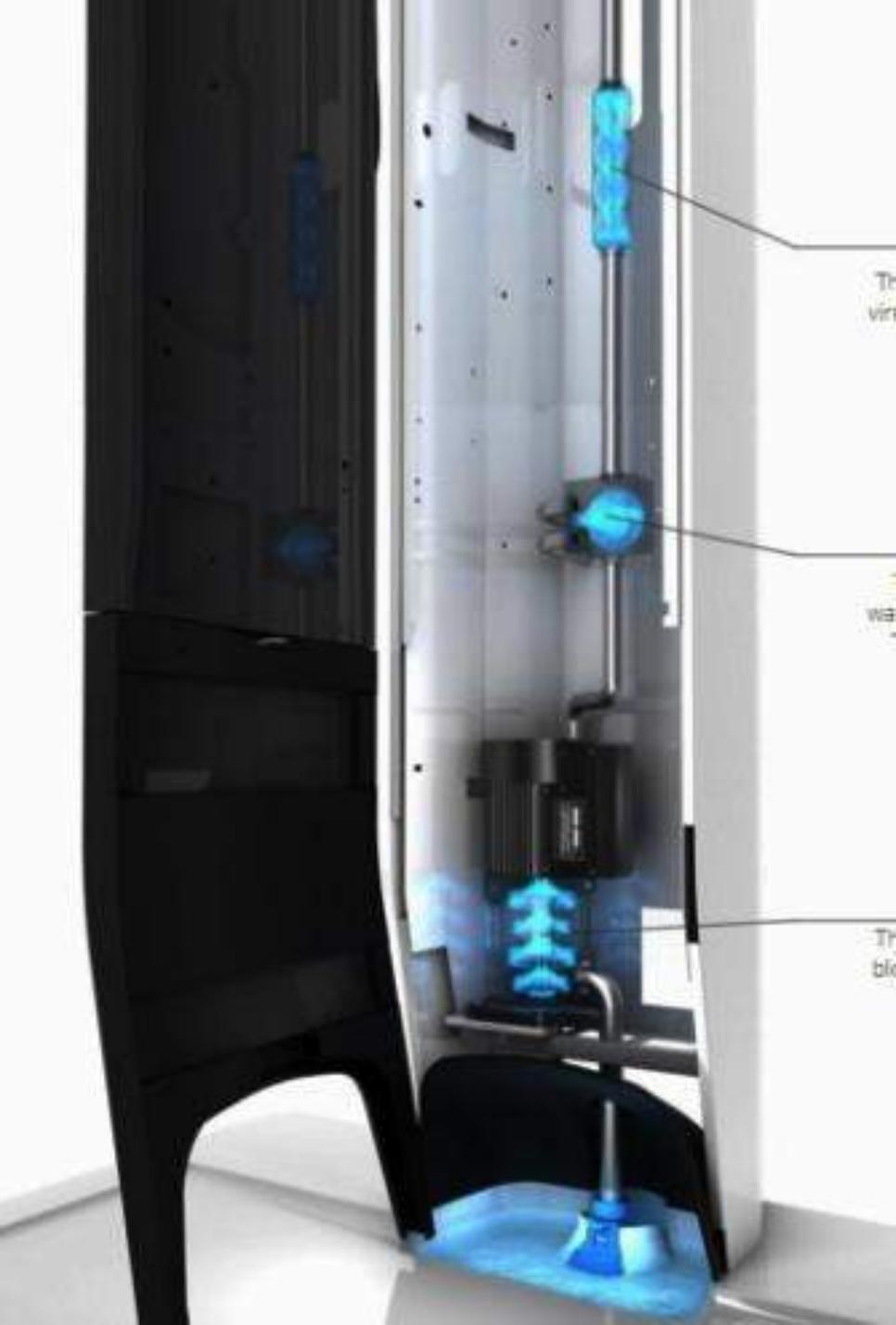
2005	2010	2015	2020 - vision	2025 - vision
NZE concept introduced to design community leaders	First examples built and occupied - proof of concept	26 certified NZE projects	1,000 certified NZE projects	All new construction built at NZE EUI performance
Leading states (WA, OR) adopt efficiency step increase goals for 2030	First national media coverage	309 registered NZE/LBC projects	Hawaii becomes first NZE state	All power generation is renewable
2007 - LBC launched, with NZE	Cutting edge design firms gain familiarity	Reveal EUI label launched	CA successfully codifies 2020 target	Fossil fuels no longer used
	2012 - NZE Building certification launched	Obama Executive Order on NZ buildings	Five additional states implement NZE code	Only biofuels used for aviation and other appropriate needs
	2014 - California sets NZE by 2020 target	Chairman of Ford mentions NZ factories	First fully NZE communities (including transport energy) completed	All regions energy autonomous, ie produce all energy used within boundaries
	2012 - MA NZE program	First NZE State Incentives - OR, IL	Omnidirectional PV commercialized	
		PV cost reaches grid parity in some locations	Heat pumps become standard for heating and hot water	
			NZE buildings as well known as electric vehicles in mainstream mind	

Nebia showerhead
0.75 gpm





Hamwell E-shower
Recirculating



Vacuum Insulation Panel (VIP)

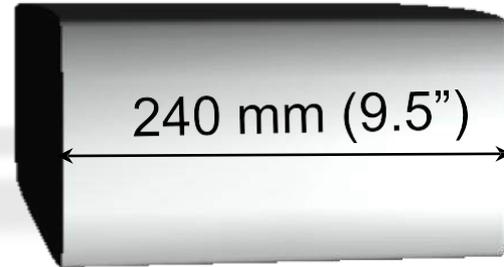


Source: Panasonic

Fiberglass



EPS



VIP

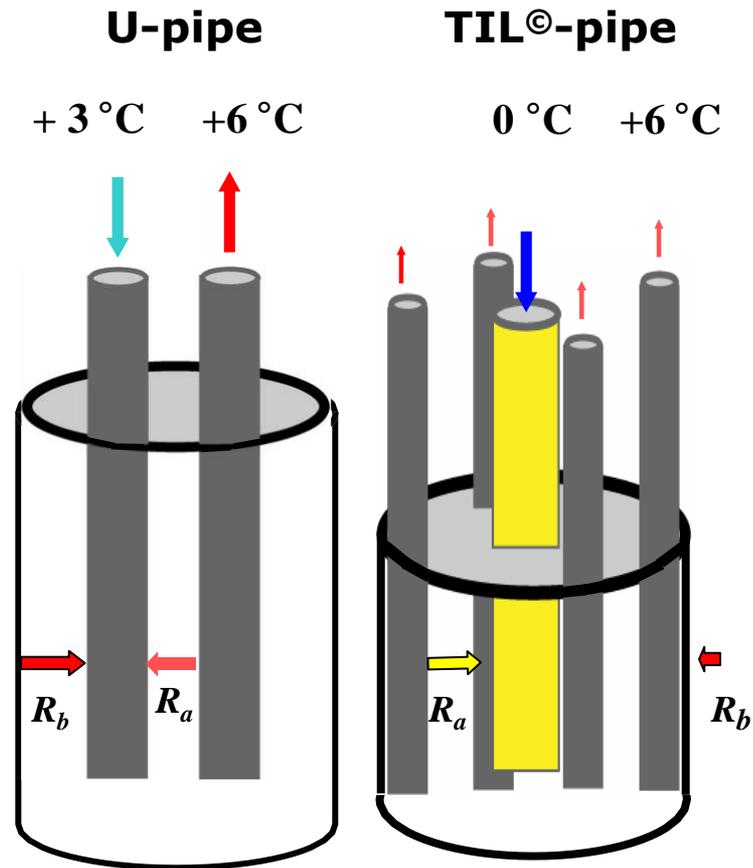


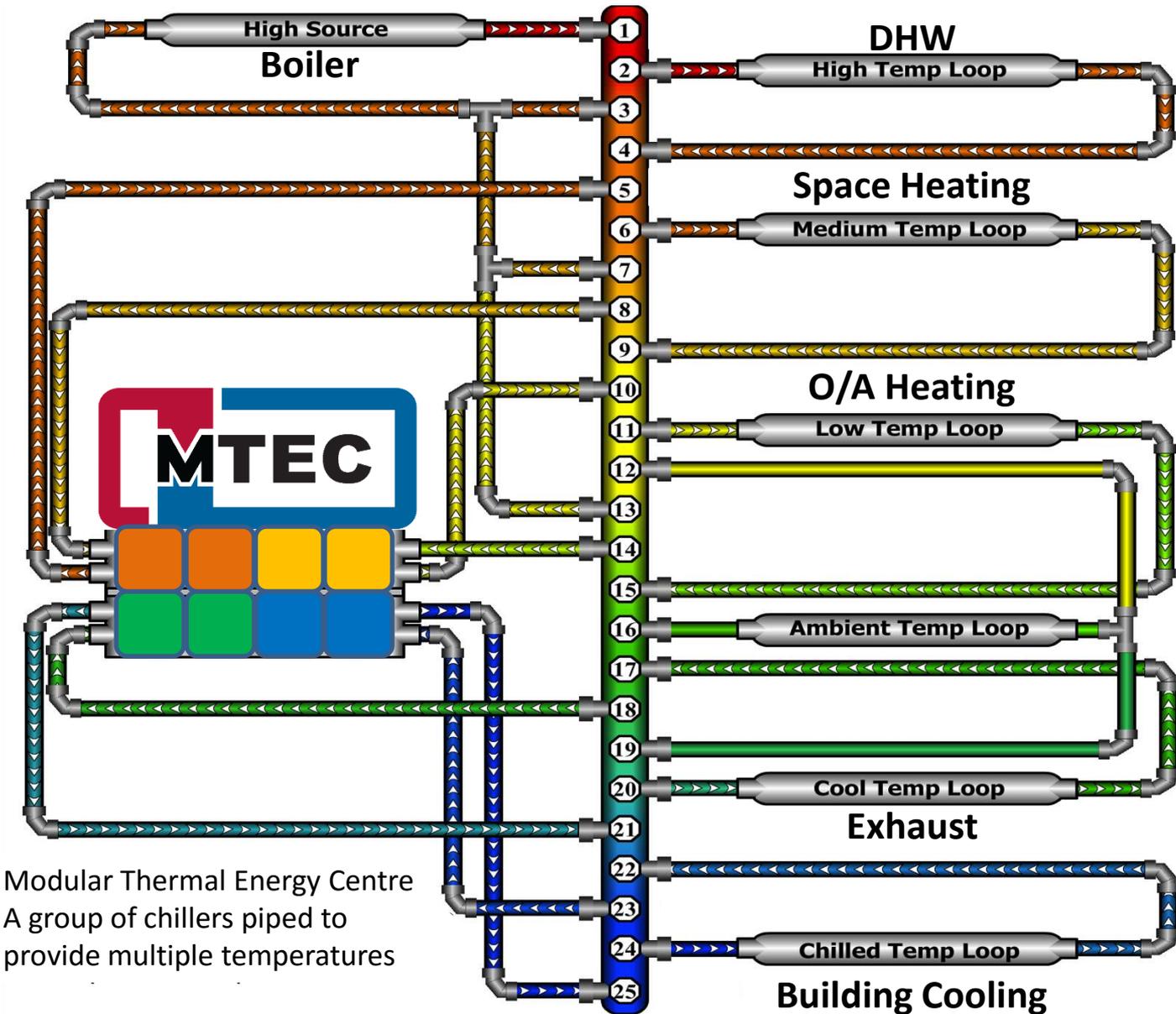
25 mm (1")



R36

Thermal Insulated Leg (TIL[®])





Modular Thermal Energy Centre
A group of chillers piped to
provide multiple temperatures



Conserval Solarwall Thermal Preheat
Vancouver BC Police Headquarters

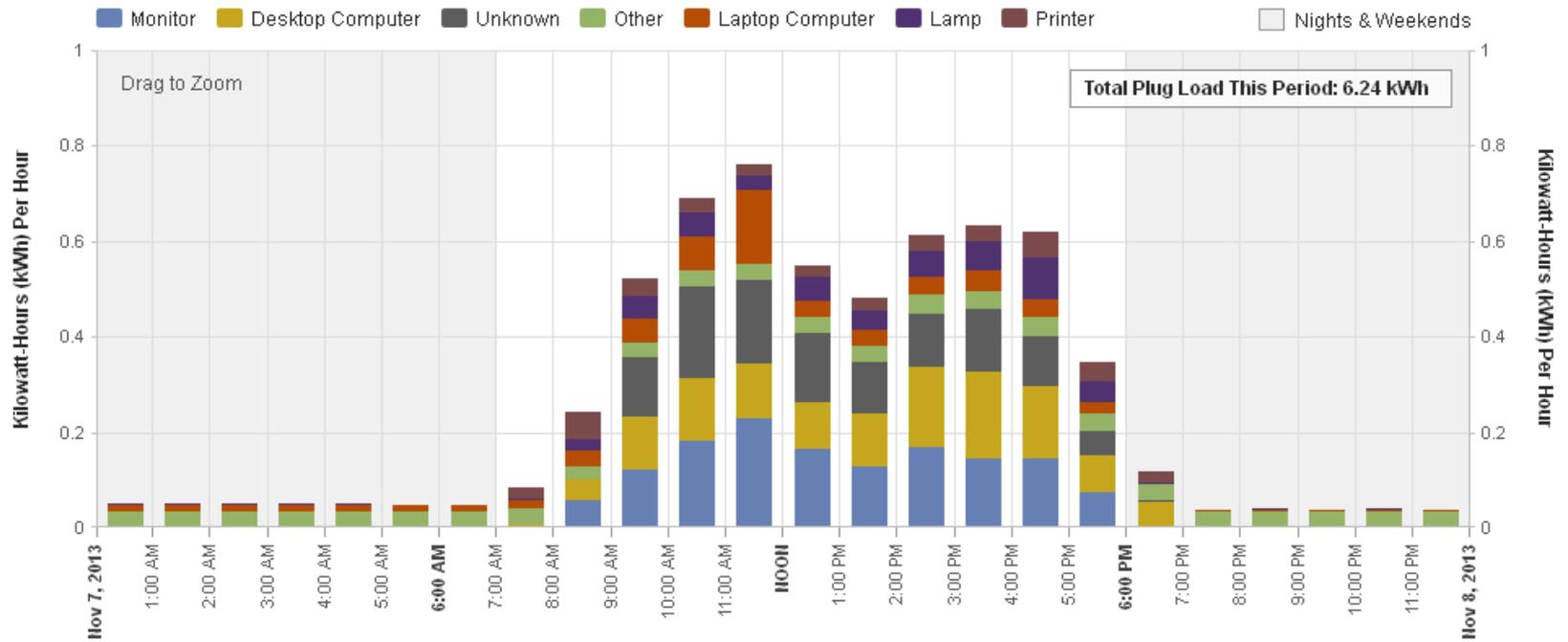
EnMetric Systems Energy Tracker



Plug Load Consumption

Kiosk Mode →

Energy Consumption Per Device Type ▼



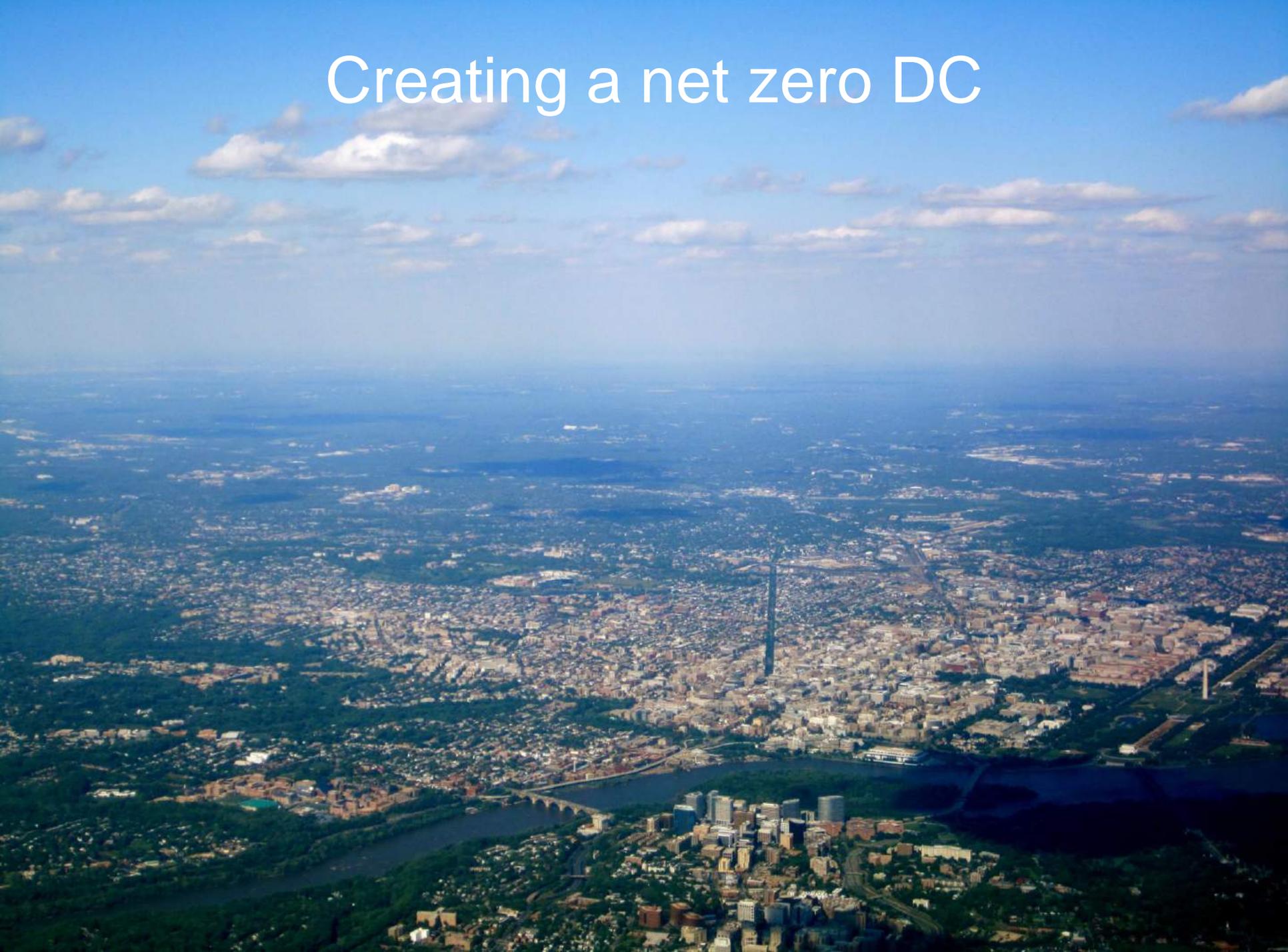
Thursday, November 7th, 2013





2010 – 2015, Brussels:
10,000,000 square feet of Passivhaus

Creating a net zero DC





DC Solar Harvest Estimates

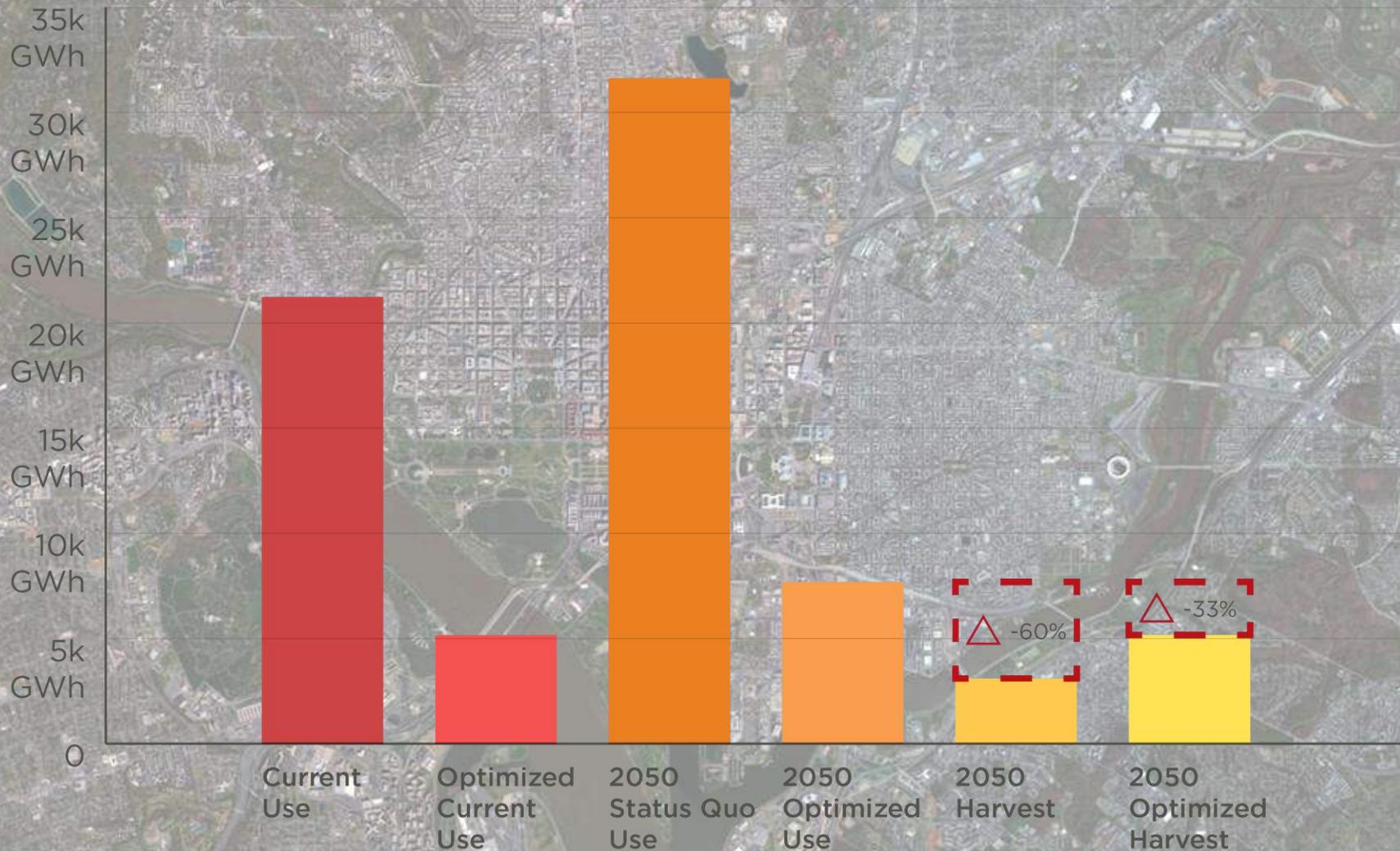
GDS: 1,488 GwH/year

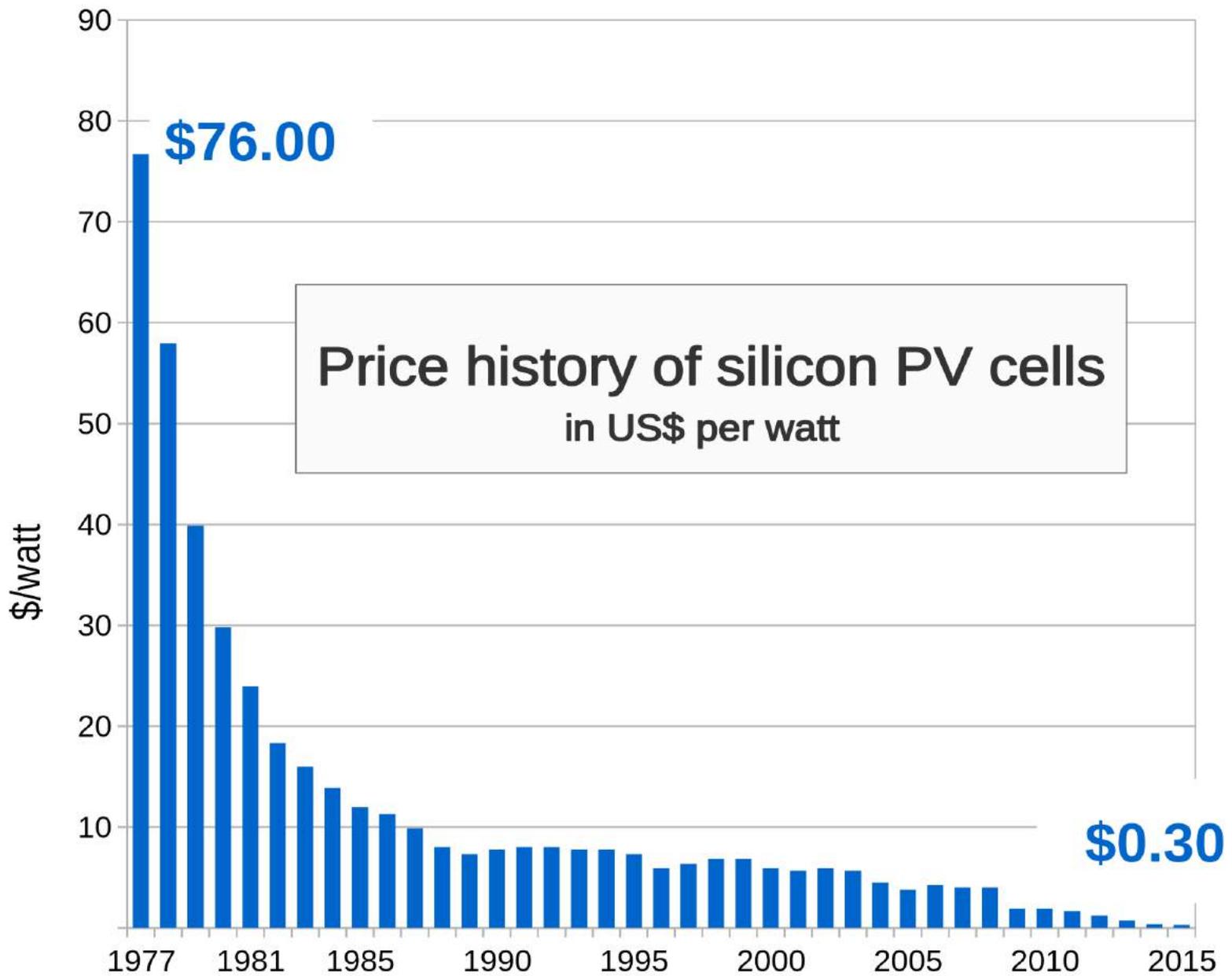
NREL: 2,490 GwH/year

Mapdwell: 2,585 GwH/year

Includes only 7% of total City area

Energy





Source: Bloomberg New Energy Finance & pv.energytrend.com

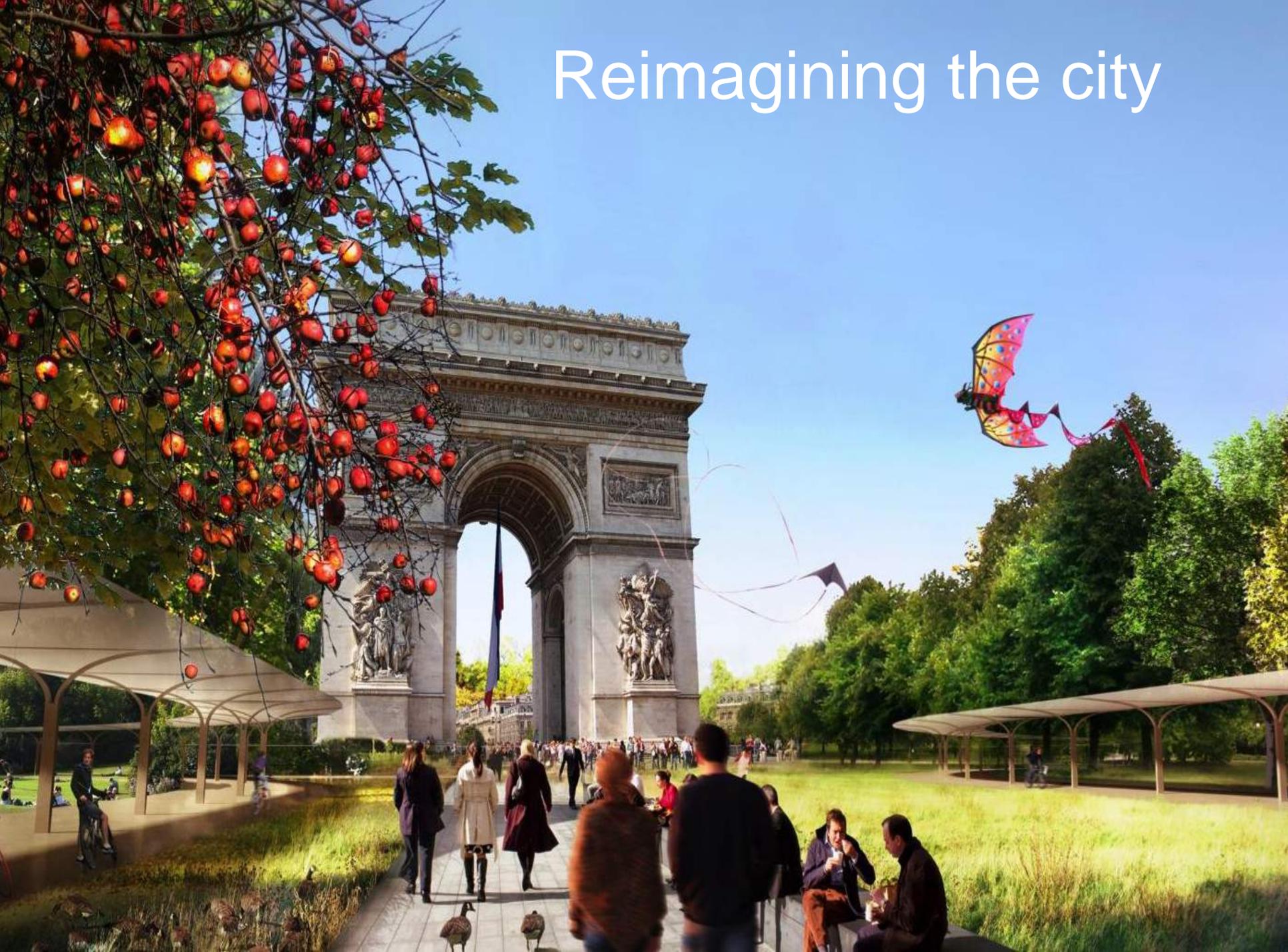
Countries with regions of Grid Parity

- Countries with regions of grid parity
- Grid parity for regions with high electricity price





Reimagining the city



12TH AVENUE BLUE-GREEN STREET



Tree-lined, serpentine boulevard.

Constructed Wetland to manage rainwater for drainage shed.

Separated bicycle path of natural materials.

Walking path of natural materials.

Agriculture integrated into the street.





Renault Twizy – 230 mpge

TRUTH + TRANSPARENCY

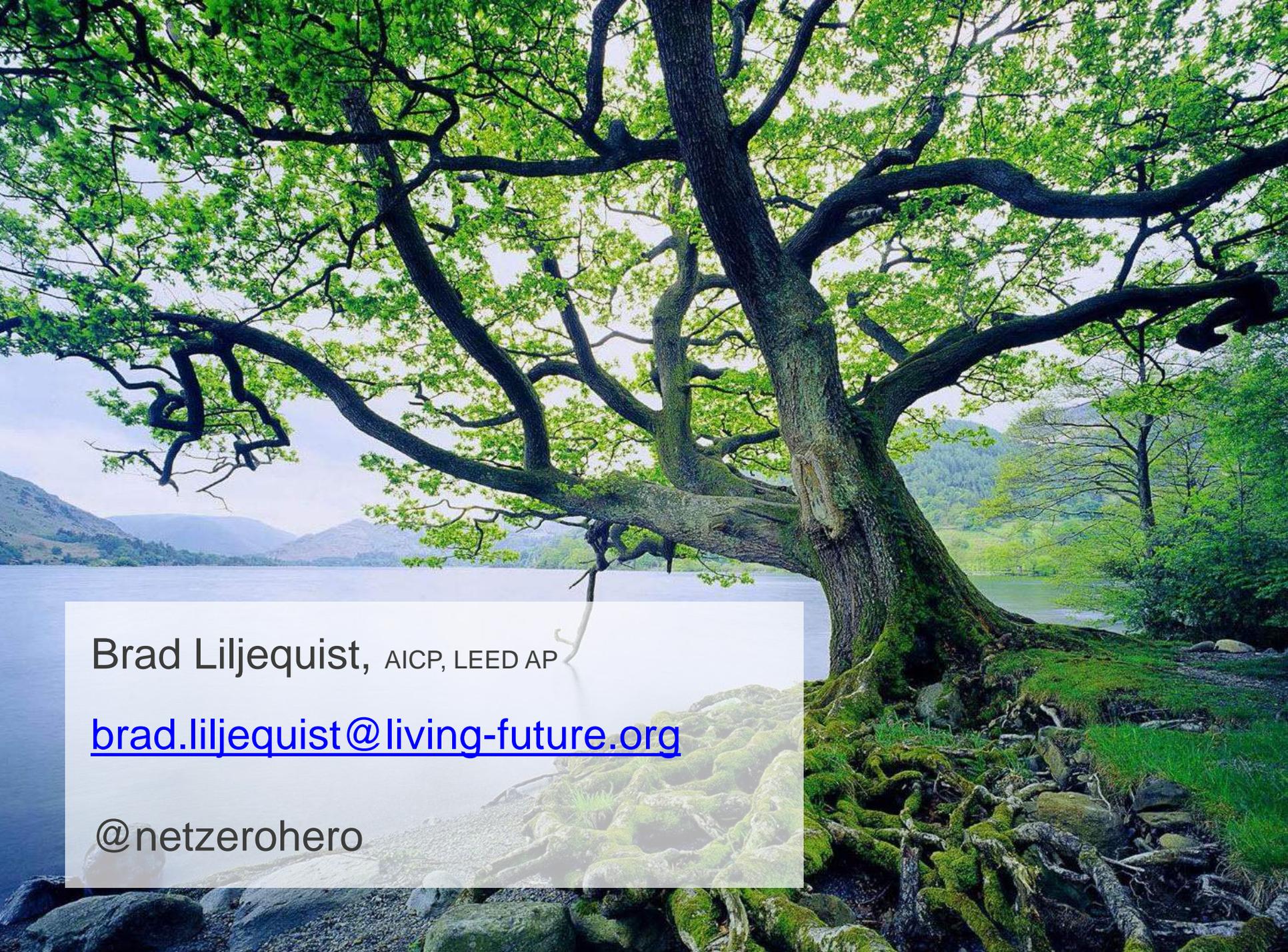
CONFRONTING THE BARRIERS TO CHANGE

LIVING
FUTURE
2016

WESTIN SEATTLE
MAY 11-13, 2016



INTERNATIONAL
LIVING FUTURE
INSTITUTESM



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@netzerohero



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