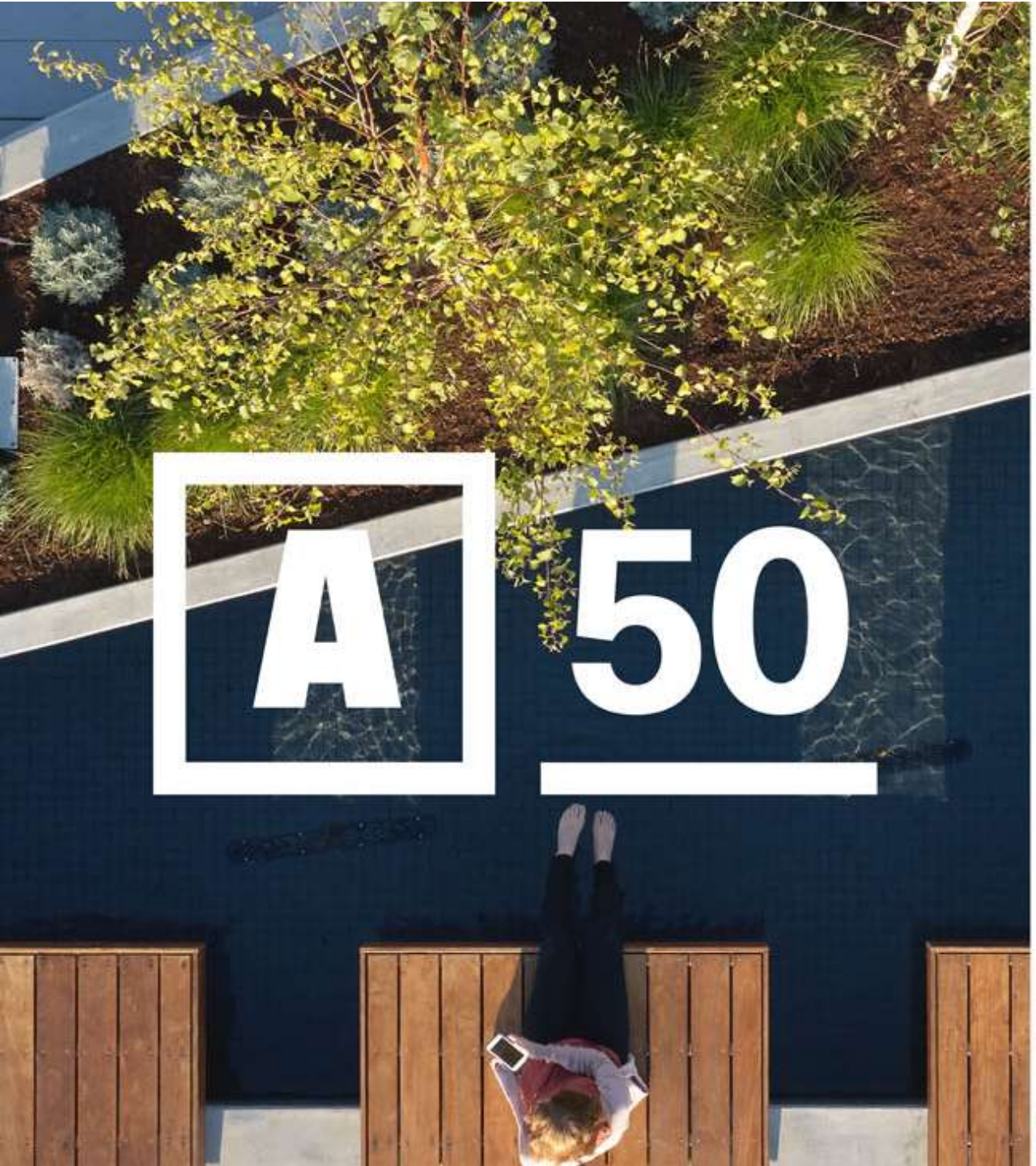
MITHŪN

mithun.com

DESIGN FOR POSI+IVE CHANGE



Mithun Ranks No. 12 overall and No. 2 in Sustainability by Architect Magazine, 2018

6 AIA COTE TOP TEN GREEN AWARDS

10+ NET ZERO BUILDINGS

AIA 2030 COMMITMENT

SUSTAINABLE R&D INVESTMENT 15,000+ HOURS

150+ GREEN STORMWATER PROJECTS

15+ PROJECTS WITH GREEN DISTRICT SCALE SYSTEMS

500+ SUSTAINABLE DESIGN PRESENTATIONS

CARBON NEUTRAL OPERATIONS SINCE 2004

40+ LEED CERTIFIED PROJECTS

MITHŪN

- ZNE-ready Affordable Housing is not only possible, but is being designed and built
- Construction is Cost-Neutral at a minimum, with potential for Lower Utility Bills
- Co-Benefits are Plentiful (and potentially Beautiful)
- **It's really about Zero Net Carbon (not Energy)**

MITHŪN

Electrifying Multifamily Affordable Housing—

R+D Study Overview—

MITHŪN

R+D

Resilience

thrive in the face of climate change

Health & Wellbeing

enhance the human condition

Carbon

achieve carbon positivity

Artificial Intelligence

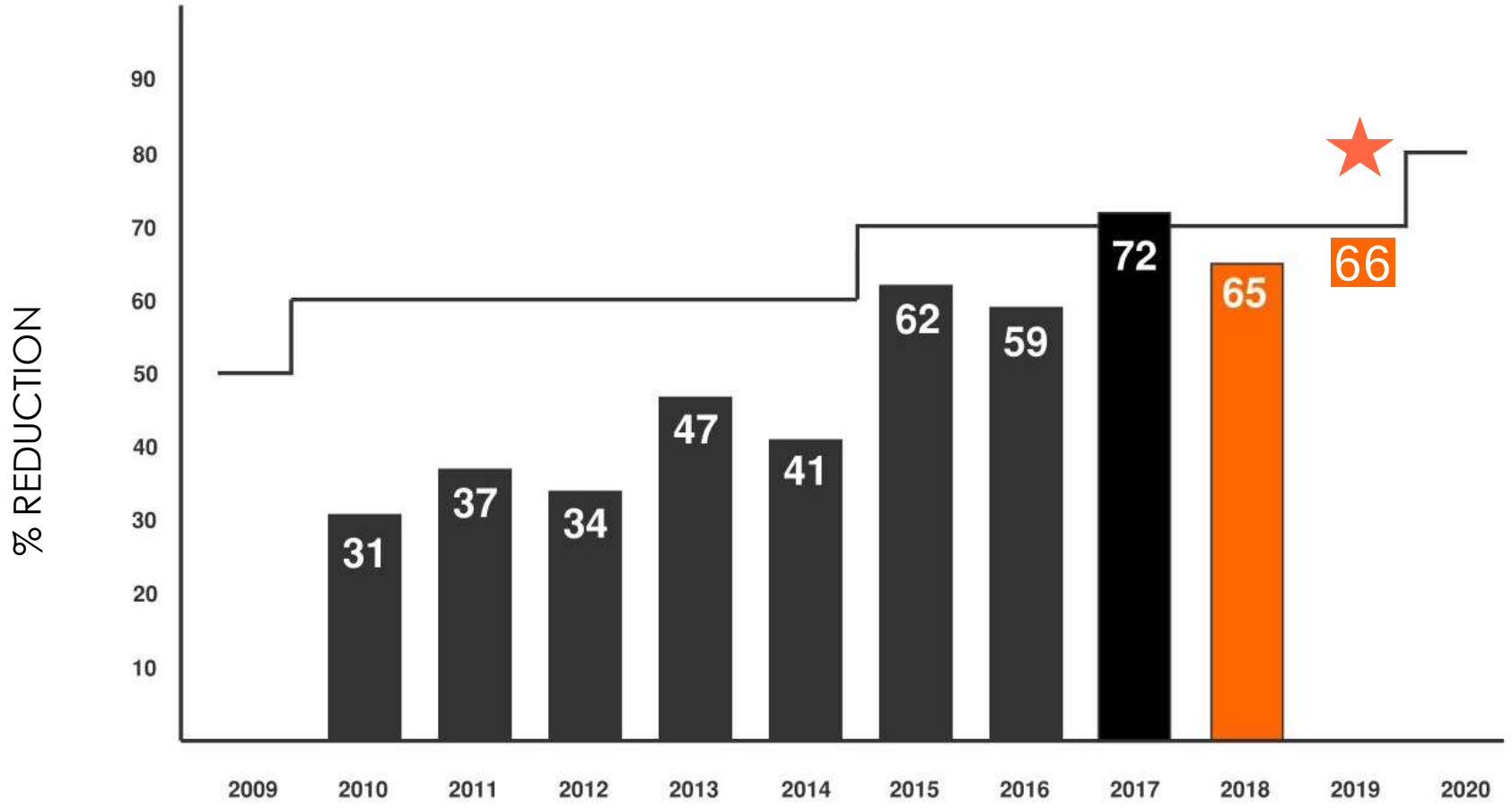
empower designers & enable superior decision-making

Construction Technology

transform building delivery for positive change

MITHŪN

2030 Challenge Reporting



MITHŪN

Performance ≠ Code Compliance ≠ Operational

Zero Net Carbon

- Comprehensive Model Analysis of all Systems
- Actual EUI
- Source Energy
- Carbon (embodied and operational)

Title 24 CEC

- Politically Weighted
- Excludes certain loads, systems & equipment
- Includes only:
- Space Conditioning, Mechanical Ventilation and Water Heating
- TDV energy use
- Cost basis

Benchmarking

- Separately metered Units, Common Areas, and Whole Building
- Actual Energy Use, Utility Costs, and ROI
- Resident Behavior

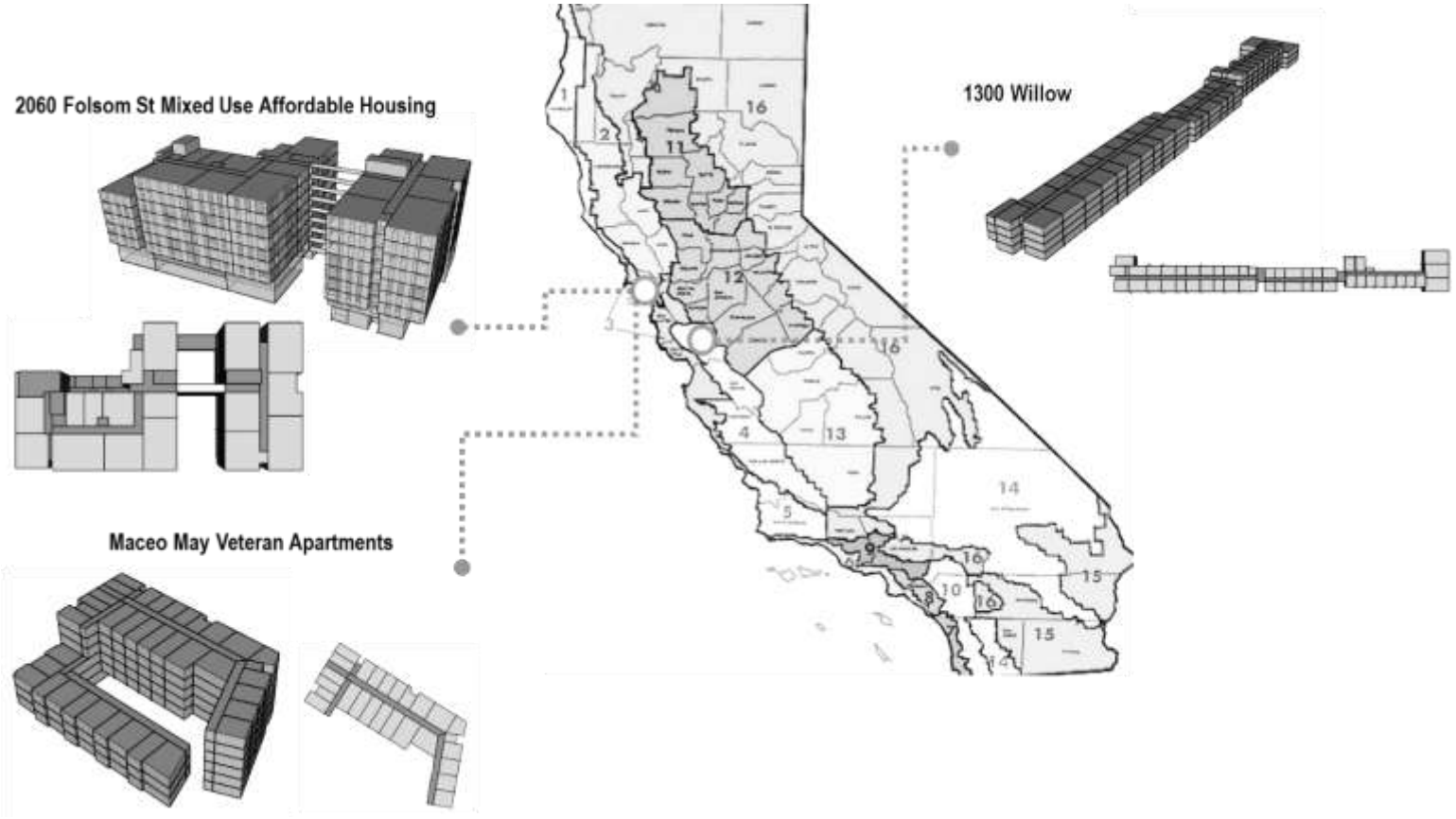
MITHŪN

R+D—

Research & Development
Zero Net Energy for CA
Multifamily Residential Design

Low, Mid and High Rise

Several Construction Types



MITHŪN

All-Electric San Francisco Affordable Housing Projects—

with ambitious EUI targets

Casa Adelante Housing (2060 Folsom)

Florida Family Apartments (Mission neighborhood)

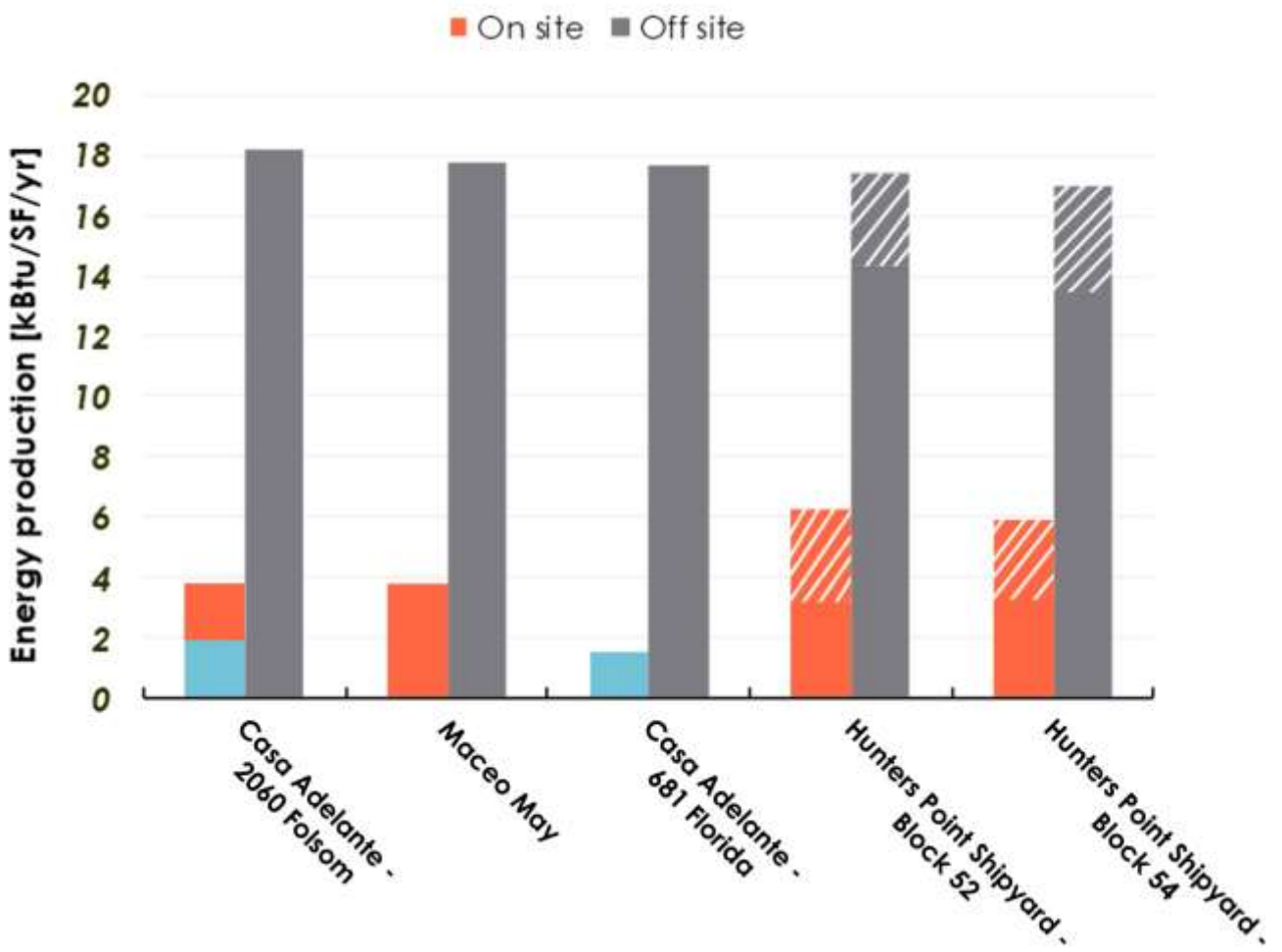
Maceo May Veterans Apts (Treasure Island)

Balboa Upper Yard (Outer Mission)

Blocks 52 & 54 (Hunters Point Shipyard)

MITHŪN

PV Production for Net Zero Energy—



MITHŪN

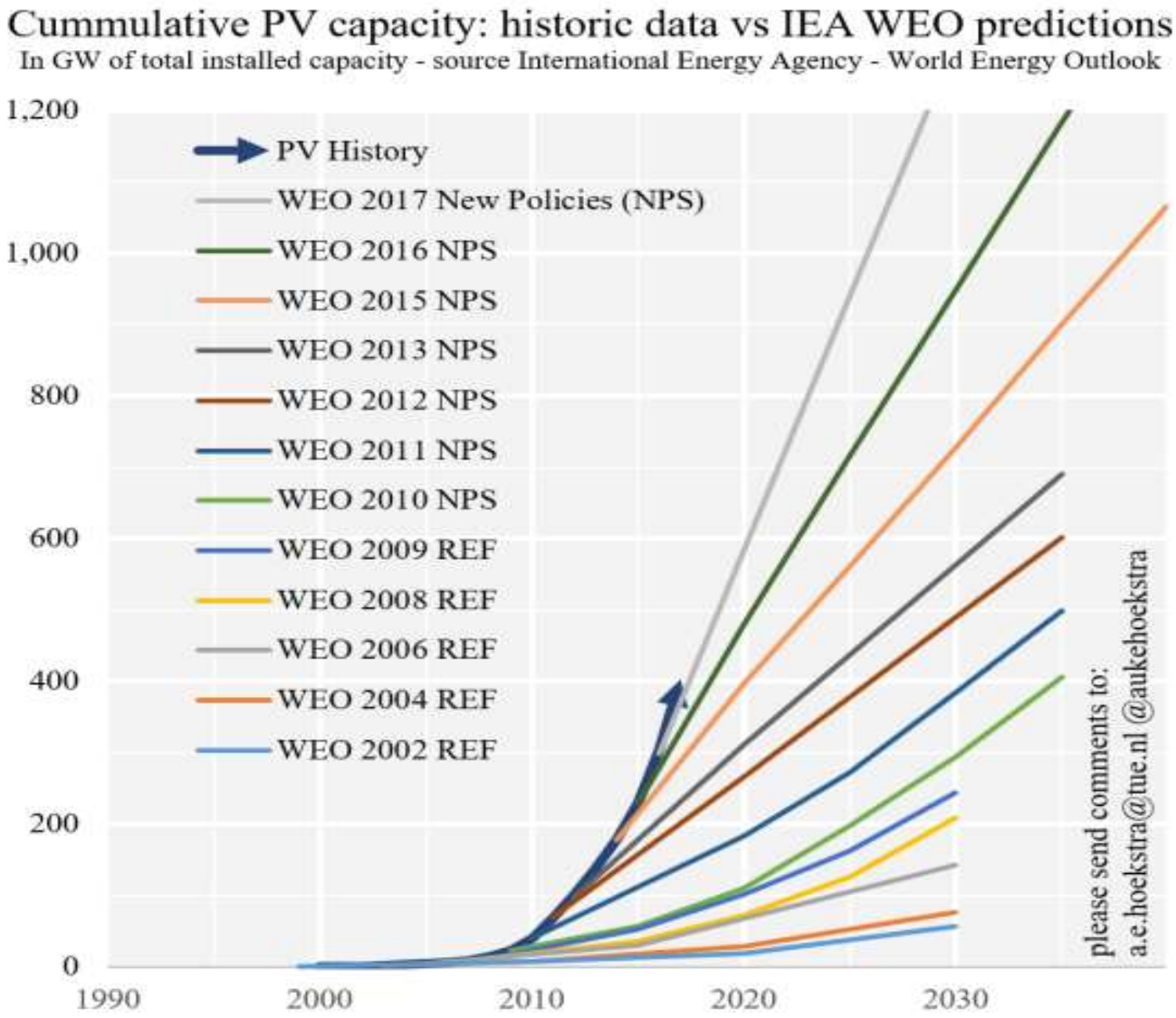
The Shift from ZNE to All-Electric—

MITHŪN

Clean Energy Sources are Outpacing Targets—

Low income and communities of color bear a disproportionate burden of pollution from fossil fuels and are more cost-burdened with utility bills

Auke Hoekstra, PhD

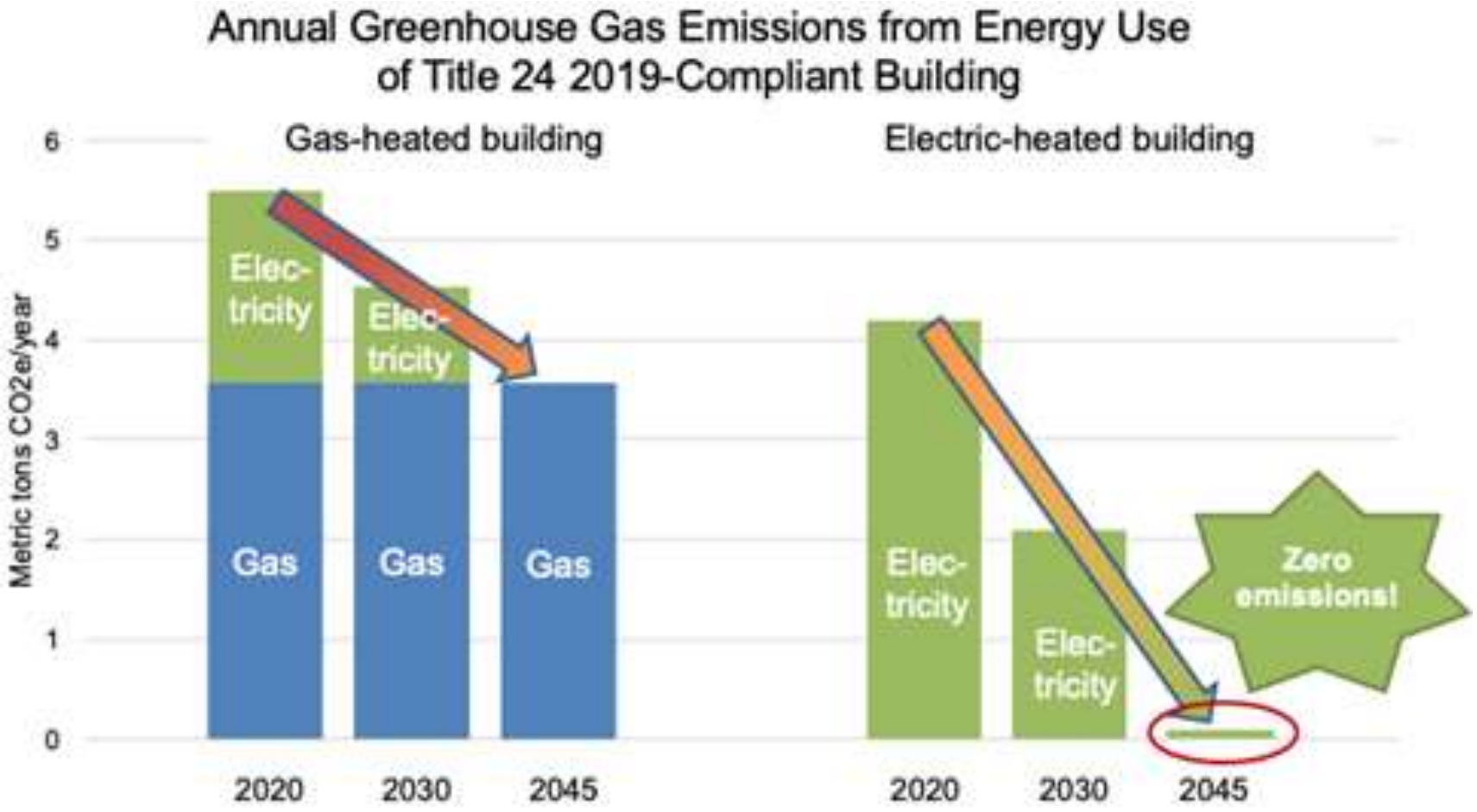


MITHŪN

Electrification is Pathway to Zero Carbon in CA—

Including Gas or Propane in a building is a guaranteed Carbon footprint in perpetuity

Rapidly greening grid means and All-Electric Buildings have a path to Zero Carbon Emissions



NRDC Analysis, Climate Zone 13 (Fresno) with rooftop solar, including methane leakage

MITHŪN

ARCHITECTURAL RECORD

Berkeley Says No to New Gas Connections

Although San Francisco has yet to institute a gas ban similar to the one recently enacted across the bay, in Berkeley, several residential projects there anticipate such restrictions, including Mithun's Maceo May Apartments, a 105-unit building for formerly homeless veterans and their families slated for completion in 2021.

Image courtesy Mithun

Hilary Noll, a Mithun senior associate in San Francisco, says heat pumps are providing savings for five all-electric multifamily housing projects the firm has underway in the city. She says this is primarily due to federal tax credits for affordable housing tied to energy efficiency targets. Those require the addition of solar water heaters when gas boilers are used, helping trim gas consumption. Without gas, additional savings come from avoided equipment such as gas piping, meters, and combustion venting, as well as simplified fire code compliance. "There's a trickle-down effect," says Noll, who estimates about $250,000 in savings per project.

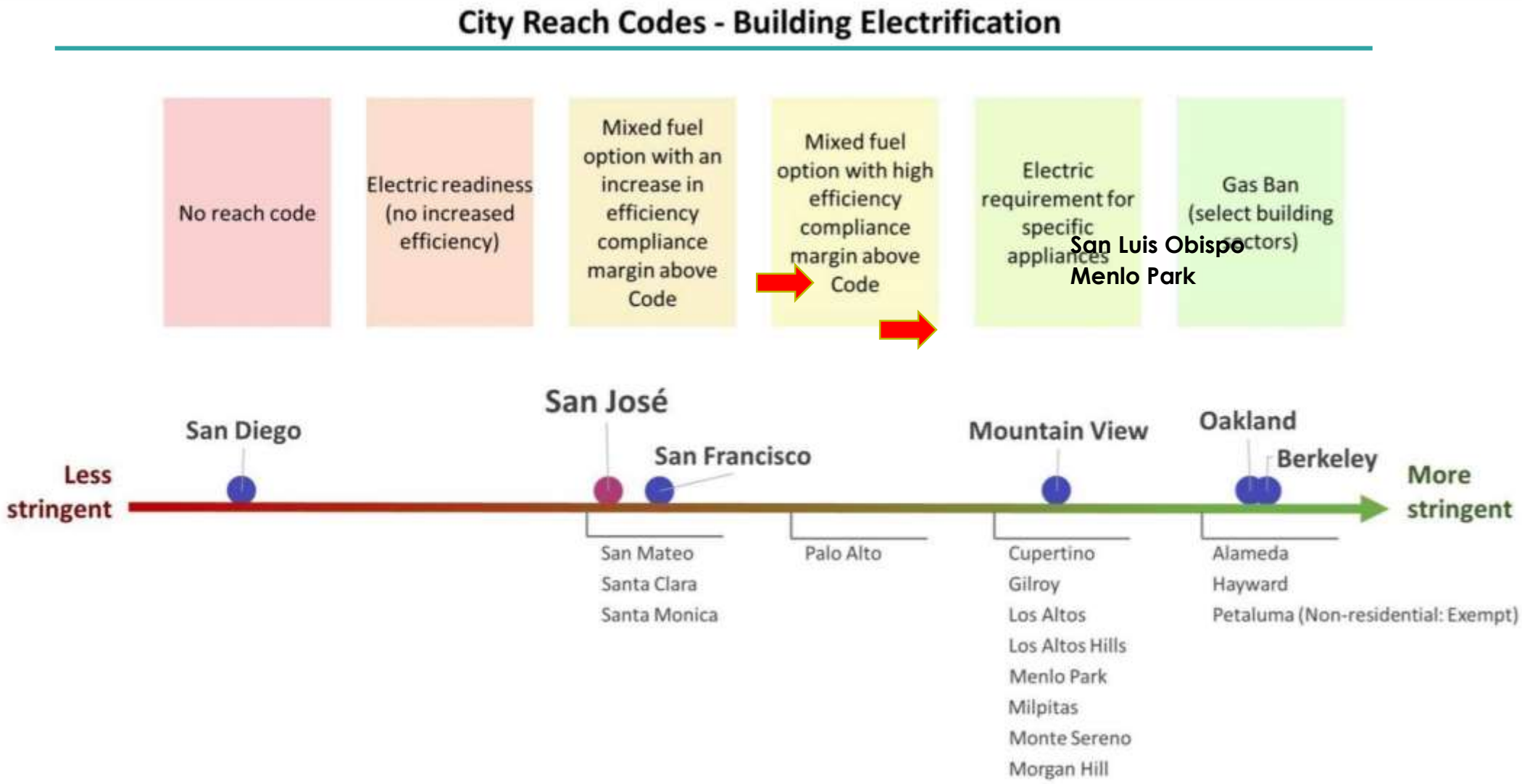
Noll says Mithun's clients favor all-electric design primarily as a response to heightened awareness of climate change. But they also feel they are getting a better building. In most of Mithun's all-electric projects, these savings are being used to upgrade air filtration systems to protect residents from soot from the region's increasingly frequent wildfires. Owners also recognize that eliminating gas today will future-proof the structures against expensive retrofits. "When you design for natural gas in a building, you're designing for obsolescence," says Noll.

Many California cities plan to ban gas only from new municipal buildings, while pushing private developers to go electric by mandating higher efficiency for gas-equipped buildings. Bartholomy says Los Angeles is following another model pioneered in Vancouver, British Columbia: phasing in limits on carbon emissions that will ratchet down over time.

Whatever model jurisdictions use, Bartholomy says, they will have to stop the installation of new gas equipment—which can last 15-20 years—in all buildings by 2030 to have any hope of meeting their mid-century carbon targets.

MITHŪN

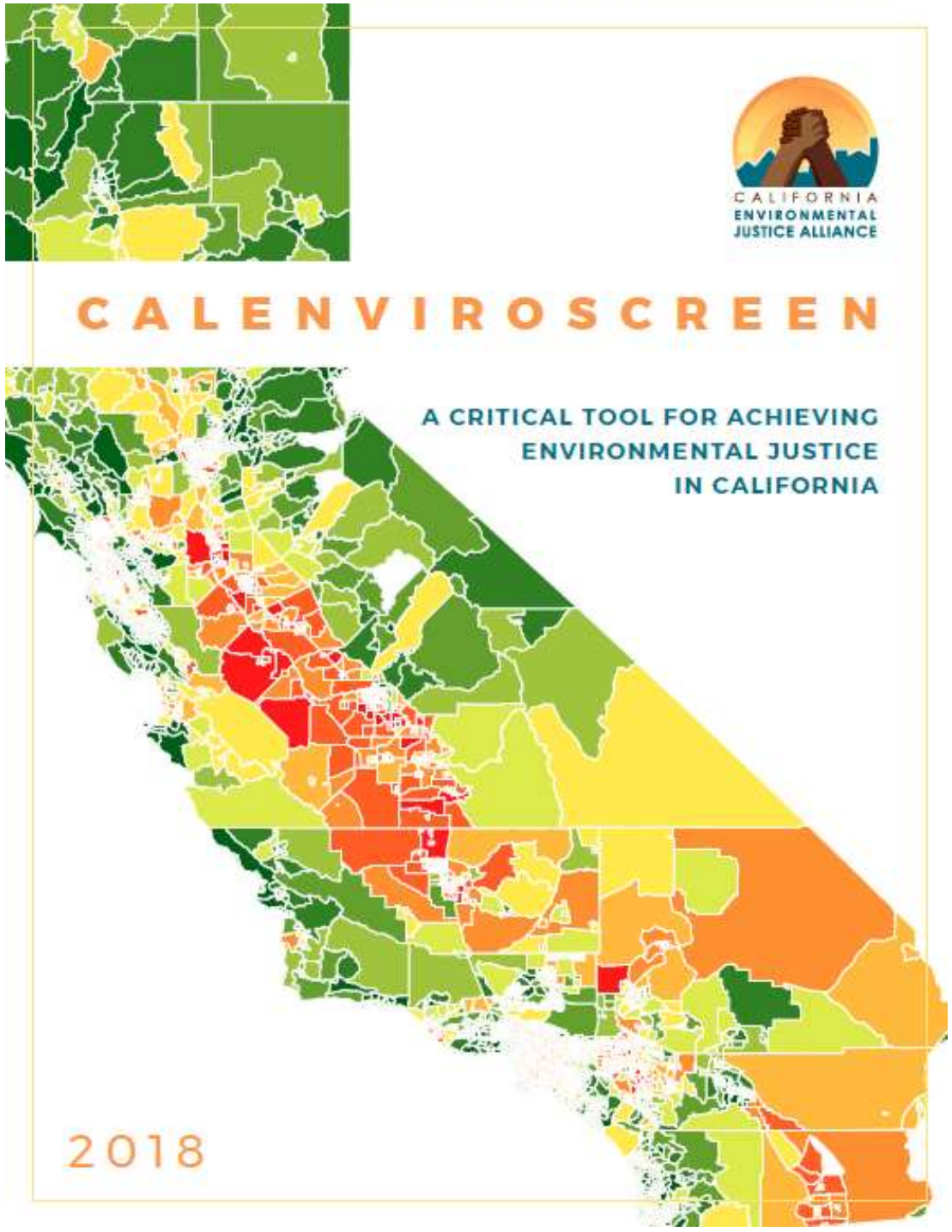
Reach Codes—



MITHŪN

Why ZNE Affordable Housing Matters—

Low income and communities of color bear a disproportionate burden of pollution from fossil fuels and are more cost-burdened with utility bills on average



MITHŪN

How Equitable Electrification is Achievable—

Equitable Building Electrification: A Framework for Powering Resilient Communities

provides decision makers with a step by step guide to achieve GHG goals while ensuring every person, regardless of race and income, can benefit from the clean energy transition.

MITHŪN

Decarbonization and Resilience—

Resilient by Design—
Bay Area, California

Project Case Studies—

MITHŪN

All-Electric San Francisco Affordable Housing Projects

with ambitious EUI targets
and all-electric systems

Casa Adelante Housing
(2060 Folsom)

Florida Family Apartments
(Mission neighborhood)

Maceo May Veterans
Apts (Treasure Island)

Balboa Upper Yard
(Outer Mission)

Blocks 52 & 54
(Hunters Point Shipyard)

MITHŪN

EUI 18.2—

Casa Adelante - 2060 Folsom
Mission Neighborhood
San Francisco, CA

Size:	127 Units and 169,995 GSF
2030 Goal:	23.6 kBtu/sf/yr
Construction Cost:	$ 68,175,234
Hard Cost / sq ft:	$ 401/ sq ft

Parkside Porch for the People

2060 Folsom

San Francisco, California

Client	Mission Economic Development Agency, Chinatown Community Development Center
Overview	Affordable housing development overlooking new neighborhood park in the Mission District
Program	127 affordable units, community room, garden courtyard, youth lounge, childcare center, parking for 150 bikes
Size	150,000 sf
Metrics	Green Point Rated, LEED Gold Targeted
Services	Architecture, Interior Design and Landscape Architecture
Collaborators	Y.A. Studio, Associate Architects

Affordable Housing and Critical Services

2060 Folsom creates in-demand affordable homes and an active community hub, inspired by the Mission District's unique blend of civic participation and working-class heritage. Maximizing density, the nine-story building houses families and transitional-age youth, and offers programs critical to the future of the district.

Maximizing Views and Connection

The building is conceived as a 'front porch' overlooking the new neighborhood park at the corner of Folsom and 17th streets. A spacious courtyard draws sunlight and park views into the building. A community room and common spaces clustered around the courtyard create a 'town square' for indoor-outdoor events.

Activated Street Fronts

A transparent ground floor holds a diverse array of active programs. Wide sidewalks, bike lanes, retail and art murals activate street frontages and encourage public interaction. Public services including a childcare center and offices for local organizations are housed on the first two floors, and an incubator café on the prominent southeast corner supports local entrepreneurship.

MITHŪN

EUI 17.7—

Case Adelante – 681 Florida
Mission Neighborhood
San Francisco, CA

Size:	130 Units and 142,100 GSF
2030 Goal:	23.6 kBtu/sf/yr
Construction Cost:	$ 64,687,461
Hard Cost / sq ft:	$ 455/ sq ft

Mission Possible Family Housing

681 Florida

San Francisco, California

Client	Tenderloin Neighborhood Development Corporation (TNDC) and Mission Economic Development Agency (MEDA) Joint Venture
Overview	130 Units with amenities/services and 10,000 SF of Production, Distribution, and Repair (PDR) space reserved for local arts organizations.
Program	Residential, Business, Assembly
Size	140,000 square feet, 0.44 acres
Metrics	Meets AIASF 2030 Challenge
Services	Architecture, Interior Design, Landscape Architecture
Collaborators	List here
Completion	May 2021
Cost	$62,000,000

Family-Friendly Mixed Use
This new, mixed use development provides amenity-rich, family-friendly urban living. A ground floor, double-height facade spanning the entire block maximizes flexibility and visibility for diverse communities; and durable materials, highly coordinated systems design, careful cost analysis, and an EUI meet the AIASF 2030 challenge; all helping to ensure the Mission remains a backbone of San Francisco culture.

Serving a Need
Responding to need, the development supports displaced and low-income families with 30% of units reserved for formerly homeless residents with income 15-30% AMI; and the remainder of units available to residents 40-60% AMI. The project also provides spaces for a variety of programs and services, from job placement and tax preparation, to urban rooftop farming and healthy cooking classes.

Honoring the Mission's Art Culture
Honoring the arts culture of the Mission, the ground-floor space is dedicated for arts organization use and designed to maximize visibility—pedestrians will be able to see through from one sidewalk across the block to the next. A forecourt with a large art gate at the main entrance welcomes events as well as curious passers-by.

MITHŪN

EUI 17.8—

Maceo May Veterans Apts
Treasure Island
San Francisco, CA

Size:	105 Units and 114,836 GSF
2030 Goal:	22.6 kBtu/sf/yr
Construction Cost:	$ 52,280,034
Hard Cost / sq ft:	$ 455/ sq ft

Healthy Homes for Veterans

Maceo May Apartments

San Francisco, California

Client	Swords to Plowshares and Chinatown Community Development Center
Overview	Six-story building on Treasure Island in San Francisco Bay providing 105 homes to formerly hoemless Veterans and their families
Program	105 multifamily units (studios, 1-bdr and 2-bdr), on-site residential services, property management offices, community room, laundry, parking, bicycle storage, outdoor common areas including pet area, culinary gardens, forested healing garden, playground, BBQ and roof deck
Size	104,500 sf; 0.74 acres
Metrics	Fitwel Certification and Green Point Rated
Services	Architecture, Landscape Architecture
Completion	2021

Creating Community

Home to a diversity of residents, from families with young children to Veterans recently experiencing homelessness, Maceo May Apartments will provide a range of common areas, from gathering spaces to healing gardens. Its community-centered design—access to views for all, active ground-floor uses, and place-based wayfinding—will integrate residents into their new neighborhood.

Infrastructure for Health Inside and Out

Pursuing Fitwel certification, the design emphasizes social cohesion and wellness, including features tailored to support those with a history of chronic illnesses and mental health challenges. Active design principles within the building connect residents to each other and the natural environment via the adjacent shared public way, community park and island trail network.

Building for a Resilient Future

The design uses net-zero energy strategies to achieve an EUI of 18.2, incorporates several resilient-design elements guarding against disaster and climate change impacts, and prioritizes healthy and durable materials throughout. Modular construction parameters have influenced the unit design and will reduce construction cost and duration—speeding the delivery of much needed housing.

MITHŪN

B52: EUI 14.2—
B54: EUI 13.6—

Hunters Point Shipyard
Blocks 52 & 54
San Francisco, CA

Size:	112 Units and 169,4746 GSF
2030 Goal:	20.2 kBtu/sf/yr
Construction Cost:	$ 69,281,046
Hard Cost / sq ft:	$ 408/ sq ft

BLOCK 52 - MASSING AXON VIEW FROM EAST

BLOCK 52 - MASSING AXON VIEW FROM WEST

Shipyard Multifamily

HPS 52 + 54 Case Study

San Francisco, California

Co-Sponsors	Mission Housing Development Corporation and the Related Companies
Architect	Mithun
Lot Area	29,000 sf
Project Size	150,000 sf
Zoning	85 foot height limit, zero setbacks, no parking required, 7,000 sf open space required
Funding	4% California Tax credits and San Francisco's Mayor Office of Housing and Community Development (MOHCD), AHSC
Timeline	Fall 2015: Development team selected Spring-Summer 2017: Community outreach 2017-2018: Design, Permits, and financing 2018 or early 2019: Construction to start 2020: Residents to move in
Metrics	Green Point or LEED rated
Transit	BART regional transit Multiple MUNI bus lines Bike lanes a few blocks away

Project Description

- Safe, stable affordable housing for low income families (60% AMI, 40% neighborhood priority)
- Located immediately adjacent to Balboa Park BART station
- 300 feet from 280 Freeway
- Highly impacted by traffic at busy intersection

Project and Community Goals

- Affordable units for families
- Active ground floor for the community
- A vibrant new BART Plaza
- Safe streets for pedestrians and cars
- Protected open space for residents

Program

- Residential 100+ affordable units with a mix of 3br, 2br, 1br and studios, community room, garden courtyard, rooftop garden, bike parking, and supportive services offices
- Child Development Center 6,000 sf
- Neighborhood Retail
- Non-Profit Office Space 6,500 sf

MITHŪN

EUI 20.6—

Balboa Upper Yard Family Apts
San Francisco, CA

2030 Goal: 23.6 kBtu/sf/yr

LEED Baseline 80.9 kBtu/sf/yr

39% savings

Promoting Health through Community Development

Balboa Park Housing Case Study

San Francisco, California

Co-Sponsors	Mission Housing Development Corporation and the Related Companies
Architect	Mithun
Lot Area	29,000 sf
Project Size	150,000 sf
Zoning	85 foot height limit, zero setbacks, no parking required, 7,000 sf open space required
Funding	4% California Tax credits and San Francisco's Mayor Office of Housing and Community Development (MOHCD), AHSC
Timeline	Fall 2015: Development team selected Spring-Summer 2017: Community outreach 2017-2018: Design, Permits, and financing 2018 or early 2019: Construction to start 2020: Residents to move in
Metrics	Green Point or LEED rated
Transit	BART regional transit Multiple MUNI bus lines Bike lanes a few blocks away

Project Description

— Safe, stable affordable housing for low income families (60% AMI, 40% neighborhood priority)
— Located immediately adjacent to Balboa Park BART station
— 300 feet from 280 Freeway
— Highly impacted by traffic at busy intersection

Project and Community Goals

— Affordable units for families
— Active ground floor for the community
— A vibrant new BART Plaza
— Safe streets for pedestrians and cars
— Protected open space for residents

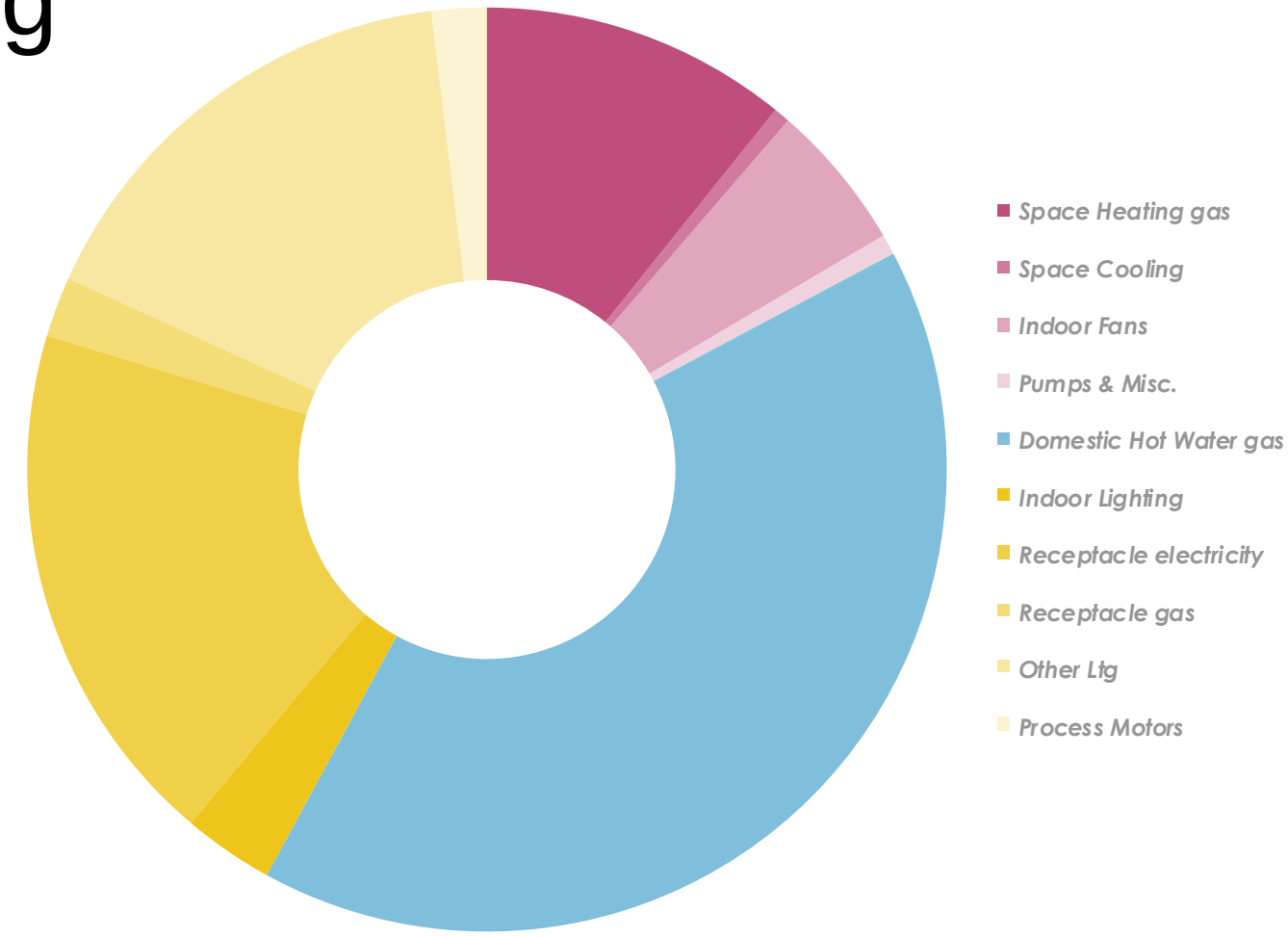
Program

— Residential 100+ affordable units with a mix of 3br, 2br, 1br and studios, community room, garden courtyard, rooftop garden, bike parking, and supportive services offices
— Child Development Center 6,000 sf
— Neighborhood Retail
— Non-Profit Office Space 6,500 sf

Energy Efficiency Measures—

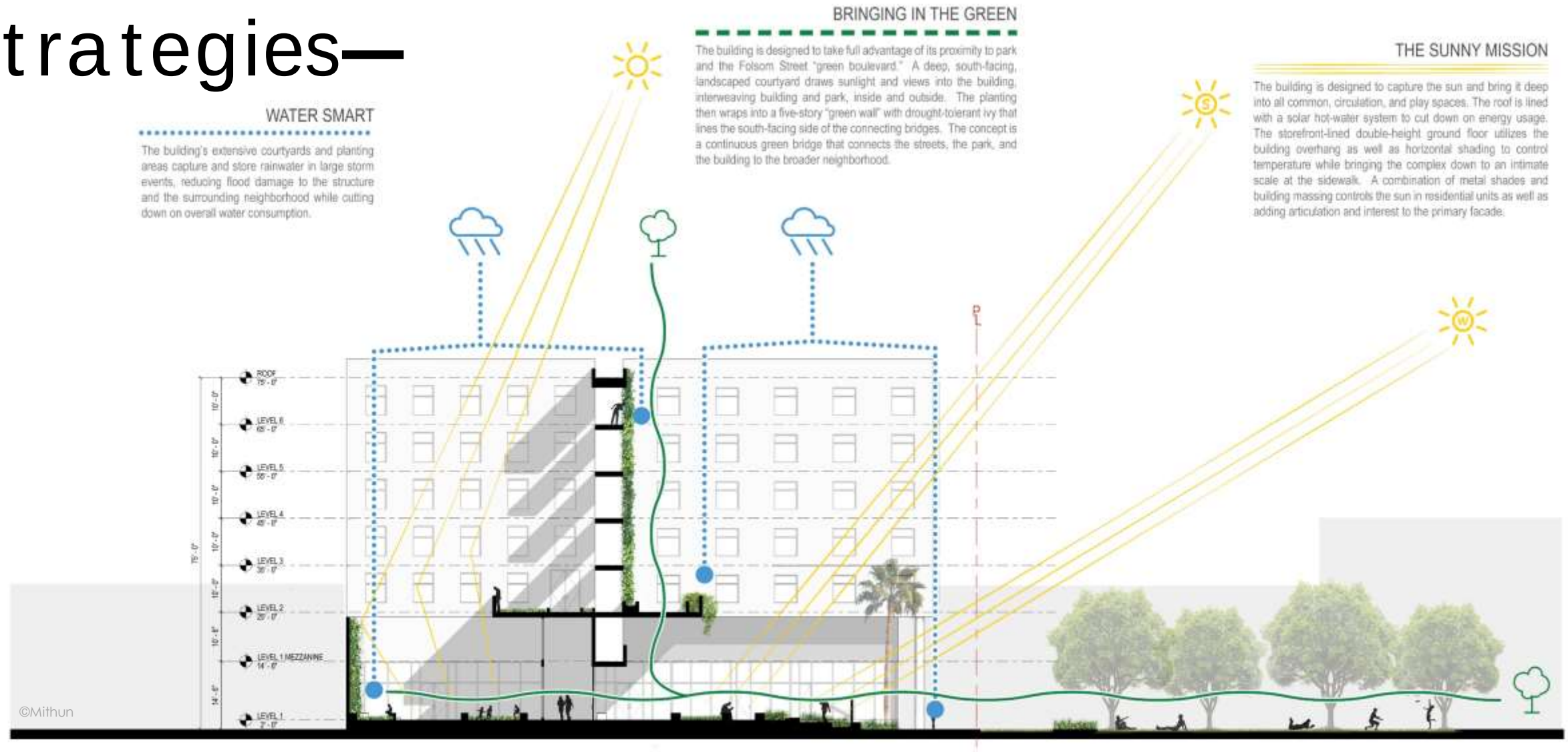
MITHŪN

Typical Loads in Multifamily Housing



MITHŪN

Passive Design Strategies—



MITHŪN

Building Systems

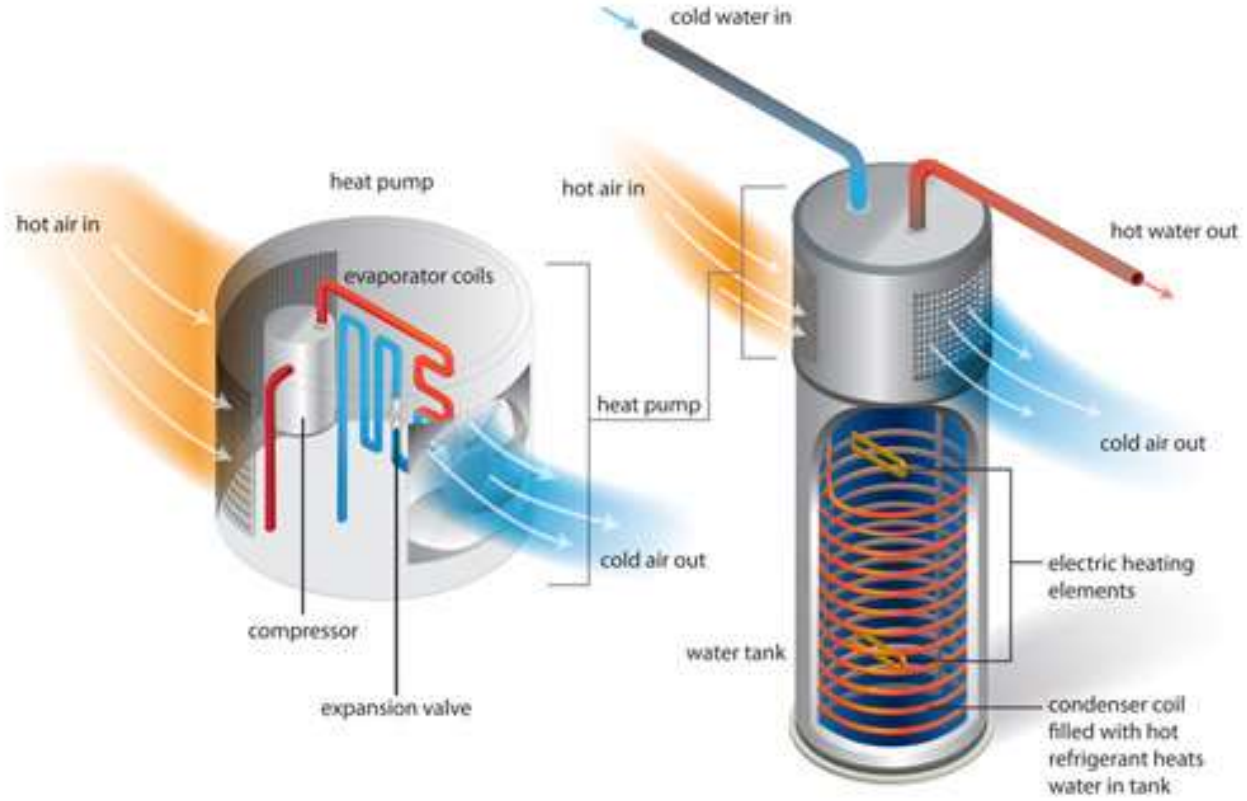
Envelope/ Wall Assemblies:	Type 1B/Type III with 2" C. I.
Window to Wall Ratios	22%
Glazing:	U-Value: 0.36 SHGC: 0.25
Building Orientation:	E-W axis
Passive Strategies:	External Shading, Operable Windows
Domestic Hot Water:	Air Source Heat Pump
Heating & Cooling, Units:	Electric Resistance & None
Heating & Cooling, Other(?):	Air Source Heat Pump & None
Ventilation:	DOAS HRVs in each Unit
Daylight Sensors/Lighting Controls:	Occupancy Sensors, Daylight Dimming
On-Site Renewables:	Solar PV (house load) & Solar Thermal Preheat

MITHŪN

Building Systems: Domestic Hot Water

Air Source Heat Pump

- Operate by moving heat from one place to another, rather than generating heat directly
- Think of a refrigerator operating in reverse
- Can be stand along or integrated with tanks
- 3 to 5 times more efficient than resistance
- Can retrofit an existing hot water system



MEP Equipment—

Systems	Model Number	System Photo
Electric Resistant Heat (MECH)	DAIKIN DPS004A	
Air Source Heat Pump (VRV) (MECH)	MITSUBISHI PURY P288TSLMU-A	 Utility Room
	PUZA30NHA7	 Community Room
Air Source Heat Pump (ASHP) (PLUMB)	COLMAC HPA15-PDAC PLC	 Water Heater
Energy Recovery Ventilator (ERV) (MECH)	RENEWAIRE HE4XINH	

MEP Equipment Cont.—

Systems	Model Number	System Photo
Ceiling Fan	BIG ASS FAN- ESSENCE	 8’
Electric Radiant Heat (MECH)	KING KCV1202	
Heat Recovery Ventilator (HRV) (MECH)	ZENDER 350-R	
Generator (ELEC)	MTU 6R0120 DS 180	

Menu of System Options—

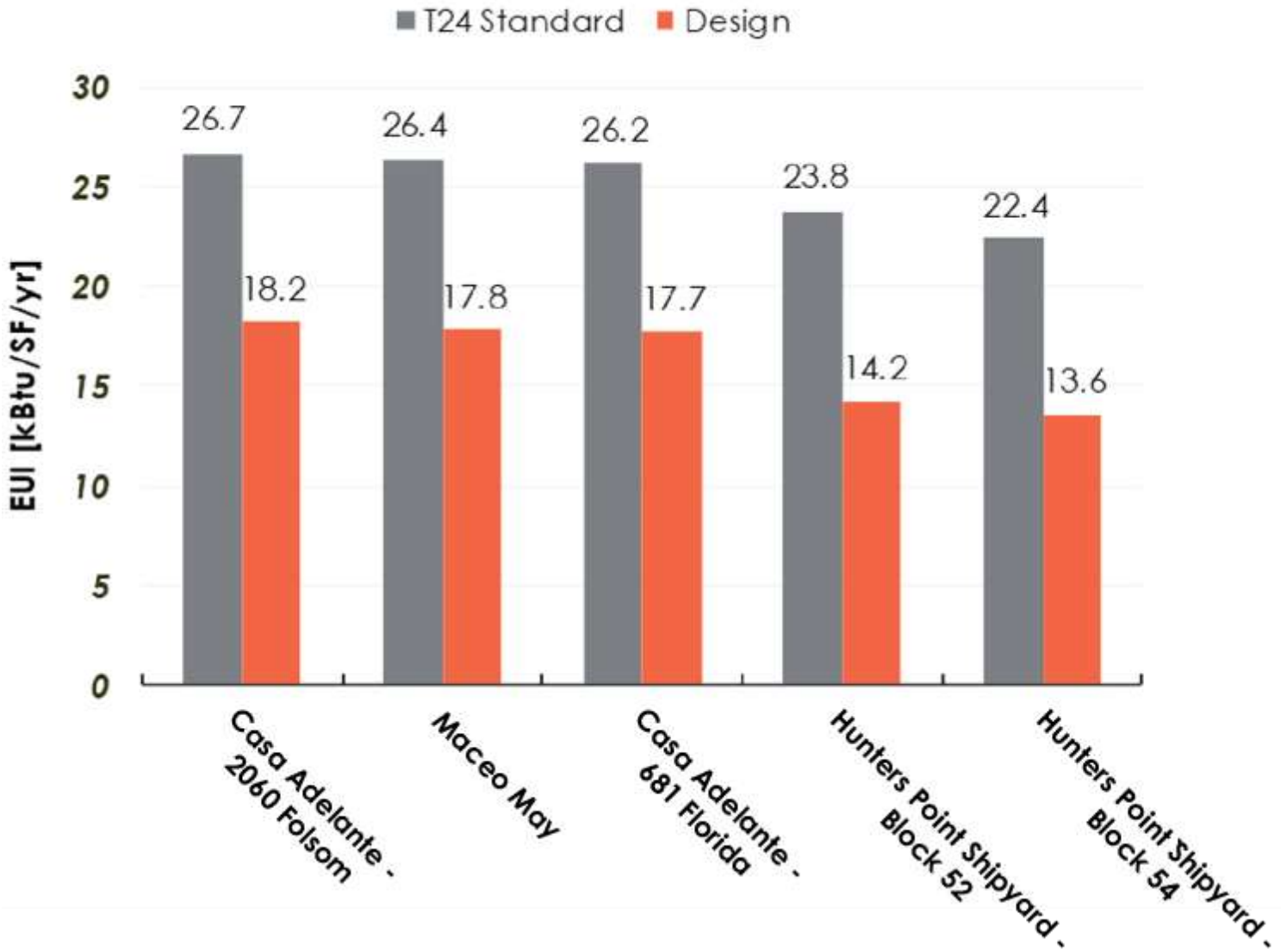
System Options	Folsom	Florida	Maceo May
Photovoltaic (PV)	●		●
Solar Thermal (ST)	●	●	
Air Source Heat Pump (ASHP) Domestic Hot Water	●	●	●
Variable Refrigerant Volume (VRV) Common Areas	●	●	●
Energy Recovery Ventilator (ERV)			●
Heat Recovery Ventilator (HRV)	●		
Electric Radiant Heat	●	●	●
Ceiling Fans (Units)		●	●
Ceiling Fans (Common areas)	●		●
Backup Generator	●		
Battery Backup			●
Z-Duct and Fan		●	

Anticipated Carbon and Energy Savings—

MITHŪN

Projected Energy Savings—

kBTU/sf/year reduction averaging 32%

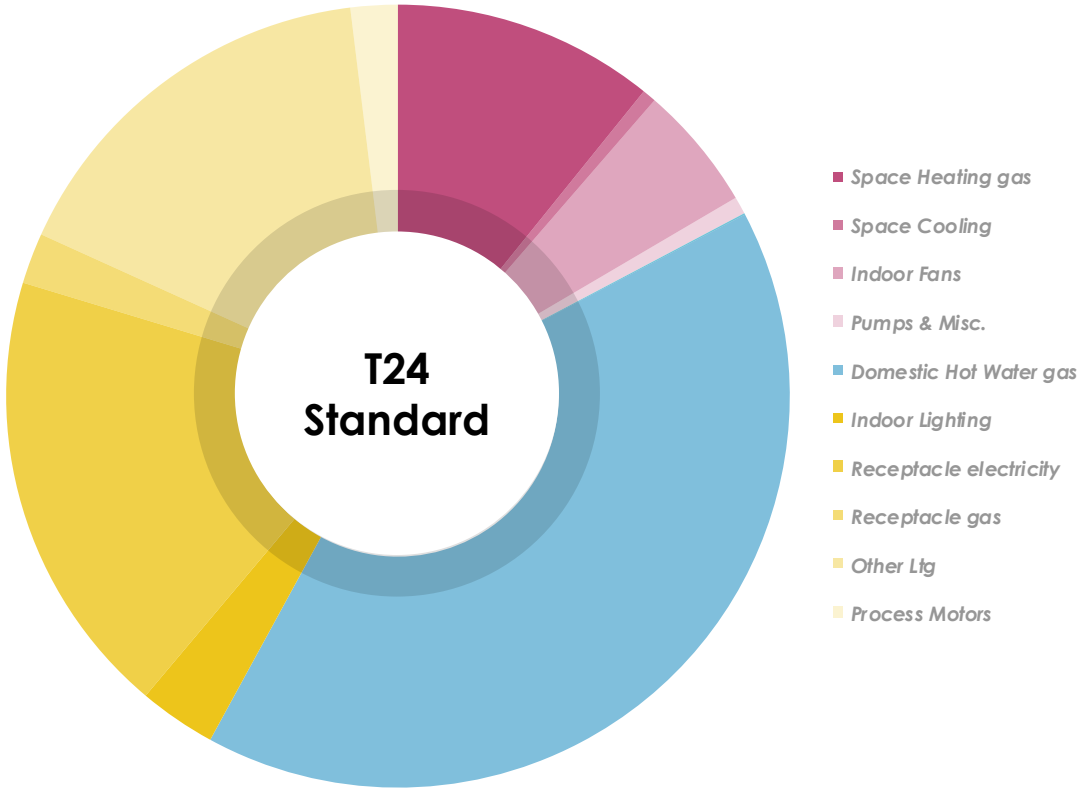


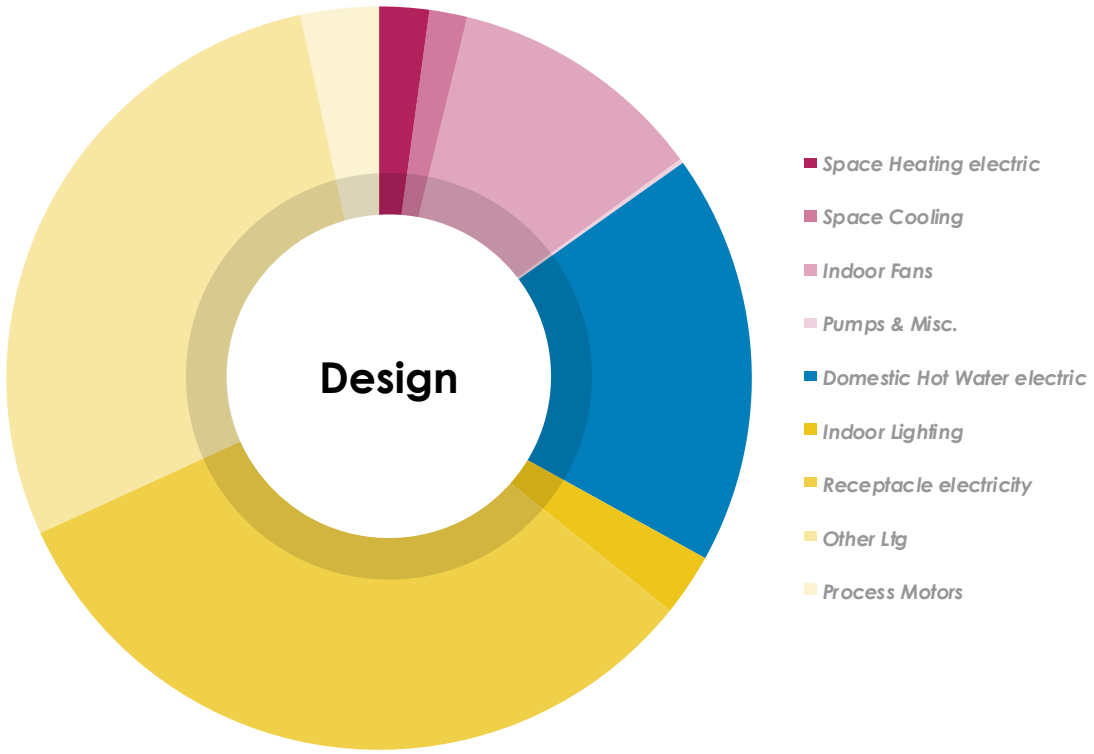
EUI = Energy Use Intensity

MITHŪN

Casa Adelante Housing—

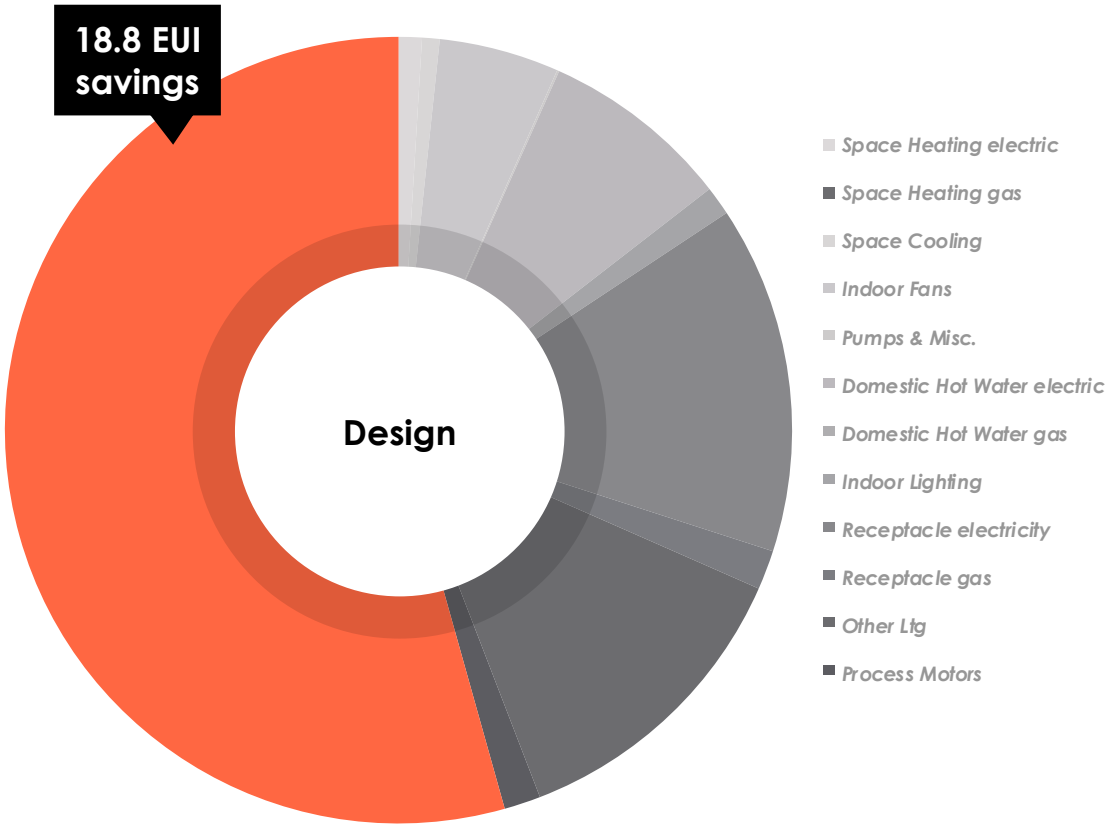
Energy Use Breakdown

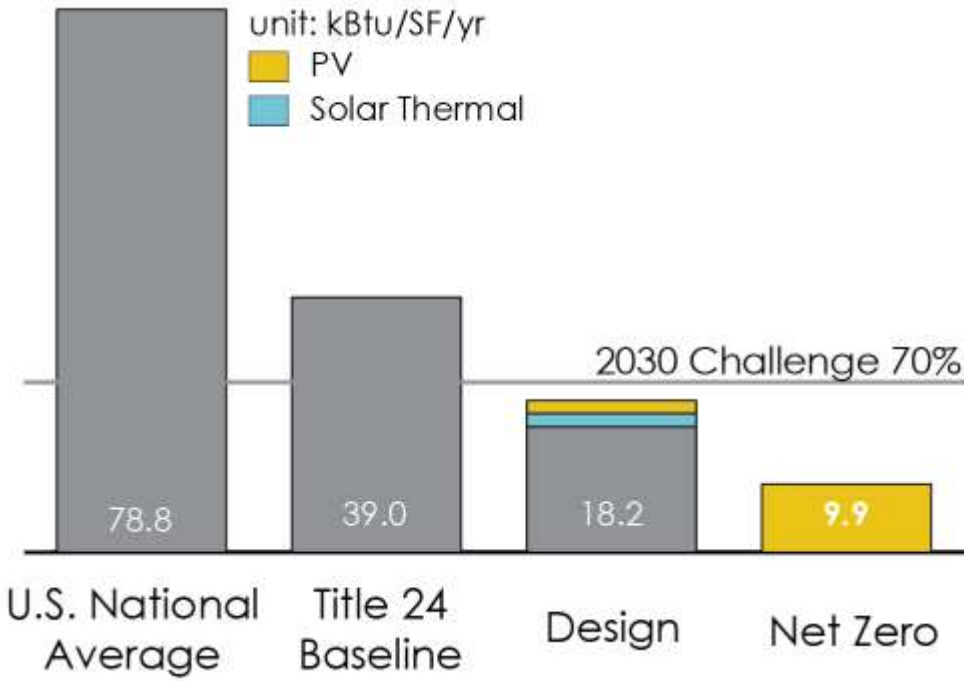




MITHŪN

EUI Comparison—

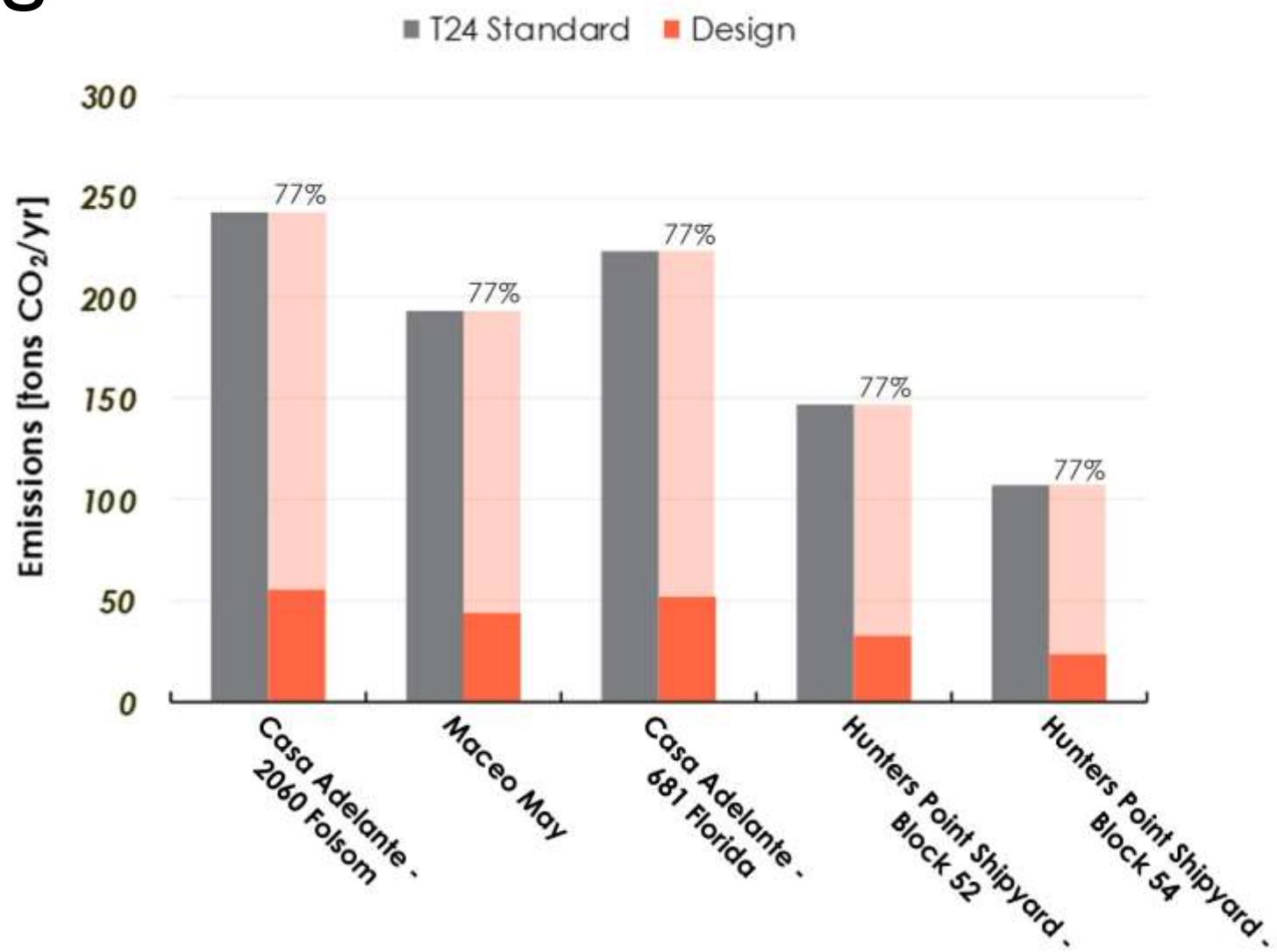




MITHŪN

Carbon Emissions

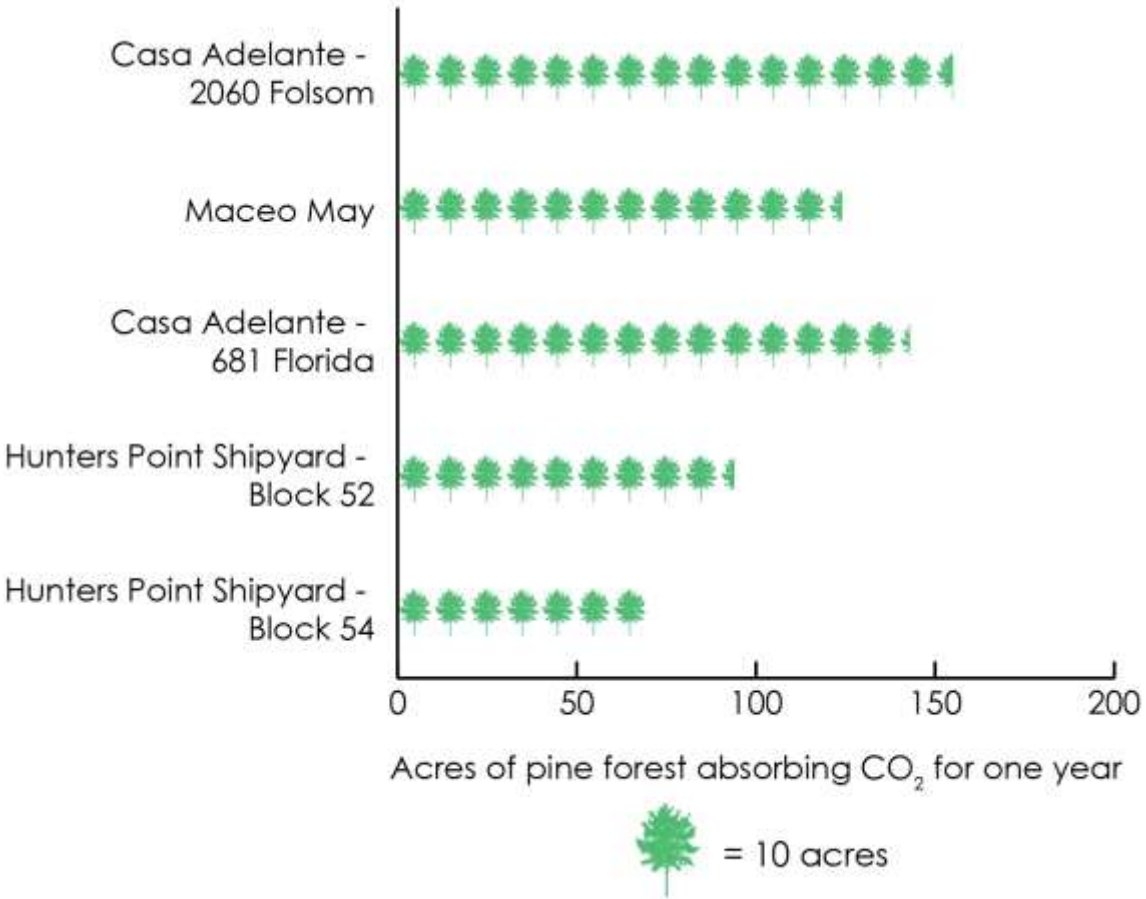
kBTU/sf/year reduction averaging 32%
Carbon tons/year reduction averaging 77% !!!

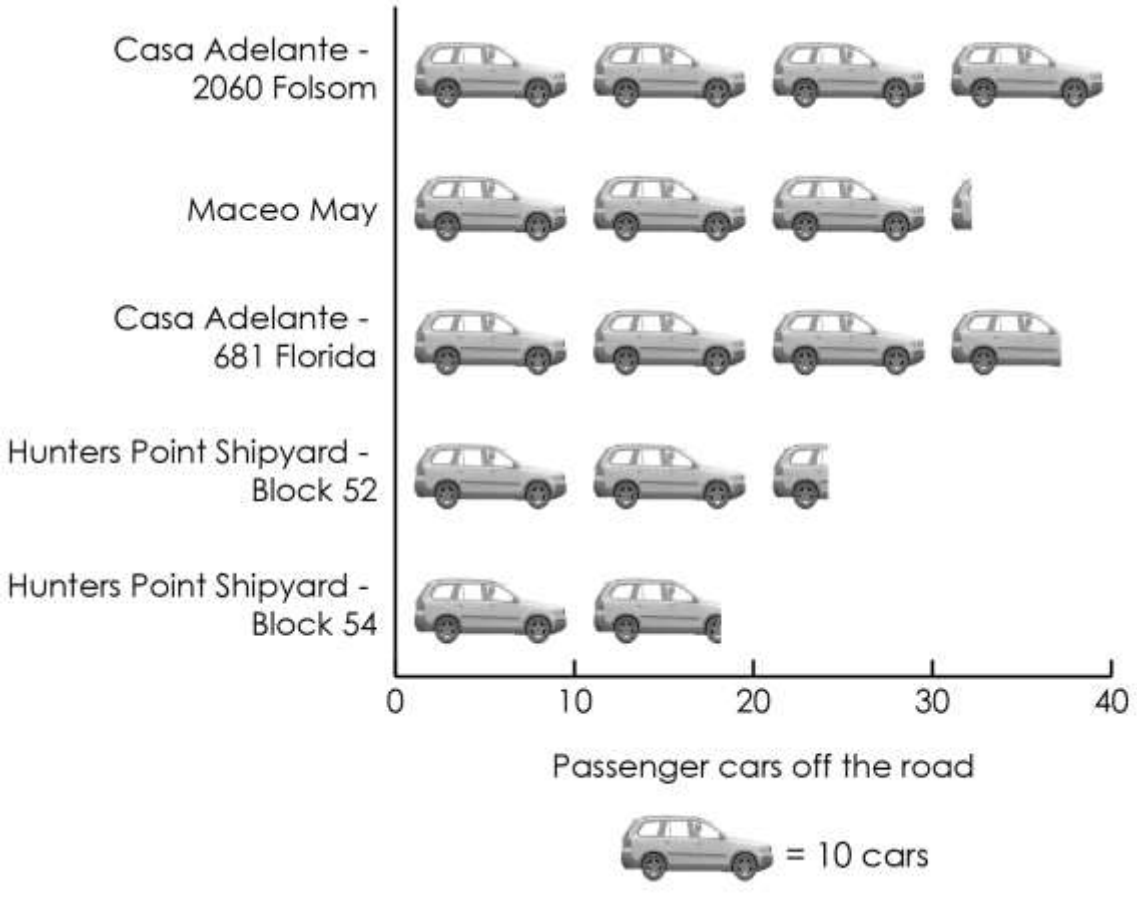


MITHŪN

Carbon Emissions Avoided—

via annual operational energy use between design and T24 standard

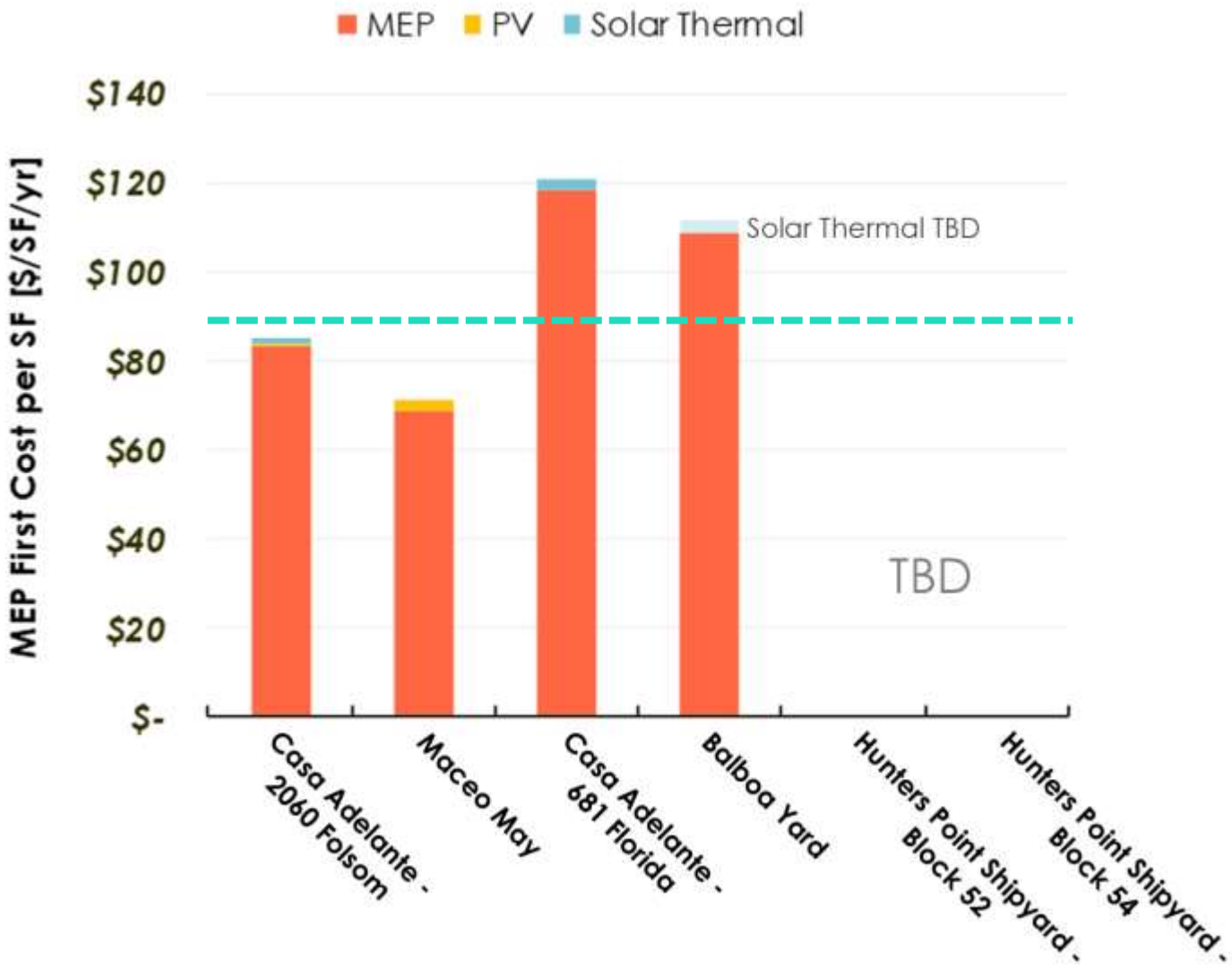




Cost Analysis—

MEP First Costs

Normalized by Gross Building Area



MITHŪN

Cost Analysis–

Co-Benefits Story:

Eliminating the solar hot water system saved $215,000 in first cost And was a simplification of systems and O&M costs over time.

$215,000 Savings Solar Thermal Allowed for addition of improved Ventilation, adding ERVs in every unit.

ERV cost premium over Z-ducts was
Appx ~$1,200/ unit
105 units = $133,000
= $82,000 savings

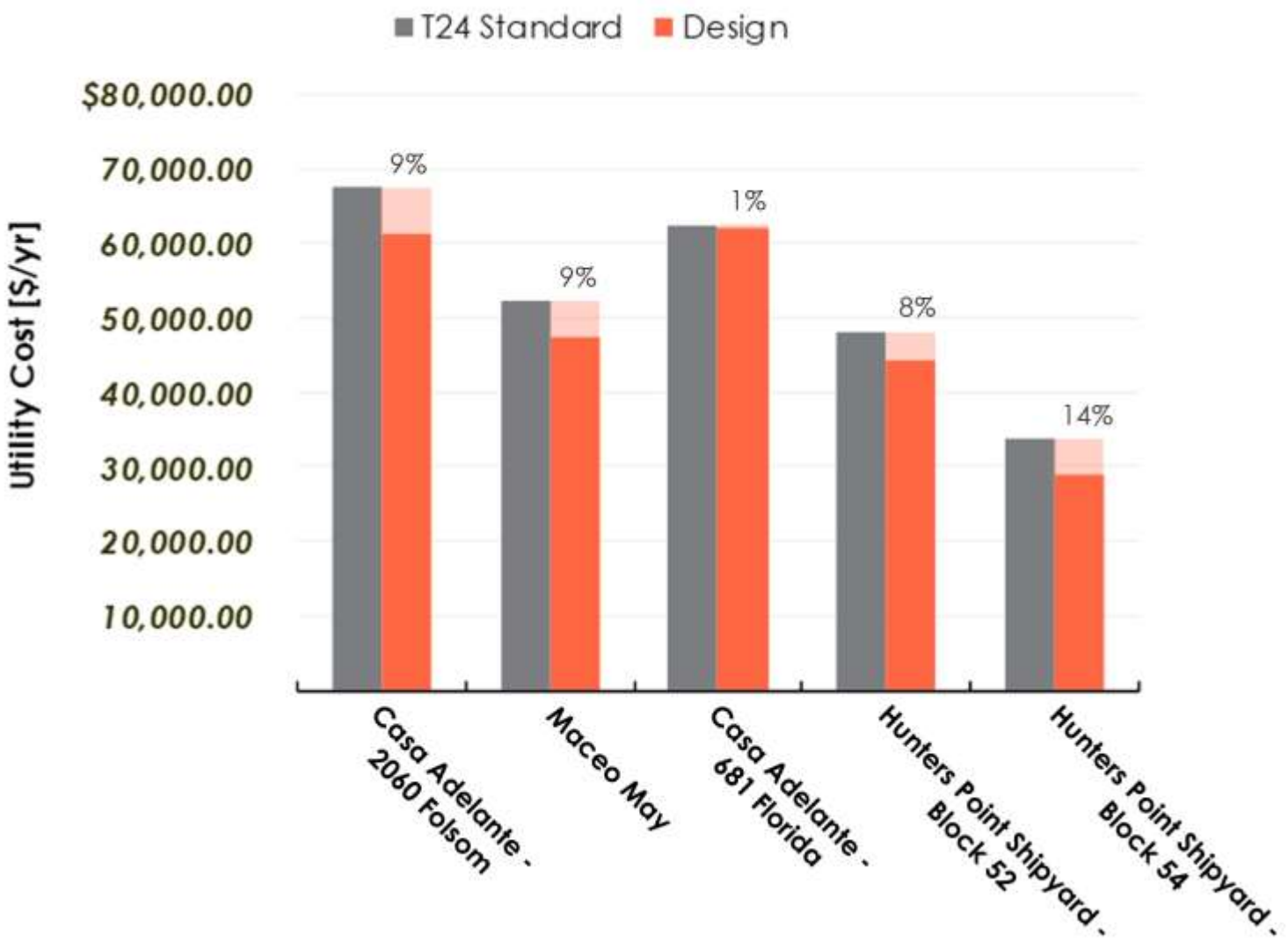
Maceo May Apts: Systems Cost Comparison

	All Electric		Natural Gas		Summaries		
DHW	Colmac HPHW	$ 106,820	Boiler RayPack	$ 30,580			
	Tanks	$ 29,131	Tanks	$ 14,900			
	Add Labor/HR	$ 14,104					
					Electric DWH	$ 150,055	
					Gas DHW	$ 45,480	$ 104,575
Solar HW	None	$ -	40% Fraction	$ 219,000			
ReCirc	same	$ -	same	$ -			
Bldg Gen.	NA	$ -	Gas Trench, backfill, pipe, stubout inside	$ 25,000			
	NA	$ -	flextend joints	$ 10,000			
	NA	$ -	Gas Meter Room	$ 28,550			
	NA	$ -	Gas piping to Boiler Room	$ 11,904			
	NA	$ -	Insulated copper pipe to Solar Thermal to Tanks	$ 25,000			
	NA	$ -	Gas to Laundry	$ 9,933			
	NA	$ -	Gas Ventilation	$ 8,000			
					GasBldg Costs	$ 168,387	
Utility Connection	Gas Connection	$ -	Gas Connection	$ 15,000			
TOTAL		**$ 150,055**		**$ 392,867**	**Total Diff:**	**$ 242,812**	
Solar PV	Array 123,000kW	$ 443,566	assume half	$ 221,250			
TOTAL w PV		$ 593,621		$ 654,117	Total Diff:	$ (160,754)	

MITHŪN

Annual Utility Cost Savings—

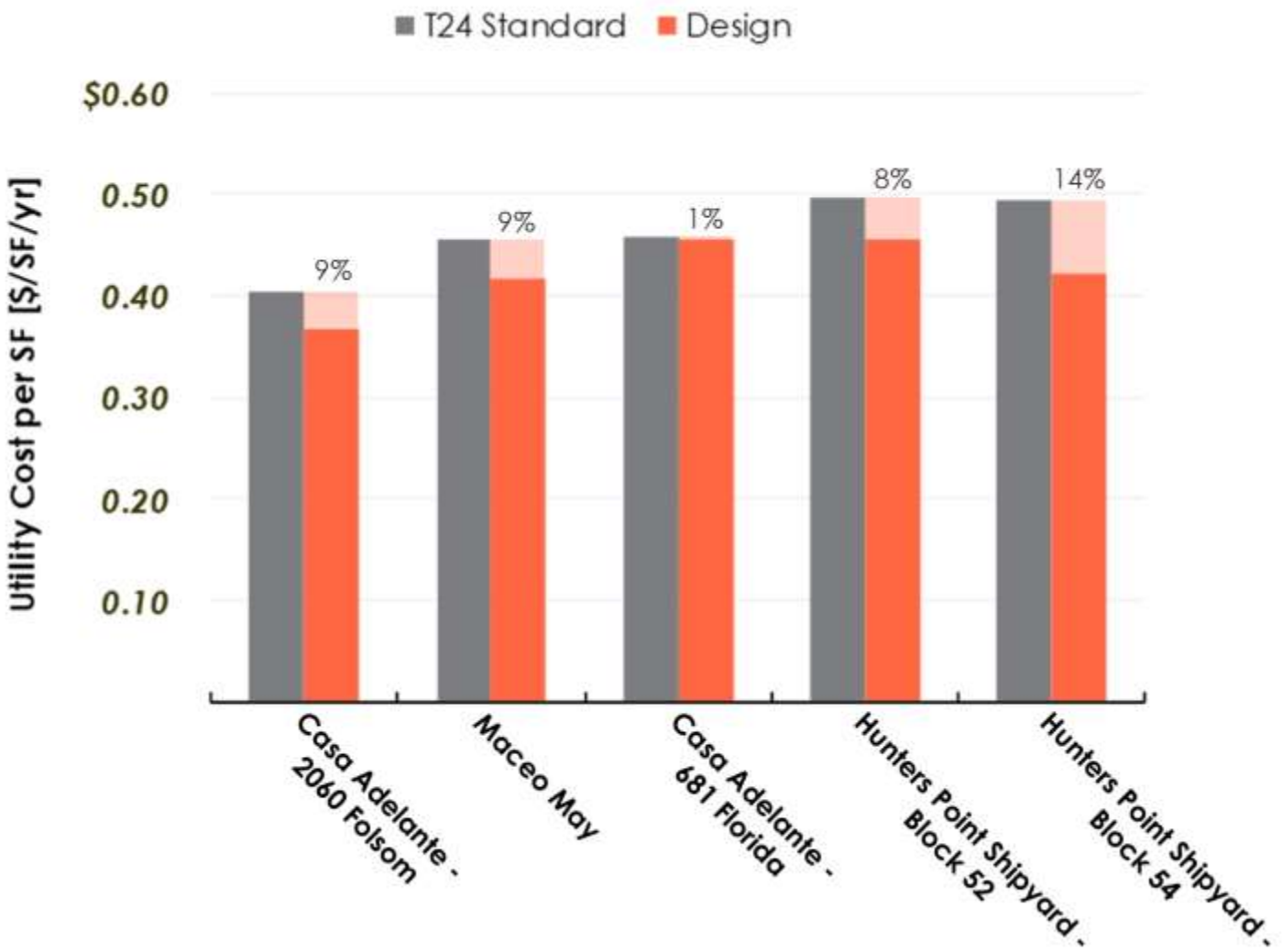
Total Annual Utility Cost (Projected)



MITHŪN

Annual Utility Cost Savings—

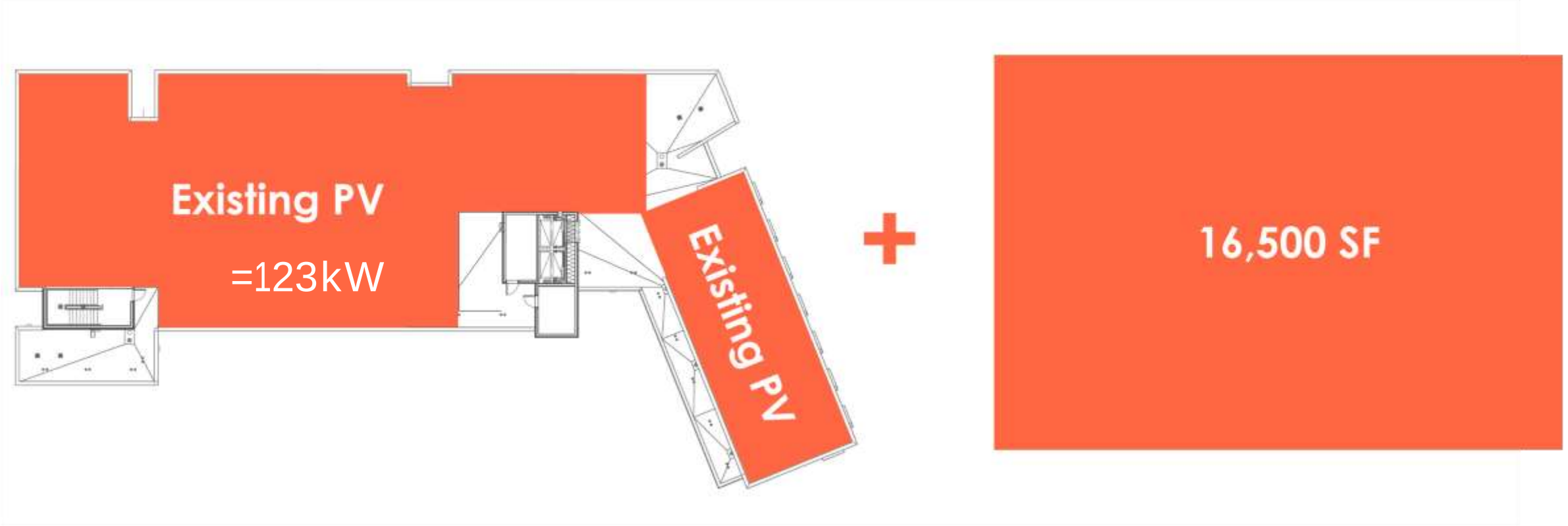
Normalized by Gross Building Area



MITHŪN

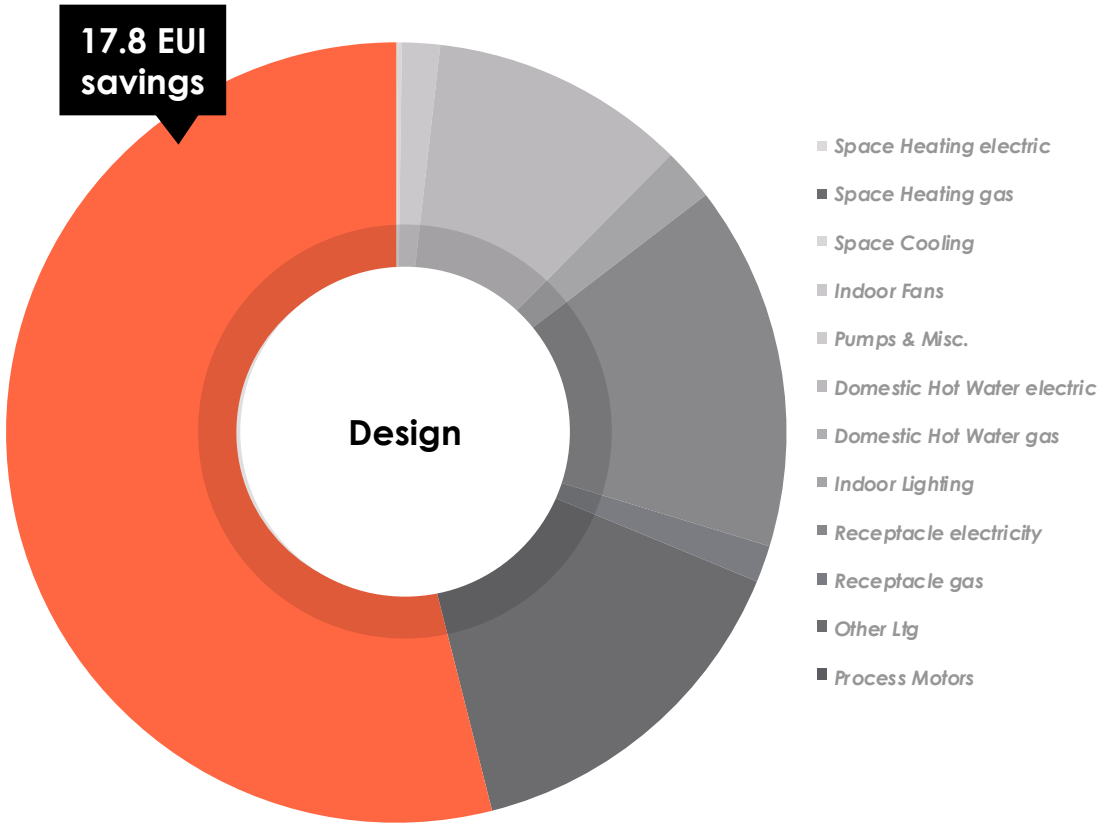
PV area required for NZE—

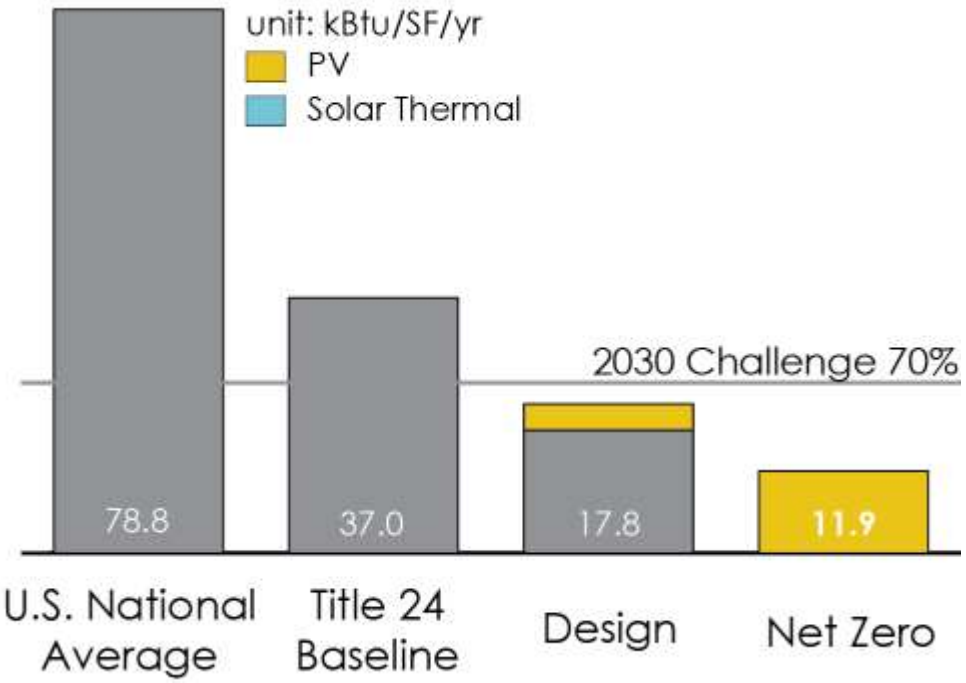
Approximate area required to achieve source NZE with design EUI of 17.8



MITHŪN

Net Zero House Loads—



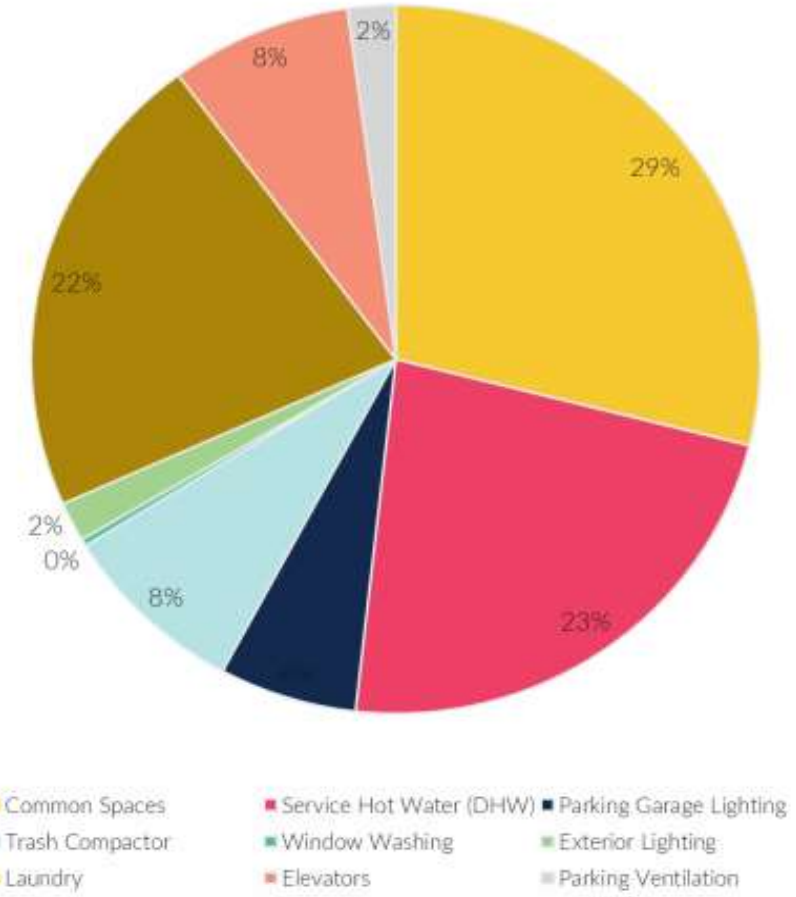


MITHŪN

Net Zero House Loads—

A benefit of the all-electric design is that the PV system can be directly linked to the biggest common area electric loads.

- HPS Bldg 54 has ~155,300kWh/year common area electricity consumption.
- If *premium* efficiency panels are installed on the maximum available roof area, the PV system should be able to offset 97% of the estimated electricity demand (~150,700 kWh/yr)
- If *standard* efficiency panels are installed on the maximum available roof area, the PV system should be able to offset 76% of the estimated electricity demand (~117,700 kWh/yr)



MITHŪN

Conclusions—

MITHŪN

- ZNE-ready Affordable Housing is not only possible, but is being designed and built
- Construction is Cost-Neutral at a minimum, with potential for Lower Utility Bills
- Co-Benefits are Plentiful (and potentially Beautiful)
- **It's really about Zero Net Carbon (not Energy)**

MITHŪN

Keys to Success—

What Not to Do:

Switch to all-electric late in design

Evaluate Systems in Isolation

Solicit Minimal Bids

What to Do:

Bring in Innovative Consultants

Select Innovative GC and Subs

Both Compliance & Performance Energy Models

Set Clear Goals and get Buy In from All

Evaluate On Site Renewables Options

Commissioning – do it

MITHŪN

Decision Making Drivers—

Cost: First and Operational

- Consensus is that it can be cost-neutral or cost-saving to go all-electric for this building type in CA market.
- Natural Gas $/therm is still heavily subsidized and cheaper than Electricity (depending on Tier Rate), but our study and others demonstrate that

ROI

- Master-metered vs tenant meters; sizing on site renewable (PV) appropriately to cover owner's house loads but not over-produce
- Solar PV as "Insurance" for Operating Budgets

MITHŪN

Decision Making Drivers—

Simplification of Building Systems

- During Construction: Reduced construction and connection coordination, saves time and money
- During Operations: One less bill to pay, PV tied to HPHW has no moving parts

Property Management and O&M

- Building Management sees benefit in elimination of the natural gas utility
- Need to build Familiarity with Training for new systems
- Can avoid proprietary maintenance contracts or sophisticated technical expertise

MITHŪN

Decision Making Drivers—

Resilience & Future-Proofing

- Mitigate impacts to building occupants and emergency workers during Seismic Disaster events
- Potentially Vulnerable during Rolling Grid Blackouts and Public Safety Power Shutoffs
- Avoid future costly retrofits to remove natural gas systems ($850,000+/- for this building type)
- “Net Zero Ready” and “Fossil-Fuel–Free Ready” building
- Ability to expand Battery Systems for TOU and future smart grid technology

MITHŪN

Next Steps + Studies—

CEC Title 24	Ability to accurately model HPWH Adding an All-Electric Baseline
On-Site Renewables:	Solar Thermal vs PV with heat pump technology
Benchmarking:	ROI and Operational Energy will be key to track in coming years– both aggregated resident meters and common area house loads from building owners
Density and Land Use:	Building Decarbonization needs to expand scope to include land use patterns, density, transit implications
Battery Storage & EV Charging:	Optimizing Battery Storage for various uses: TOU, Peak Shaving, Resiliency / Off-Grid Islanding
	Critical discussion about EV Charging requirements, future EV infrastructure capacity

MITHŪN

mithun.com

Hilary Noll AIA, LEED AP BD+C
Senior Associate + Sustainability Integration Leader
415-489-4860 hilaryn@mithun.com