

REALIZE

Demand & Energy Stakeholder Workshop Summary

May 4 - 5th, 2017 | PG&E Pacific Energy Center

San Francisco, CA



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Introduction



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Acronym Key

ADA – Americans with Disabilities Act	MASH - Multifamily Affordable Solar Housing
AH – Affordable Housing	MOU – Memorandum of Understanding
ASHP – Air Source Heat Pump	NEM – Net Energy Metering
BMP – Best Management Practice	O&M – Operations & Maintenance
CA – California	OBF – On Bill Financing
CEC – California Energy Commission	OSHA – Occupational Safety & Health Administration
CHPC – California Housing Partnership Corporation	PACE – Property Assessed Clean Energy Financing
CPUC – California Public Utilities Commission	PG&E – Pacific Gas & Electric
CUAC – California Utilities Allowance Calculator	POU – Publicly Owned Utility
DHW – Domestic Hot Water	PPA – Power Purchase Agreement
EE – Energy Efficiency	PTHP – Package Terminal Heat Pump
ERV – Energy Recovery Ventilation	PV – Solar Photovoltaic
ESCO – Energy Services Company	RAD – Rental Assistance Demonstration (HUD program)
EUI – Energy Use Intensity	R&D – Research & Development
GC – General Contractor	SF – San Francisco
HUD – US Department of Housing and Urban Development	SHPO – State Historic Preservation Office
HVAC – Heating, Ventilation, and Air Conditioning	TC – Tax Credit
IOU – Investor Owned Utility	TCAC – California Tax Credit Allocation Committee
LA – Los Angeles	UA – Utility Allowance
LABBC – Los Angeles Better Buildings Challenge	US – United States
LIHTC – Low Income Housing Tax Credit	VA – Virginia
LIWP – Low Income Weatherization Program	ZNEc – Zero Net Energy/Carbon
MSA – Metropolitan Statistical Area	

REALIZE Concept Narrative

Context

Desirability, convenience, and cost are the three greatest barriers to adoption of deep energy retrofits. A root cause is that suppliers (the architecture, engineering and construction industry) and demand are disaggregated. As a result, no one is yet able to sell energy efficiency at scale due to the fact that every upgrade is a custom project. This results in greater time, complexity and cost. In the Netherlands, Energiesprong is a program designed to overcome these barriers, and make net zero carbon housing available as a *product* where sales, manufacture, delivery, and performance assurance can be optimized. Energiesprong has retrofitted social housing units, at scale, to net zero with no upfront capital cost to tenants. Energiesprong retrofits are now being completed in fewer than 10 days per unit, without displacing residents, and industrial processes have reduced costs 60% in the past three years, while improving the product from a 50% energy reduction to net zero.

Project Intent

While the approach is performing well in Europe, it has yet to be tried in the U.S. In coordination with Energiesprong, and building off their experience, **REALIZE** seeks to adapt this approach to the U.S. market, starting in California and New York. With over 137 million existing homes, the U.S. is a significant market opportunity. The convening in San Francisco sought to socialize the concept and results of Energiesprong with regional affordable housing owners, to gauge their appetite for such a solution, and to leverage local energy stakeholders to assess key considerations to bring the model to California, starting with the San Francisco Bay Area.

Executive Summary

Takeaways

- The Energiesprong example generated considerable excitement, and there was broad interest in a similar market-based solution. However, heterogeneity of San Francisco building stock led to skepticism about the feasibility of standardization.
- Building owners were keen on the concept, but expressed concern about historic building stock and the complexity of financing. Inconsistent energy performance metrics and existing complexities around diverse sources of capital were identified as significant challenges for the broader California market.
- Allowing for the use of the California Utility Allowance Calculator for the 4% LIHTC was deemed critical for the concept to work for the affordable housing market.
- Most building owners and energy stakeholders expressed a need for stronger project economics and greater certainty of financial benefits, even with the strong project economics presented during the technical analysis results. This could be achieved by a combination of cost-reductions and mitigation of perceived financial risk to owners or tenants. Risk could be reduced by greater subsidies and/or performance guarantees.
- The concept of a service based performance guarantee (e.g. guaranteed temperature range, number of gallons of hot water, budget of plug loads) was very well received by participants.. Service structures that engaged tenants were considered critical for realizing energy savings.
- *Several building owners stated interest in participating in a **REALIZE** ZNEc offering, and several stakeholders committed to support reform of local and state programs in order to enable this model.*

Next Steps

- The **REALIZE** team will complete its go-to-market strategy recommendations for the San Francisco / California market later this summer.
- The San Francisco Department of Environment and **REALIZE** team will reconvene to determine a strategic path forward, developing capacity for a market facilitator with the agenda to:
 - Formalize commitments amongst building owners, government and utility programs, and contractors and suppliers to set consistent performance criteria, help stakeholders to re-allocate key risks, obtain firm commitment of volume of stock for renovation to ZNEc at an affordable price, and facilitate cost-reduction through product improvement.
 - Reform regulations and programs to enable the concept in San Francisco as well as the broader California market, delivering better housing, innovation in the buildings sector, and net zero carbon housing at scale.

Key Takeaway – Cost Baseline and Innovation Goals

Results from the technical analysis show the current net zero retrofit cost as well as cost reductions required to achieve desirable cost targets.

	6 Unit Prototype	15 Unit Prototype	65 Unit Prototype
Baseline NZEc Retrofit Project Cost (\$/Unit)	\$19,013	\$22,255	\$22,296
Baseline NZEc Cost With Current Incentives (\$/Unit)	\$7,527	\$8,985	\$11,329
NZEc Retrofit Initial Target: Cost Equal to 25 Year Present Value* Utility Bill Savings (\$/Unit)	\$17,997	\$22,053	\$12,189
Initial Targeted Cost Reduction (Without Incentives/With Incentives)	5.34% / 0%	0.9% / 0%	45.3% / 0%
NZEc Retrofit Ideal Target for High Volume: Cost Equal to 10 Year Simple Payback (\$/Unit)	\$9,045	\$11,371	\$5,867
Ideal Cost Reduction (Without Incentives/With Incentives)	52.4% / 0%	48.9% / 0%	73.7% / 48.2%

**The energy savings PV was calculated using a 5% discount rate and an escalation rate of 2.28-2.48%, which is a blended average rate based on last 10 years of gas and electric escalation in California from the EIA. 25 years selected as life of retrofit package. The water and sewage savings were calculated assuming 5% discount rate and 5% escalation rate.*

Workshop Foundations



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REALIZE Goals for California

What: Delivering net zero carbon retrofits at scale across the California market, with the intent to drive carbon neutrality in the residential market, contributing to California Zero Net Energy Goals.

How: Engaging and coordinating the California building and policy ecosystem to develop a NZEc retrofit process that is widely successful in the market.

Objectives – Day 1

Understand Demand: Deepen understanding of the demand for ZNEc in the California affordable multifamily market, and the criteria this market is seeking in the San Francisco MSA.

Socialize a Key Example: Demonstrate that ZNEc is possible in typical San Francisco multifamily buildings with current technology, and that ZNEc is being delivered at scale in Holland via the Energiesprong program.

Building Owner Needs: Determine what building owners need for such an offering to provide them value.

Create a Shared Vision: Collaboratively develop a vision and path forward for this concept in California.

Identify Pilots: Identify portfolio/building owners who would like to partner on pilot projects and the future roll out of such an offering.

Agenda – Day 1

9:00 AM – Kick Off

10:00 AM – Module 1: Inspiration

11:00 AM – Break

11:15 AM – Module 2: Business Case and Feasibility

12:30 PM – Lunch

1:15 PM – Module 3: Challenges and Pain Points

2:15 PM – Module 4: Opportunities

3:30 PM – Break

3:45 PM – Next Steps

4:30 PM – Check Out

5:30 PM – End

Attendees – Day 1

Name	Organization
Shilpa Sankaran	Net Zero Energy Coalition
Sudeshna Pabi	Electric Power Research Institute
Peter Turnbull	Pacific Gas & Electric
Tom-Pierre Frappé-Sénéclauze	Pembina Institute
Jessie Denver	San Francisco Environment
Peter Villareal	MidPen Housing
Norm Koplin	Community Housing Improvement Systems and Planning Association, Inc.
Keith Cooley	San Francisco Community Land Trust
Tabitha Harrison	Tenderloin Neighborhood Development Corporation
Nehemiah Stone	Stone Energy Associates
Ellen Morris	Eden Housing
Stephanie Berkland	TRC Energy Services
Jim Coyle	Equity Community Builders
Ben Cooper	San Francisco Environment
Mara Blitzer	San Francisco Mayor's Office Of Housing and Community Development
Rafael Reyes	Prospect Silicon Valley
Ray Smith	Episcopal Community Services
Ann Edminster	Net Zero Energy Coalition
Jeff Finsand	Dahlin Group
Barry Hooper	San Francisco Environment

Attendees – Day 1 (cont.)

Name	Organization
Katrin Klingenberg	Passive House Institute US
Rich Chien	San Francisco Environment
Conrad Asper	Pacific Gas & Electric
Michael Strong	Pankow Builders
Genise Choy	Chinatown Community Development Center
Ron Van Erck	Energiesprong
Vanessa Guerra	Mutual Housing
Randall Higa	Southern California Edison
Stephanie Chang	California Public Housing Corporation
Jeff Summerville	MidPen Housing
Toby Lieberman	Northern California Community Loan Fund
Johanna Partin	Carbon Neutral Cities Alliance
Marty Keller	First Community Housing
Amy Dryden	Build it Green
Sean Armstrong	Redwood Energy
Jennifer Childs	Rocky Mountain Institute
Billi Romain	City of Berkeley
Martha Campbell	Rocky Mountain Institute
Alisa Petersen	Rocky Mountain Institute
Christopher Meyer	California Energy Commission

Objectives – Day 2

Develop a Pool of Common Knowledge: Identify the conditions that support this model and which don't—gain information from those already in this space.

Build a Community: Build an implementation network for **REALIZE** in the local market.

Create a Shared Vision: Collaboratively develop a vision and path forward for this concept in California.

Agenda – Day 2

9:00 AM – Kick Off

10:00 AM – Module 1: Inspiration

11:00 AM – Break

11:15 AM – Module 2: Business Case and Feasibility

12:15 PM – Lunch

1:15 PM – Module 3: Challenges and Pain Points

2:15 PM – Module 4: Market Coordination

3:30 PM – Break

4:15 PM – Next Steps

4:30 PM – Check Out

5:00 PM – Close

Attendees – Day 2

Name	Organization
Mindy Craig	Blue Point Planning
Katy Hollbacher	Beyond Energy
Tom-Pierre Frappé-Sénéclauze	Pembina
Nancy Malone	Siegel & Strain Architects
Ron Van Erck	Energiesprong
Conrad Asper	PG&E
Bronwyn Barry	Passive House California
Mike Maroney	TRC Energy Services
Peter Turnbull	Pacific Gas & Electric
Dan Johnson	Beyond Efficiency
Jennifer Childs	Rocky Mountain Institute
William Vincent	Southern California Edison
Sean Armstrong	Redwood Energy
Amy Dryden	Build it Green
Martha Campbell	Rocky Mountain Institute
Alisa Petersen	Rocky Mountain Institute
Gregory Sherman	Bright Power
Bill Daikin	Davis Energy Group
Christopher Meyer	California Energy Commission

Attendees – Day 2 (cont.)

Name	Organization
Nolan Browne	ADL Ventures
Heather Larson	Stop Waste
Ann Edminster	Net Zero Energy Coalition
Andy Brooks	Association for Energy Affordability
James Bill	ZIA Architecture
Tabitha Harrison	Tenderloin Neighborhood Development Corporation
Pierre Delforge	Natural Resources Defense Council
Can Anbarlilar	Pacific Gas & Electric
Charles Eley	Eley Inc.
Shilpa Sankaran	Net Zero Energy Coalition
Barry Hooper	San Francisco Environment

Downloading Sessions



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California Energy Commission Presentation Highlights

Takeaways

California's ZNE goals were set eight years ago; it's time to carefully consider if the intent (GHG reduction, equity, and economic health) matches the goals.

NEM and site ZNE assume the grid is a battery. This is fine when renewables are a small contributor to the electric supply, but breaks down when total renewable generation exceeds total consumption. California has this challenge on three time scales:

- Hourly - PV output is greatest in afternoon, and demand peaks around and after sunset.
- Seasonal - On cool sunny spring and fall days, renewable energy output is high but demand for electricity is low. During the afternoon in these seasons, the cost of electricity is "negative" and renewable energy is curtailed (wasted).
- Annual - In an all-electric home with enough PV for ZNEc, the home is a net exporter to the grid in summer, and a net consumer in winter.

Each of the above challenge the physical and financial health of the grid. It would not be cost-effective for society to invest in more renewables if a significant portion of the existing renewable resource is curtailed/wasted.

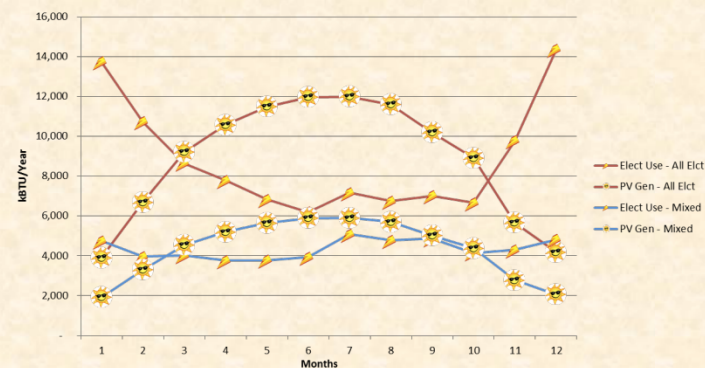
- Minimizing exports to the grid might require infrastructure upgrades.
- Energy efficiency measures that are included in building codes are analyzed to ensure they're cost effective within the life of the equipment.
- From the utility perspective, projects are best when they reduce their load and then right size their PV system. Oversizing the PV system to offset natural gas is not in the utilities best interest.
- Highest carbon levels are at night when consumers are most reliant on grid energy.

All-Electric - Summer Duck vs Christmas Turkey



All-Electric homes use more kWhs in the winter than summer that may result in higher peak and demand in winter – Grid harmonization becomes more important – Like a broken clock, a dumb PV systems is correct twice a YEAR

2,700 sf Mixed Fuel vs All-Elect, CZ12, Source Energy, 3.1 & 6.3
kW PV Sized to Displace Annual kWh



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Energiesprong Presentation Highlights

History

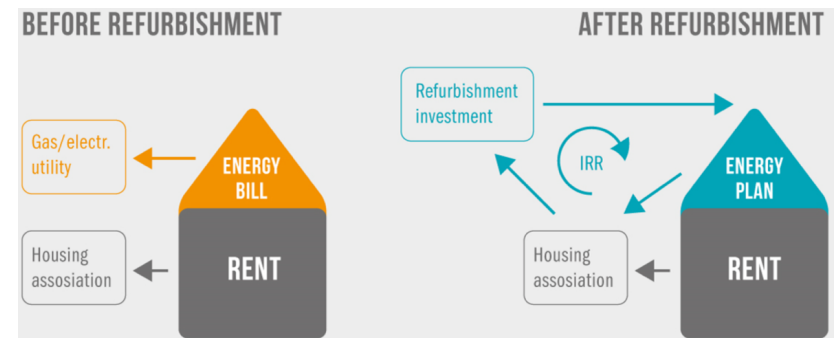
- The Dutch government was unsatisfied with efficiency programs and wanted to jump start a transformation. Result: €40M investment to create the Energiesprong program. Note: Replication in new markets costs less.

Philosophy

- ZNEc is a “product” that is desirable for building owners, rather than a collection of isolated projects. A 3rd party facilitator can organize the supply chain and realign risks - bringing costs down.
- Four attributes must be met for wide market adoption: high quality, non-intrusive installation, affordable, and aesthetically pleasing.
- For mass adoption, project cost must be reduced to the amount of capital that can be repaid by cash flow from energy savings.
- Commit to a specific, measurable guarantee: energy produced onsite is sufficient to maintain thermal comfort, provide hot water, and serve a plug load budget (consumption beyond this level is paid for by the tenant).

Accomplishments

- A “mega” contract was established between six of the largest affordable housing associations in the Netherlands, the government, and contractors, resulting in the commitment of 11K units for improvements, to be offered along a declining cost curve by contractors, contingent upon governmental regulatory reforms.
- To date, roughly 2K units have been retrofit, including both low and high rise multifamily units.
- The first project was roughly €130K per unit, with a 60% price reduction over three years. The goal is for a complete rehab budget of roughly €40K per unit.



RMI Market Feasibility Presentation Highlights

Key Questions

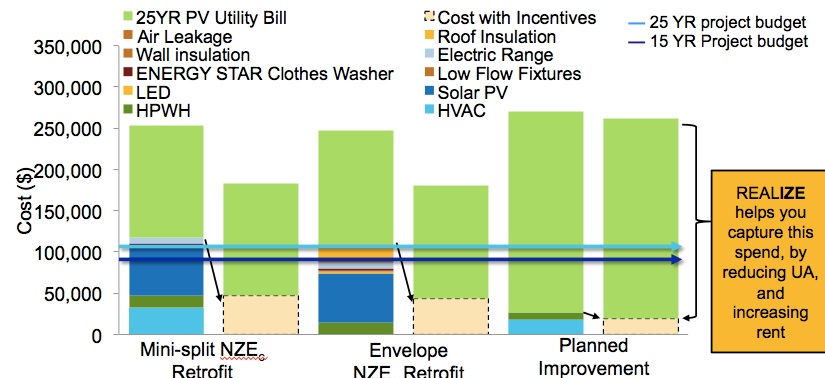
- What are three relatively standard building typologies in San Francisco?
- Can we get to net zero carbon cost effectively for these prototypical buildings today?
- Are building owners able to capture these savings and if so by how much can it increase their project budgets?

Findings

- Low-rise row style housing in San Francisco enables relatively retrofit-light improvements to meet zero.
- For small multifamily, net zero carbon retrofits are roughly debt neutral today, even without incentives. With incentives they are well in the money.
- Five-story-plus retrofits require maximizing efficiency measures to meet zero carbon, as roof area is not adequate to offset loads.
- Five-story-plus retrofits, therefore, require substantial incentives to be roughly debt neutral.
- Water and sewer savings are critical for enhancing the economics for larger scale projects.

6 Unit Prototype: NZE Retrofit vs. Baseline

With incentives, the NZE retrofits is well below the increased debt capacity



Note: The net zero retrofit cost does not include expected cost reduction from REALIZE ECM integration and scale.

* The 25 YR PV was calculated using a 5% discount rate and an escalation rate of 2.35%, which is a blended average rate based on last 10 years of gas and electric escalation in California from the EIA. The water escalation rate is assume to be 5%, well below historical rates.

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Day 1 Discussions



Poke Holes in the Business Case

Assumption	Reactions
Gives edge in competing for LIHTC	• Viability in larger buildings and challenges with financing environment • Need large scale to make tax credits work
Savings can be captured by modifying the UA allowance	• It is a common practice to already have low UAs to increase rents in SF and LA; there's not enough juice to squeeze in the current UA level • How do we shift policy goals from dollars in tenant pockets to better housing? • Tenant education to “realize” real world ZNEc • Synching state agency policies necessary • Rebound effect: Can housing associations still recoup if energy savings not realized? • Impact on gross rent/net rent breakdown
Creditors will underwrite energy savings captured as rents	• Syndicate partner objections (really only one opportunity for change every 10 years) • Can additional debt really be taken on?
O&M can be reduced by REALIZE	• Water savings and O&M savings may not be realizable, especially with small unsophisticated staff who may not change behaviors in building management even after retrofit • Are water and sewer savings realistic?
The market needs better coordination	• Not cost effective to do for a wide variety of properties across geographic locations, so fragmented

Poke Holes in the Business Case (cont.)

Assumption	Reactions
Costs are realistic	• Pre-ZNEc capital improvement costs and needs too low (baseline, e.g. seismic) • Why haven't other programs succeeded? PACE? LABBC? Others?
Variety of building stock is overcomeable	• Historic building challenge, building prep, relocation, etc. • Diversity of housing types, owners, needs and solutions required • Roofs? Typology right? Height to wall ratio? Penetrations? • With 100% electric even more PV needed
Tenants will buy-in	• Can't increase rents without something "shiny" to go with it
Risk can be reduced	• Identified challenges are not adequately mitigated by identified opportunities • Contractor desire – GCs of scale don't work with wood retrofits; this is a litigious state, possibly need a risk reserve for guarantee; union issues
Utility context is overcomeable	• Rate assumptions, net energy metering, time of use, behavior need to be better modeled • Too building centric; need to look at utility system

Challenges Pain Points: Demand

Low Risk Tolerance	Financing Constraints	Market Knowledge	Triggers	Building Stock
Affordable Housing Has Low Risk Tolerance	Timing - Alignment of financing timing, regulation, rules for funding - Utility program cycle alignment	Language/Perspective Too many languages/values on project team (e.g. energy consultant, asset manager)	Land Mines/Code Triggers - Unknown existing conditions - Protect and accommodate tenants	Low Volume Small % of large portfolios eligible
Trust in Accuracy of Models - Behavior - Technology - Financing	Cost - High soft costs - Rehab capital costs - Relocation costs - Efficiency is only valued at 50% of its cost by most banks	Public Policy Alignment - Recalibrate societal mindset - Quality of life goals/ connection to quality of building stock not well enough understood	Codes/Permits - Too many regulations - Historically diverse, with diverse requirements - Scope creep - Official's education ⇒ Change orders	Diversity Variation in the building stock does not support a single solution
The Cost vs. Reward Balance - Confidence in savings: energy, water/sewer, O&M - Already low utility bills: cost recovery?, defaults? ⇒ Financing model?, loan effects?	Compatibility of Multiple Funding Sources UA not accessible to 4% LIHTC retrofits - Effects on other programs (e.g. LIWP) ⇒ Many state agencies would need to buy in and align	Technical Knowledge Project teams lack necessary knowledge to define, implement and manage towards goals ⇒ Snowflake projects with low implementation scalability	Public Policy Alignment - City and state triggers - Incentives vs. mandates	
Tenant - Logistics, coordination - Mindset/selling the good stuff - Education to ensure persistent savings	SF Lacks Financing - SF PUC gives limited incentives and no OBF - MASH resources depleted	Maintenance Training long-term staff to ensure long-term maintenance savings a must		
Technology Risk Are the technical solutions trustable?	Lender Tolerance Layering of additional financing onto existing loans in AH a no-go	Convenience Status quo easier than new approach		

Opportunities: Financing Constraints

Solutions that Exist Today

Solution: Unencumbered properties are high opportunity sites

Conditions: No LIHTC just borrow and use incentives

People: Owners, project team, lenders, program administrators

Solutions that Need to Be Tweaked

Solution: Change TCAC rules to allow CUAC to apply to rehabs, increasing project resources

Conditions: CUAC allowed for rehabs

People: TCAC, more stakeholders

Solution: LIWP

Conditions: Extend eligible geographies

People: Legislature

Solution: CPUC to allow IOU rebates to be available for retrofits from existing rather than code baseline

Solutions to Create

Solution: Reduce architecture and engineering soft costs and tenant disruptions

Conditions: Pilot programs that lower transaction costs

People: Us!

Solution: New funding source

Opportunities: Triggers

Solutions that Exist Today

Solution: Replace with like type

- Don't disturb
- Mitigate only disturbance

Conditions: List of varied technologies

People: Equipment specialists/manufacturers

- Mini ducts
- Ductless
- DHW

Solutions that Need to Be Tweaked

Solution: Clarify triggers and reactions by City to retrofits

Conditions:

- Group meeting for ZNE retrofits
- Develop guidebook of BMPs for: asbestos, historic, structural, fire, ADA

People: Unions, Fire, Mayor's Office, CA OSHA, Dept. of Toxic Substances Control, ADA

Solution: Historic retrofits

Conditions: Identify historic rules and exemptions

People: Planning office, SHPO, State Architecture and Building Officials

Solutions to Create

Solution: Education of building officials and planners

Conditions: CEC, IOU, & CPUC collaboration

People: California Building Officials for mass messaging

Solution: IOU incentives for NZE retrofits

Conditions: Baseline becomes existing equipment not code

People: CPUC

Solution:

- Low boy ASHP DHW
- High performance PTHP

People: Manufacturers

Opportunities: Building Stock Diversity

Solutions that Exist Today

Solution: Mini-split + ventilation with owner and tenant control (within limits)

Conditions: Full market deployment

People: Manufacturers and aggregated demand

Solutions that Need to Be Tweaked

Solution: Selection process/algorithm/categorization tool: zero energy (ZE) now, ZE staged, ZE later, ZE ready

Conditions:

- Consensus around need and cost
- Integrate w/ existing other assessment tools

People: Asset managers/owner, City, consultants

Solution: Virtual net metering across property & ownership lines (shared PV production)

Conditions: Regulatory reform/realignment

People: Financial stakeholders, regulators, IOUs & POUs

Solutions to Create

Solution: Abandon in place (e.g. steam heaters)

Conditions: Field research/pilot, financial proof

People: Building owners and engineers

Solution: Component/solution innovations: self fitting window, end coating, air seal spray, etc.

Conditions: R&D investment, inventors, demand

People: inventors, willing guinea pigs (owners & contractors)

Opportunities: Low Risk Tolerance

Solutions that Exist Today

Solution: Risk burden/guarantee (energy bill savings risk) on 3rd party (or party providing solution)

Conditions: Fixed cost = comfort

Solutions that Need to Be Tweaked

Solution: Create alignment of certification and skill set

Conditions: Need to support better analysis (e.g. CUAC -> trust in model)

Solutions to Create

Solution: Central resource/guide providing technical assistance and increased access to \$

Solution: PPA for EE, parallel to PV

Conditions:

- Coupled with behavioral model (gamification)
- Metered energy efficiency management (silver bullet)
- Pre-paid budget
- Risk utility structure

Opportunities: Market Knowledge

Solutions to Create

Solution: Mega MOU

Conditions:

- “Coalition of the Willing”
 - Shared goal
 - Path to collaboration
 - Commitments
- Proof of concept

People: Public and private players

- Shared risk, accountability

Solution: Education

Solution: One-Stop-Shop

Solution: Pay for Performance

Coaching Questions

Financing Constraints

- How do you find people that are out of syndication?
 - CHPC may have access to this
 - HUD has all tax credit syndication by date
- The City is making grants on 75% of the costs for deed restricted properties
- For HUD & RDA you have to send rents back if you lower utilities
- Look beyond LIHTC
- Reach out to Investor Confidence Project, they are doing some work around aggregation

Triggers

- Consider MOD (?), ADA, and fire codes
- Get local building officials on board then go to CA Building Officials

Building Stock Diversity

- A number of solutions are needed
- Utilities need to solve their issues before you go to the PUC
- How is TI (?) different than plugging into benchmarking systems?

Low Risk Tolerance

- Really like the idea of an energy budget; this is a great potential solution for tenant education

Mega MOU

- How would you fund that work?
- Does San Francisco PUC have resources?

Energiesprong's Overall Feedback

- Standards help industry converge and avoid getting caught up on what is “fair”

Participant Commitments to Moving Concept Forward

- NZEC is doing research on what needs to be done to meet 2020 and 2030 goals and is available to support this effort.
- The City of San Francisco commits to continuing to convene and organize the “Coalition of the Willing,” while sharing their technical knowledge to move the concept forward.
- The City of Vancouver has committed resources and political capital to this concept and will continue to do so.
- Redwood Energy commits to advocating for their LMI clients on the technological solution side.
- Energiesprong came to understand whether Northern California has conditions conducive to creating a market; they are happy to continue conversations with owners to see if this is a scalable in this market.
- PG&E can share case studies from their ZNE projects.
- CEC will attempt to focus more on multifamily code instead of single family; concrete data and case reports will be needed to do so.
- Tenderloin NDC has several projects up for resyndication and smaller stock as well, but wasn't convinced the solution could solve their biggest problem: historic buildings prevent them from being able to touch the facade. Wants to be kept in the loop as the solution evolves.
- Mutual Housing can commit a handful of projects that could be a good fit.

Confidential: Not for Public Distribution

Participant Commitments to Moving Concept Forward (cont.)

- Panko Construction has a passion for ZNEc and commits to coming up with better opportunities for design-build GCs.
- California Housing Partnership wants to understand what other types of solutions are out there and how to evolve financing available for projects and solutions.
- MidPen Housing is in the early stages of finding projects in Palo Alto and Menlo Park but is limited by finding someone to do the work and the financing. Would be open to this solution if these barriers could be addressed.
- TRC Companies (PG&E MUP) will continue to drive projects deeper and can be a good resource for projects in the pipeline while helping navigate incentive programs.
- Stonewood Energy Associates will work with TCAC to expand the use of LIHTC.
- ECB would be willing to help draft the next MOU, which it thinks is most critical to prevent one off projects, if more due diligence is done on why programs in the past haven't moved forward. Want to focus less on technical solutions and more on cultural solutions.
- CNCA will support ambitious but smart efforts cities are willing to take to move innovative ZNEc concepts forward, and they will bring in additional funders as necessary.
- Eden Housing will have resyndication projects in 2019 to offer to the effort and would like us to share our learnings in the meantime with their network.
- PHIUS commits to being the standard setting organization for this concept in the US.
- Build it Green can support program design, codes and standards, and implementation support as well as working with TCAC to expand the use of the California utility allowance calculator.
- Northern California Community Loan Fund is an intermediary financing organization that can help come up with financing for early stage or risky projects and would like to be at the table to help develop creative financing solutions for this concept.

Day 2 Discussion

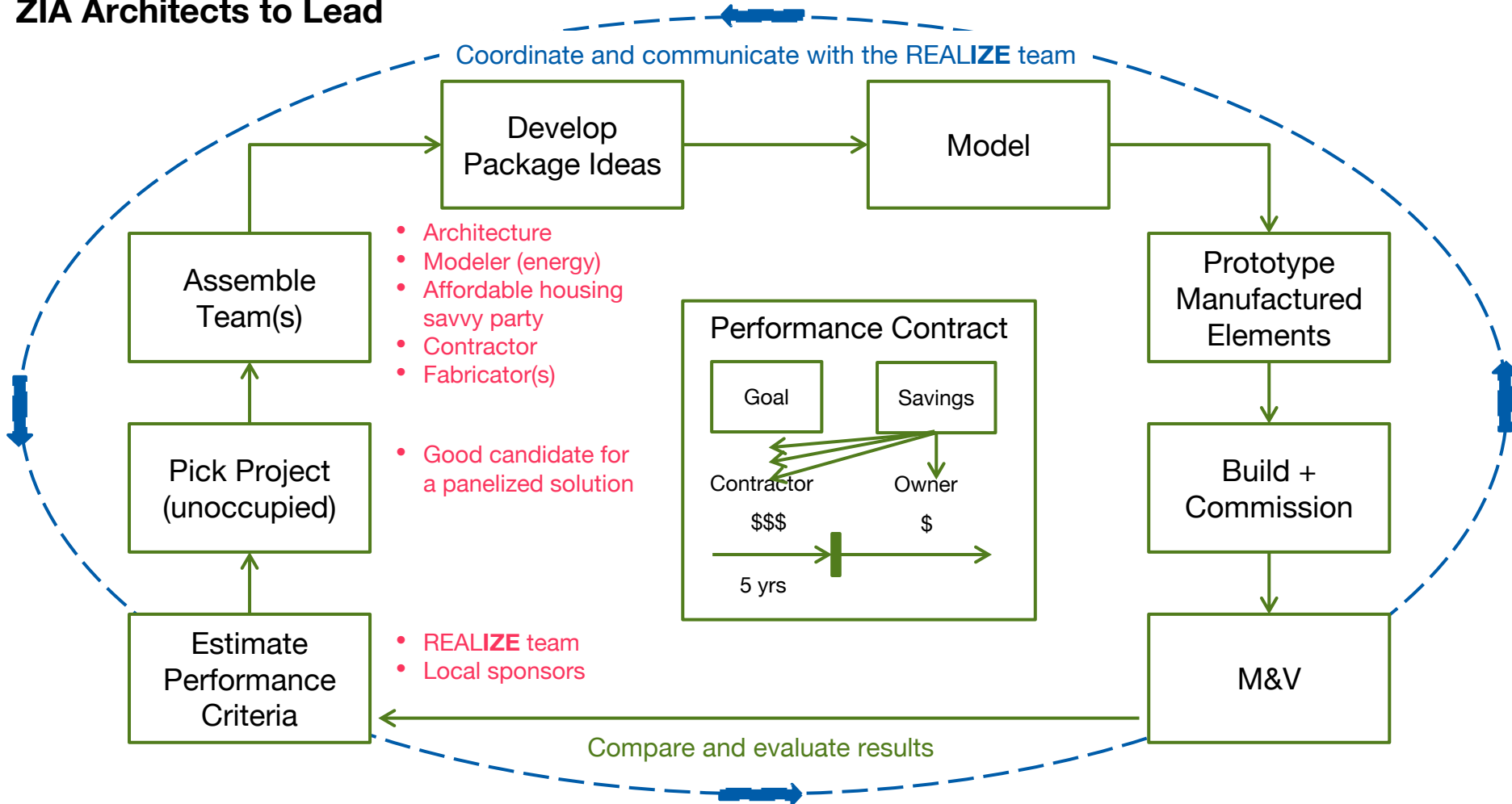


Challenges & Pain Points: Supply

Financing	Code & Permitting	Design & Construction	Grid Integration
Risk of Underperformance - Bad occupancy habits - Bad model? - Lack of cap-ex for commissioning	Technology Bias Code is biased towards using natural gas	High Risks w/Low Risk Tolerance Diversity of existing conditions & risks/hazards coupled with risk aversion maintain the status quo	Rate Structures - Tariffs provide wrong signals - Community solar programs don't provide users with reduced costs
Policy hurdles - Section 8 housing vouchers - Utility allowance limitations - Tenant rights advocates misperceptions on equity and benefits	Ineffective Zoning - Zoning and design review guidelines drive building form (e.g. dormers, second story setbacks) → solar potential killed - Kills cost effectiveness of optimized design	Supply Chain Engagement - Most contractors do not do design build - If contractors play the OEM are there contractors large enough to absorb risk?	Definitional Challenges - ZNEc does not look at grid friendliness (low peak, EUI) - ZNEc currently privileges rooftop PV over community solar - Community solar definition not broad enough - ZNEc should look at quality not just quantity of energy - Aggregate meters; why should each unit or single family be on its own system? - Time dependent valuation needs to be reworked
Complexity - Affordable housing financing package complexity - 15 year rehab cycles	Prescriptive - Code is not an outcome based energy code - Lack of transparency on actual performance versus predicted - > a feedback loop is needed	Knowledge - Designers lack familiarity with manufacturing requirements - Successful management of building science/hazards/climate variables needed	
Culture - Lack of whole systems thinking - Focus on simple paybacks - Proper valuation of measures and lifecycles	Perverse Incentives - No incentives to bring below code buildings up to code - No incentives for innovation - Market failure at time of sale with inaccurate valuation of improvements by appraisers	Culture - Business-as-usual mindset/product orientation - Mindset needs to shift from craft to production/manufacturing - Industry doesn't have marketing savvy or service orientation	Future Proofing - How does Community Choice Aggregation change the ZNEc goal/equation?

Big Ideas: Pilot Projects

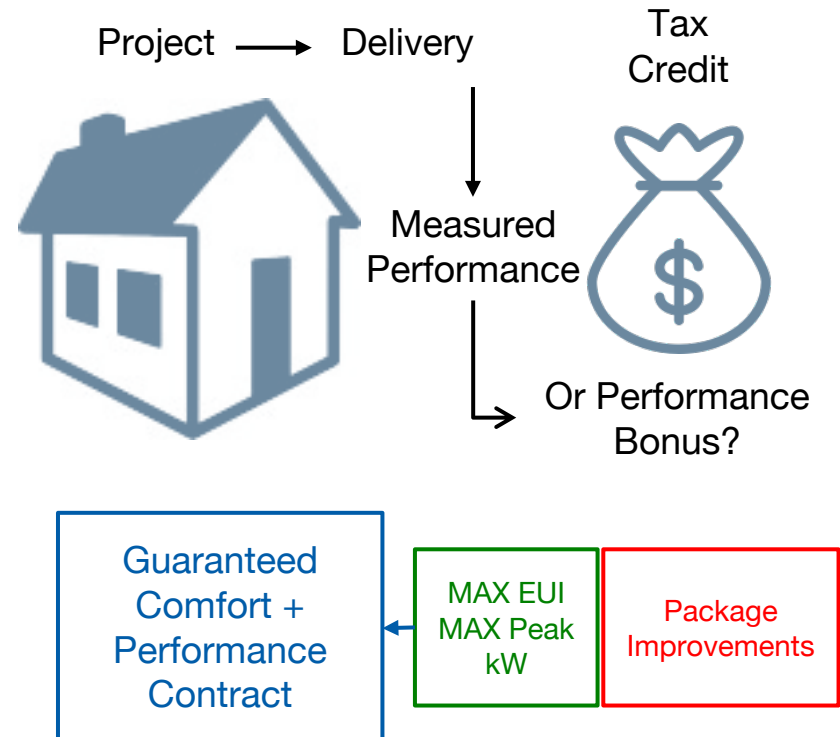
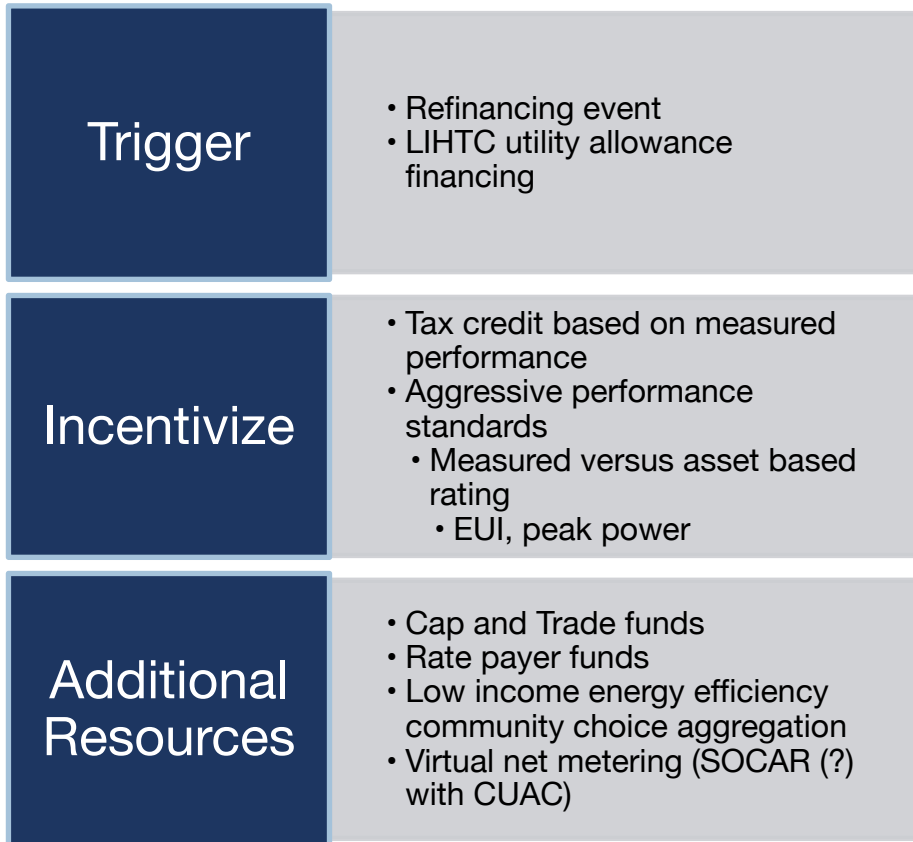
ZIA Architects to Lead



Coaching Comments

- Who holds the contract and how do they manage risk?

Big Ideas: Financing Driver



Coaching Comments

- Don't throw out an asset based score so quickly
- How do you account for changes in occupancy?
- You need to manage the risk in this structure somehow

Big Ideas: Retrofit of Trailer Homes

Solution: Develop low amperage mechanicals to replace inefficient systems and electrify loads

Loads:

- HVAC and domestic hot water: 15 amp
- Aermac – 2.5 ton: 40 amp

Measures:

- ERVs
- HVAC
- Domestic hot water
- Door
- Lighting
- Reflectives
- Community solar array
- Solar canopies

Budget:

- Less than \$5,000 per unit

Coaching Comments

- What will HOAs control?
- You should just start new given the toxicity of these units; hardly worth the investment

Big Ideas: Package + Microgrid/Demand Side Management Kit

Value Propositions		
Building Owners • One stop shop • Lower risk • Lower operating costs • Rental income increase • Increased asset value	Tenants • Guaranteed comfort • Improved aesthetics • Prestige • No change in energy bill	Utility • Same volume of unit sales (negawatts and kilowatts) • Grid harmonization • Generation • Demand side management
Third Party Service Provider Business Model (CA Specific) • PPA service offering to building owner • PPA contract allows them to sell negawatts and demand side management to utility as a generation resource using a metered energy efficiency transaction structure • Ownership of everything but the land, slab, and studs • Install smart appliances with controls, solar, potential panelized solution, HVAC systems		

Coaching Comments

- Concerns were raised about financing
- Ownership structure perceived as a severe contractual arrangement

Big Ideas: HUD NZE Retrofits

Solution: Contract master insurance policy

Elements:

- Performance contract with guarantee between building owner and ESCO
 - PPA structure for solar to eliminate large upfront cost
 - Broker grant incentives with owners based on volume and required operational policies
 - Master meter versus individual meter with virtual aggregate meters
- ➔ Mega contract with volume = profit

Conditions:

- Competitive environment
- Government incentives
- R&D

Key Players:

- New nonprofit to manage deals and broker terms
- Government
- Large scale building owners
- ZNEc retrofit contractors

Coaching Comments

- HUD doesn't like PPAs

Where do we go from here?



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Net-Zero
ENERGY COALITION



Rocky Mountain Institute

What Does REALIZE Provide and Where do You Fit in?

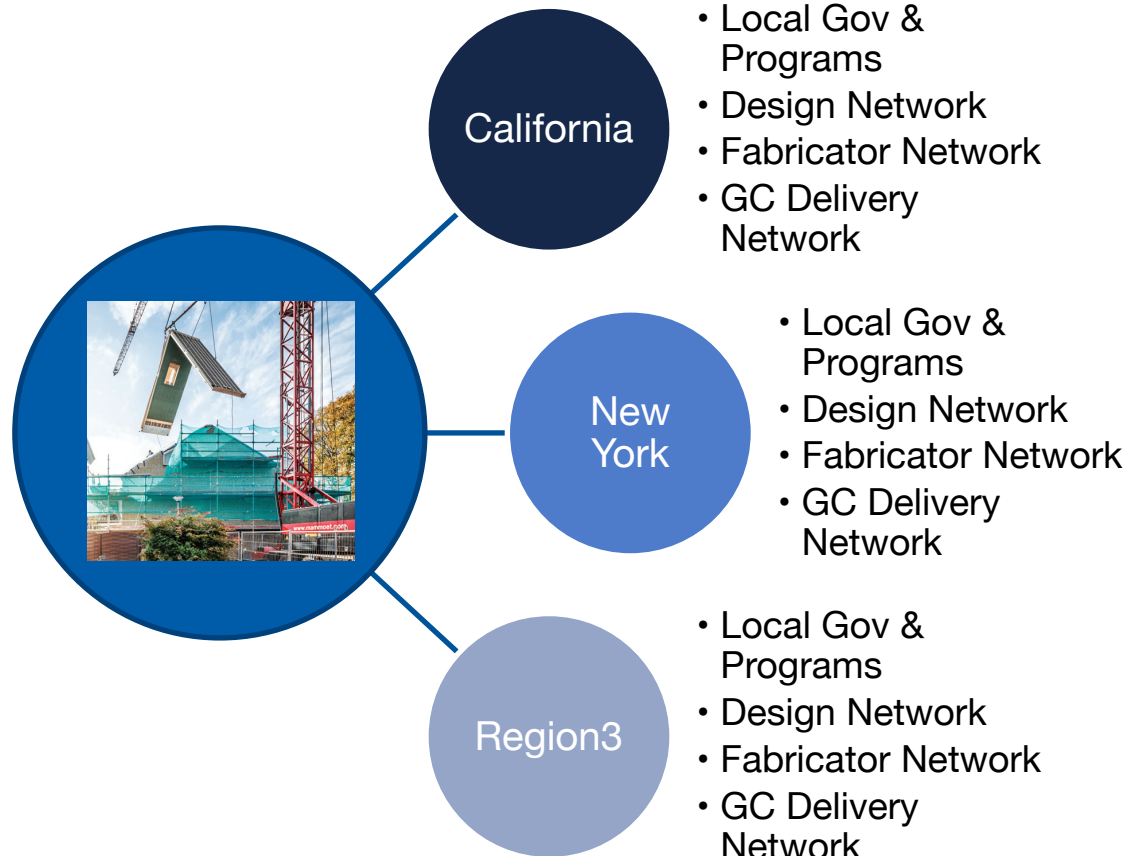
REALIZE Platform

Supply Side

- Performance Standards & Guidelines
- Catalogue of Whole Building Solutions
- Quality Control

Demand Side

- Standardized Contracts
- Financing
- Quality Control



REALIZE Builds a Collaborative Effort that Continues to Grow



Air Conditioning & Heating



National Supply Chain

- R&D New Innovations
- Package Development
- National Procurement and Pricing
- Quality Standards



ROCKY MOUNTAIN INSTITUTE®



Passive House Institute US



Net-Zero
ENERGY COALITION

National Coordination & Collaboration

Supply Chain Creation

- Performance Standards & Guidelines
- Catalog of Whole Building Solutions

Local Dev & Support

- City/Muni Partnerships
- Building Owner Engagement; Demand Aggregation
- Financing
- Quality Control



SF Environment



Leading Local Programs & Governments

- Program Development
- Local Knowledge
- Leadership & Market Engagement
- Deployment Support
- Knowledge-sharing

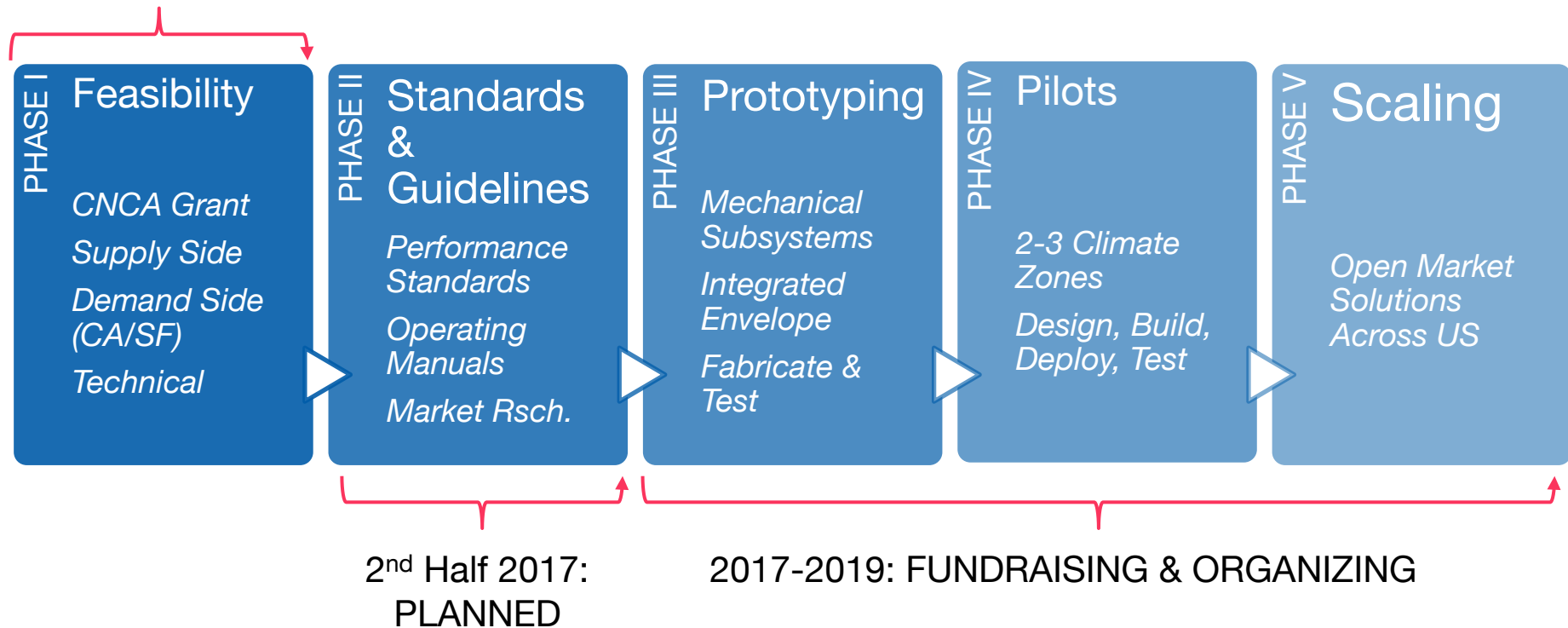
REALIZE WORKSHOP PARTICIPANTS?

Local Design & Deployment

- Design & Engineering
- Fabrication
- Site Construction

REALIZE Timeline

WE ARE HERE



Appendices



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Needs Assessment: Results



Needs Assessment: Overview

- 31 responses
- Primarily unfamiliar with Energiesprong concept
- Top three expectations for workshop:
 1. Learn more about the opportunity
 2. Define and develop a solution
 3. Create a shared vision

Needs Assessment Overview: Stakeholders

- Many questions / doubts:
 - *More of the same with few new ideas.*
 - *Lack of market understanding and demand make this work very challenging. I'm not convinced that 'zero' is the right branding to drive this. It's a good concept for professionals, but not the general public.*
 - *Balance of feasibility, flexibility and creativity --- balance of local and scalability.*
 - *How well do estimated savings materialize? Does the program truly understand human and building behavior to mitigate risk of under-performance of building upgrades?*

Primary concern is barrier of **Construction Costs + Market Demand**

Needs Assessment Overview: Building Owners

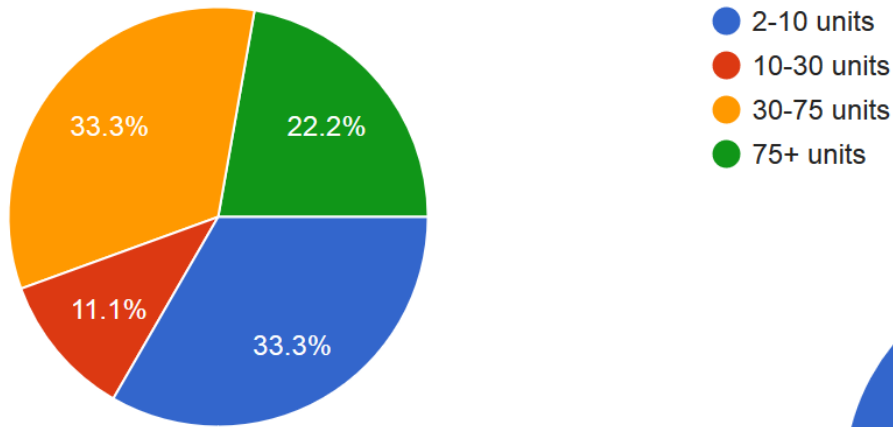
- An optimistic bunch!
- Some questions / doubts:
 - *I worry about relying on prefab as a strategy, rather than being neutral on the construction strategy.*
 - *Financial feasibility of proposed building/construction solutions.*
 - *Concern for technical language — hoping for both high level and the details.*
 - *Difficulty of application in California affordable housing.*

Primary concern is barrier of **Construction Costs**

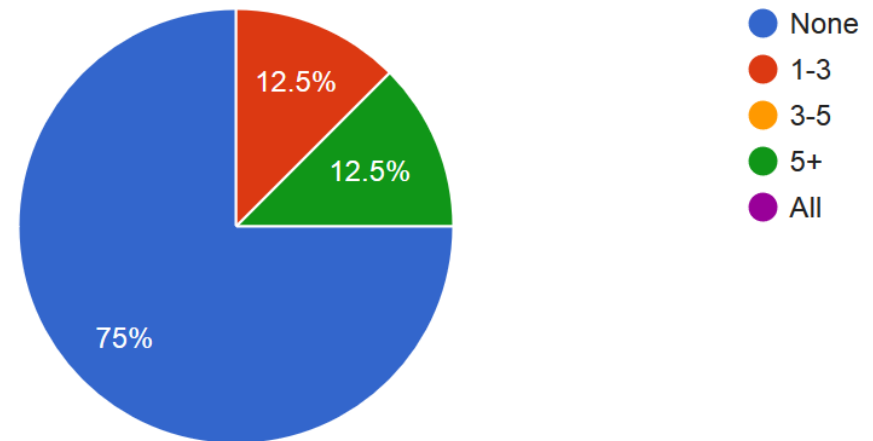
Needs Assessment Overview: Building Owners

Large Portfolios: 77% respondents 300+ units in portfolio

Varying Building Sizes



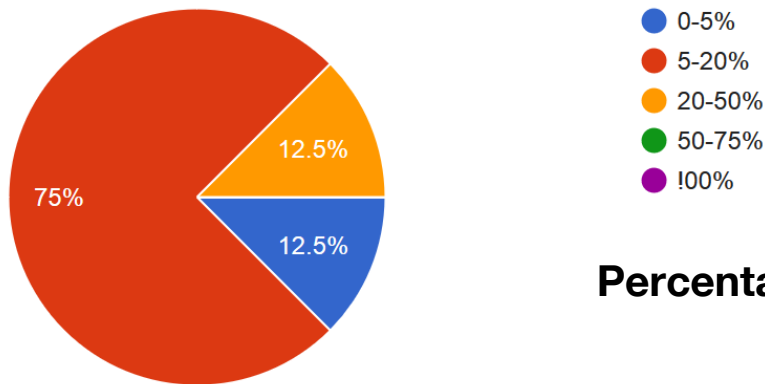
Minority Currently ZNEc



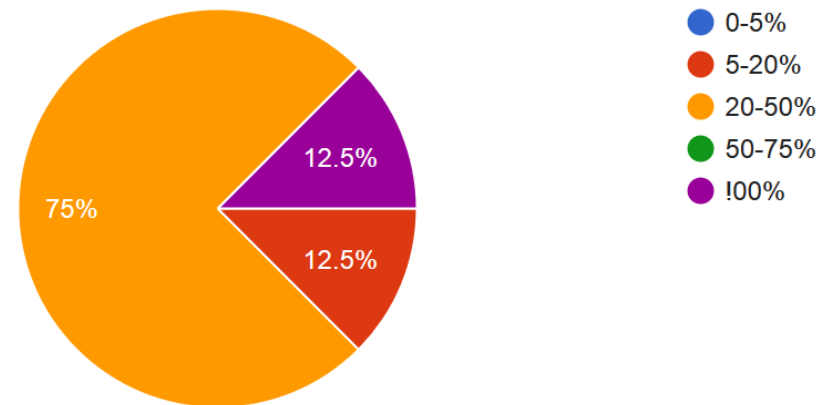
Needs Assessment Overview: Building Owners

Improvements of all types: roof, window, envelope, HVAC, etc.

Percentage of portfolio improvements in next 5 years



Percentage of portfolio improvements in next 10-15 years



Needs Assessment Overview: Building Owners

- Cost concerns about California Zero Net Energy Goals
 - *Costs to meet code requirements*
 - *Concerned about the availability of federal state and local funding that is needed to support increasing building/renovation costs to achieve zero energy goals for existing buildings*
 - *Cost of compliance*
 - *Unfunded mandates*
 - *Required capital input to meet goals is much higher than what we can afford as a nonprofit, without significant subsidies*

Thank You

This work was made possible by the generous support of the Carbon Neutral Cities Alliance

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