



REALIZE Industry Convening Summary

The Pocantico Center

November 9th and 10th, 2016



SFEnvironment

Our home. Our city. Our planet.

A Department of the City and County of San Francisco

Transforming global energy use to create a clean, prosperous, and secure low-carbon future.

REALIZE Concept Narrative

Context

Desirability, cost and convenience are the three greatest barriers to adoption of deep energy retrofits. One of the root causes of these persistent barriers is that both the supply side (the architecture, engineering and construction industry) and the demand side are disaggregated, with no one really selling energy efficiency at scale. The result is that every upgrade is a custom job, which results in greater time, complexity and cost. Ultimately, only a minority of existing homes in the U.S. have had a deep energy or zero energy retrofit. A solution in the Netherlands, known as Energiesprong, has created a model to overcome these barriers. 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 project, without displacing the residents using industrial, predesigned solutions. Energiesprong has seen a 40% cost reduction since the first pilots three years ago, while at the same time going from a 50% energy reduction to net zero.

Project Intent

While the approach is proven in Europe, it has yet to be tried in the US. Supported by Energiesprong, and building off their experience, REALIZE seeks to adapt their approach to the North American market, starting in San Francisco, Vancouver and New York. With over 137 million existing homes in the U.S., this represents a significant market opportunity on the national scale. The convening in Pocantico was *the first major step* in this effort, serving to socialize and catalyze the model with manufacturers, developers, construction companies and housing agencies.

Objectives

Overarching

WHAT are we trying to accomplish?

- Delivering net zero energy retrofits across the North American market, driving carbon neutrality in the residential market by 2050.

HOW will we do this?

- Catalyzing the market and coordinating the value chain to develop a solution and process that is widely successful in the renovation market.

Event

- Gain a deeper understanding of the demand and the type of solution the affordable housing market is seeking in North America.
- Develop a shared vision of the process/solution necessary for such a concept to take root in North America.
- Establish a high-level road map and teams to move the concept forward.
- Determine what barriers need to be overcome for successful action on the road map.

Executive Summary

Takeaways

- There was broad support for this type of market-based solution.
- We will need a ringmaster - an entity to coordinate activity in a local market. This can be the same organization coordinating nationally, but doesn't need to be.
- There is strong agreement that these upgrades should be done at the same time as other planned rehabs, not standalone.
- Prototype projects will initially need to be subsidized and maintain flexibility for innovation.
- We will need to iterate; it will take time and several learning attempts to hone the technical solution, to be able justify and trust a long-term performance guarantee, to demonstrate the value of the upgrades in the market, and to streamline delivery.
- A large general contractor with integrated design experience is needed to deliver this successfully. There is a relatively small group of players with the ability to do this.
- *This is possible.* There was an aha moment during RMI's presentation showing the economics. We should deepen this analysis and present this at the San Francisco convening to garner buy-in in the San Francisco market.

Comments

- The group is lacking the mechanical and structural engineering expertise needed to really dial in the technical solutions.
- How can New York, San Francisco and Vancouver leverage efforts, without adding too much complexity to the process?
- A national coalition is needed to help activate markets and share knowledge, but local teams are required to get projects done.

Next Steps

- Expand the demand-side convening in San Francisco to something larger.
- Net Zero Energy Coalition (NSEC) will propose an engagement plan to continue momentum and keep this group connected.
- NSEC and Rocky Mountain Institute (RMI) want to serve as the organizing body to keep this concept moving forward. The group agreed such a role was necessary and they were the right players to serve this purpose.

What Are You Determined To Do When You Get Home?

Participant Commitments

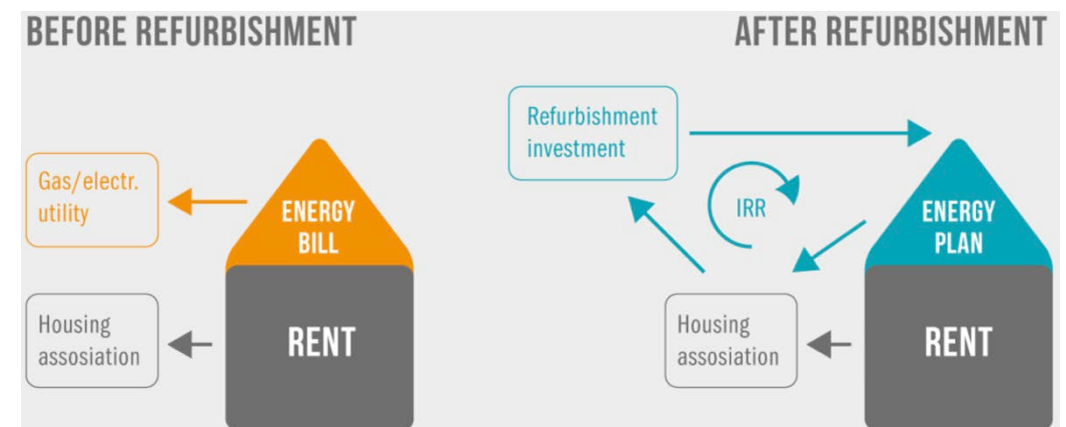
- Bring in agencies and contacts necessary to collaborate and find solutions that go beyond our lifetimes
- Stay engaged and see where this goes while exploring with senior staff internally
- Integrate the work we've done into an approach to apply in NYC
- Share information and promote the Energiesprong concept
- Collaborate with San Francisco and improve engagement with supply side in California
- Continue to develop and promote the model - the concept has legs already
- Develop and provide products for first pilots
- Recruit colleagues to solve the financial problems discussed
- Cultivate the idea of bringing Medicare/health into the equation; provide materials that provide "food for thought"
- Present to team to drive buy-in while working with NYSERDA to aggregate as much demand as possible
- Take back to company to continue building support for this concept
- Provide personal buildings science knowledge
- Continue scaling our solutions for this market
- Provide government support at a local level and dedicate time to this
- Explore all-in standards or labels that allow cost optimization and quality assurance
- Continue contributing data processing and modeling capacity
- Commit to spending more on this concept, all-in
- Recognize complexity but commit to being an overarching compiler and communicator



Downloading Sessions

Energiesprong Highlights

- Funded through EU development goals to promote attractive NZE residential building retrofits without subsidies
- Goal is €35k per retrofit, based on energy savings
- To be viable, must meet four criteria of:
 1. *Quality with long warranty*
 2. *Refurbishment speed (week)*
 3. *Affordability (finance through savings without subsidy)*
 4. *Attractiveness (looks better than your house did before)*
- Must transition from craftsman/project-based industry to industrial-based
- 20 general contractors and 60 suppliers have moved into the space to drive organic industry growth and solutions
- In America, more diligence is paid to credit-worthiness of borrower and performance guarantees are only partially persuasive
 - *More must be done to convince lenders of the benefits of investment*



Retrofit New York

New York State Energy Research and Development Authority:

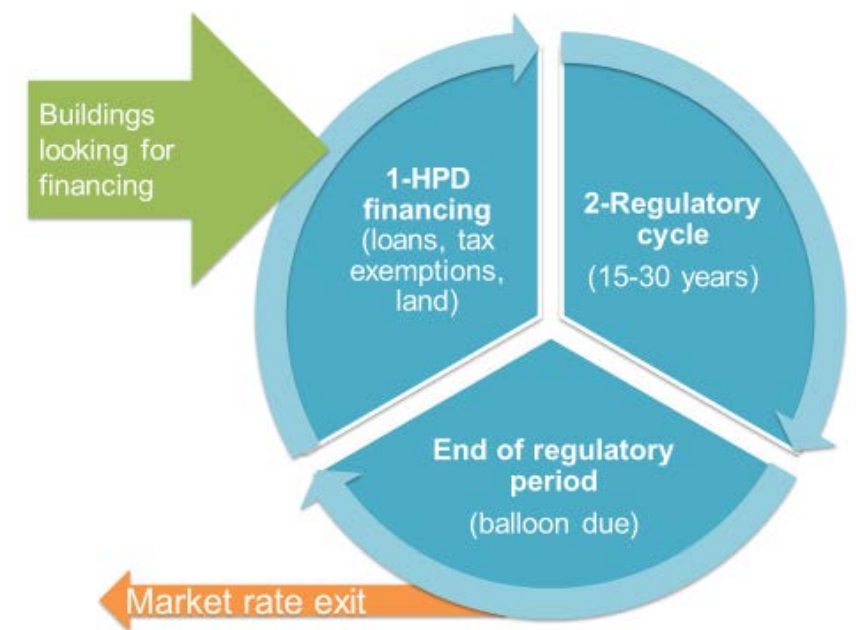
- Goal is to enable innovation, reduce GHGs, and grow economy
- At \$30k/retrofit, NYC alone is a \$1B market annually
- Risk: energy price and occupant behavior, need strong pilot results in 2017 to drive buy-in

NYC Department of Housing Preservation & Development:

- Largest municipal housing agency in the nation
- Not an owner but provides portion of financing and credit enhancement
- 73% GHG emissions in city from buildings
- Majority of stock walk-up, 3-6 stories, pre-WWII multifamily
- Local law to reduce GHGs by 30% by 2030, 80% by 2050 but HPD often precedes legislation
- Require certification with Enterprise Green Communities as condition for financing



HPD Development Process



San Francisco & Vancouver

San Francisco:

- Commitment to 80% GHG reduction by 2050 possible through rooftop PV requirement, and electrification of thermal loads
- SF thermal loads less than half demand of NY climate
- 80% of market is rent controlled but stock moving from government managed to privately held



Vancouver:

- Traditional energy is cheap, focused on building codes that ratchet down GHG emissions
- New construction largest current market
- Adopted zero emission plan for new construction with focus on Passive House envelope standards
- Building stock similar to US but in smaller volume



Key Takeaway:

- How can we engage building inspectors as they likely aren't pricing the value of energy efficient homes correctly?

RMI Market Feasibility

Key Questions:

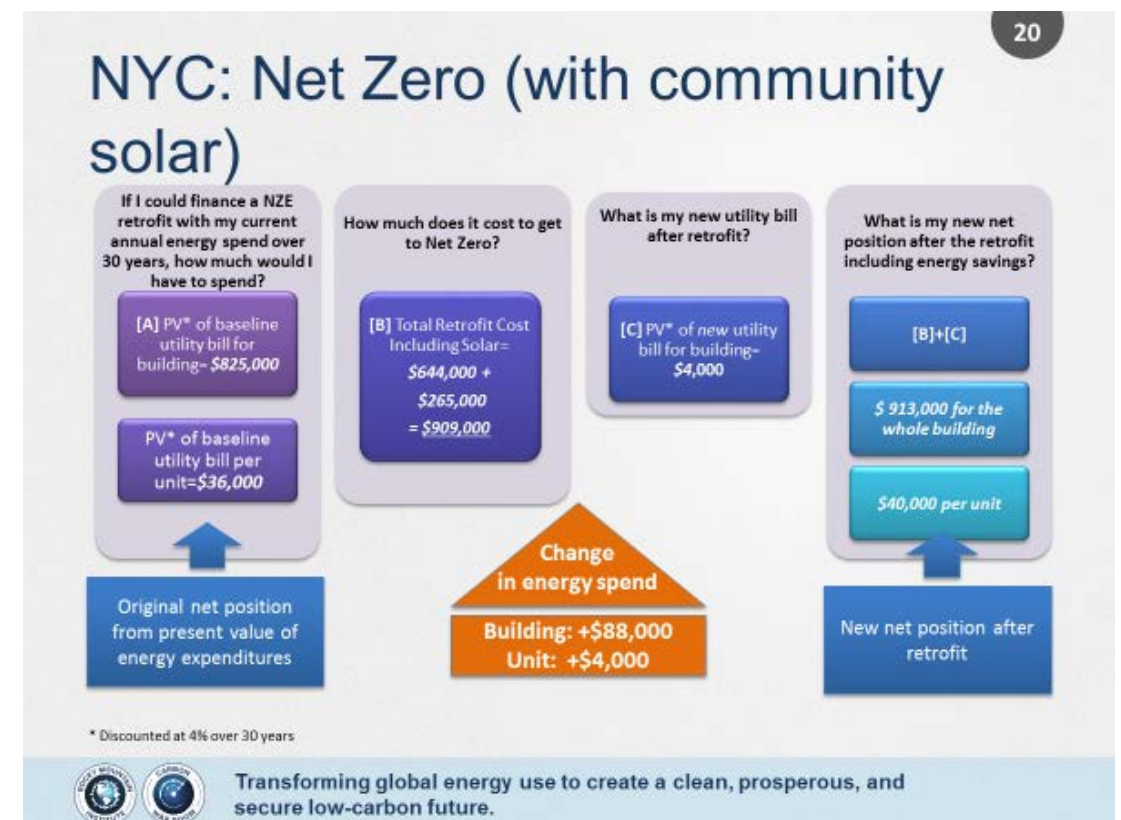
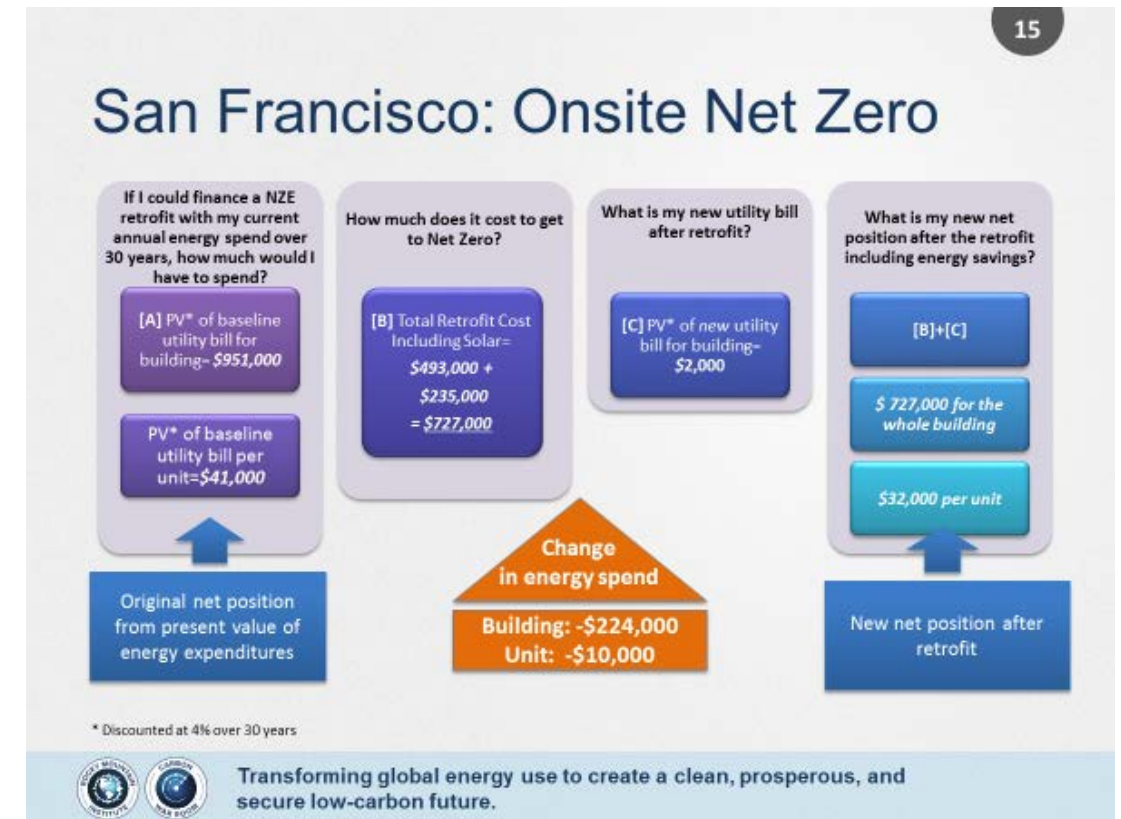
- What can 20 & 30 years of energy spending finance in a retrofit budget?
- What is the current average cost of a net zero carbon retrofit?
- How much do we need to compress the cost curve for this model to be viable in the US?

Takeaways:

- Today SF is most cost effective when you combine electrification with solar.
- NYC is not far away from being cost neutral.
- Community solar will be required in lower solar resource climate zones.
- Efficiency is optimized to where the cost of efficiency equals the cost of solar.

Comments:

- Envelope optimization costs may be underrepresented by ~20%.
- Studies are often very sensitive to accuracy of grid emissions factors for assessing GHG savings.



DOE Building Science Considerations

Key Takeaways:

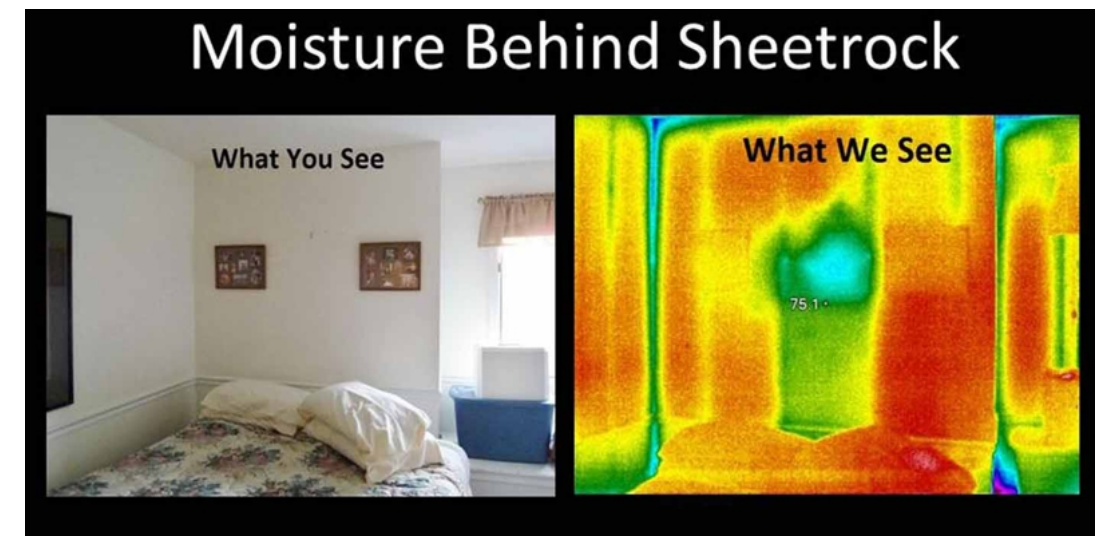
- Customers will pay for a transformational experience; show value of well designed home (health and comfort) and customers will pay
- Information asymmetry -- buyers don't know the underlying energy/air quality of their home
- Infrared imaging is already at our fingertips and quickly exposes flaws
- In the future, energy efficiency and health could be reviewed on a building-by-building basis (like an Amazon Review)

Six Steps to NZE:

1. Optimized enclosure
2. Water protection
3. Optimized comfort
4. Indoor air quality
5. Efficient components
6. Solar ready

Risks Include:

- Thermal bridges/foundations
- Near-term obsolescent code cycles
- Some designs can't be retrofitted; must be torn down





Space of Creation

Learning Like a Dolphin – Group Insights

Objective:

Get one participant to complete an unknown objective by only providing positive feedback (clapping) when he/she advances toward completing objective.

Outcome:

After 8 minutes, the group's "dolphin" found and rang a bell, removed their jacket, did a lap around the room, and sat in their chair solely through receiving positive feedback from the audience.

Observations:

"Having no direction can be difficult and frustrating."

"I wanted to yell out and help; it was difficult not to give it away."

"In our situation what is clapping? Is it money, contracts? How can get the positive feedback loop to help us create solutions here?"

"When there was no action/activity, there was no feedback. You must always be acting, failing, and learning, to complete the goal."

25/10 Crowdsourcing – Big Ideas

Objective:

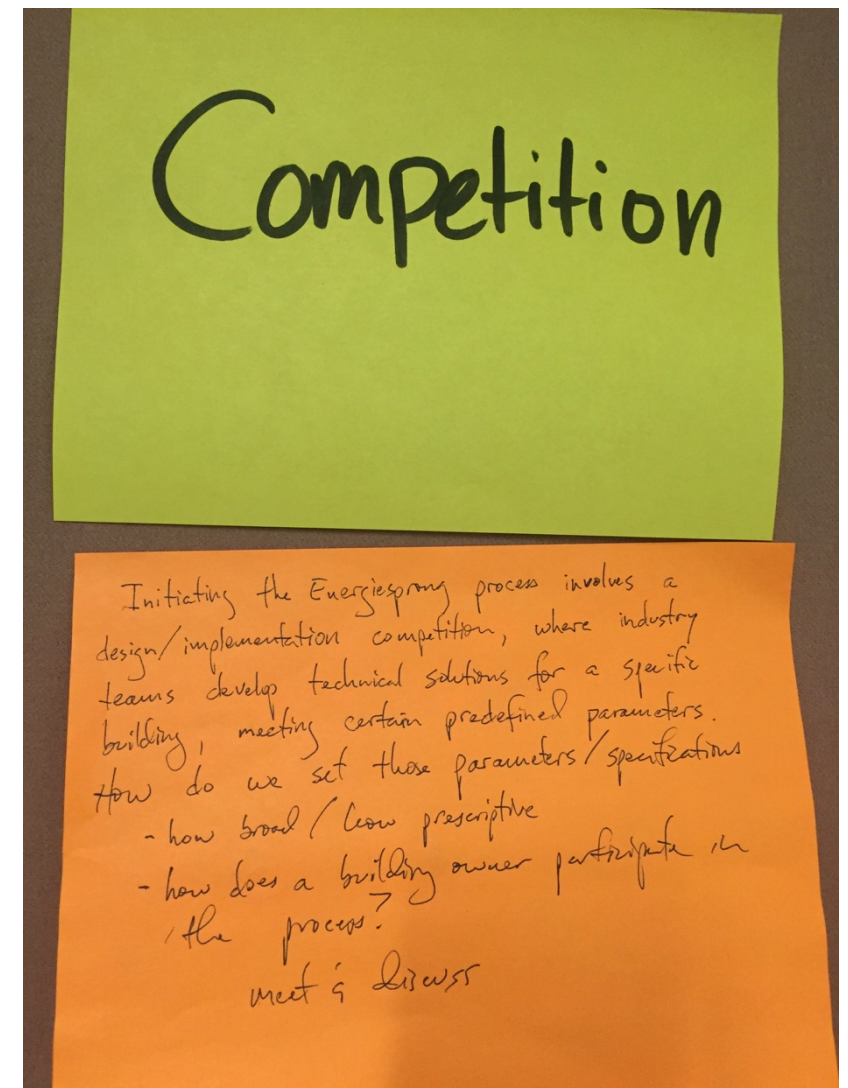
Have all participants write a bold idea on a post-it. Pass ideas around and review with a partner the idea that landed in front of you, score from 1-5. Repeat five times and tally total score. High scores indicate best ideas.

Ideas Fit Seven Key Categories:

1. Project generation
2. Planning and implementation
3. Data and information sharing
4. Design and marketing
5. Policy
6. Financing
7. Competition

Observations:

- Common theme of uniting stakeholders and understanding what incentivizes each specifically.
- Need for an overarching coordinator to unite the fragmented market on both the demand and supply sides.



Big Ideas

Project Generation:

- Leverage relationships: top multifamily property owners in the US, National Association of Home Builders, National Multifamily Housing Council, and other associations, with single family REITs.
- Plan timing of retrofit to coincide with planned rehabs based on expected end-of-life of systems and/or funding cycles for building investments.
- Identify building stock appropriate for Energiesprong approach in five to ten cities/states.

Planning and Implementation:

- Harmonization of stakeholders' paths of least resistance to going to scale, find intersection of criteria of each stakeholder where criteria falls at lowest end of spectrum from easiest to do > hardest to do. For example: engineer- smallest number of measures, finance- best quality of borrowers, owners- timing optimal for retrofit, occupant- most appealing measures. Too often one stakeholder's criteria drives whole process.
- Establish labor buy-in. Bring a new form of high-skill production jobs to the non-believing American demographic within 500 miles of a given housing market. Their new voice can transcend demographics.

Big Ideas Cont.

Data and Information Sharing:

- Have different folks from the industry (builders, suppliers, etc.) discuss a hypothetical solution if there were no code constraints.
- As retrofits are rolled out in the affordable housing sector, take time to conduct market research with teams to capture the most attractive benefits and challenges beyond cost savings to develop marketing/communications strategy for broad market. Also include young architects/engineers/developers and students in pieces to encourage innovation and long-term market development.
- Define incentivization options for various density conditions, types or ownership and climates.
- Create online database of housing stock. Private or public agents can use this to aggregate demand as well as signal interest. Ideally could be equipped to understand legal and regulatory barriers by geography. Market it through promoting energy savings and comfort and have it grow virally like an app. Combine with virtual reality and augmented reality to help owners visualize transformations.
- Assemble inventories in NY+CA of multifamily stock, assign a typology to each building in a jurisdiction. Include Google Street View/Essex, NREL building component library, tax credit re-syndication date, most recent building permits, rebate participation. Get peer input on RMI model for California. Review all building prototype/"typical" inputs, and add effect of available rebates/incentives. Share with BayREN to justify offering incentives on a GHG reduction basis and to target participants.

Big Ideas Cont.

Design/Marketing

- Sell the concept and design as a no cost/low-cost house remodel for a sexier, healthier, cheaper, smarter, planet friendlier house/apartment. Go beyond just selling zero energy and look at all opportunities to innovate a better home. This makes it easy to buy.
- Use the opportunity given by a deep energy retrofit to improve the social or health aspect of affordable housing, by striving for more than just financial and environmental criteria.
- Identify optimal envelope performance targets based on climate and cost before adding PV to reach source/carbon zero (for each pilot city + each building type).

Policy

- Set a time on the phase-out of natural gas infrastructure in cities.
- Engage city/state policy makers to create strong policy incentives to build demand and industry buy-in.
- Convene a multi-sectional working group to create a model for deep retrofit building code based on the international building code and/or ASHRAE 90.1 that can be adopted by states or local governments.

Big Ideas Cont.

Financing

- Methodology/approach to underwrite to savings with construction lenders. What criteria or info do lenders need?
- Billing for energy improvements to multifamily is the key NZE driver. Erasing the “split incentive” is the primary solution for any climate or building – it allows the building owner to invest and recoup. Bill via energy surcharge or increased rent.
- Lending dependent on threshold level “passive” performance. Mandate approach. Innovation will follow.
- List all potential benefits of retrofitting existing housing stock at scale through an industrialized approach, determine who can share in these benefits to help develop a viable pathway for financing (particularly where energy savings aren’t enough for positive present value) and spreading risk.
- To ensure market rate penetration of the concept, an ESCO style model for bundled energy savings on EE+PV and possibly EV is crucial to making the case for homeowners (Solar City lease type situation for everything).
- Initiate a carbon tax, roll money into municipal fund to finance a move away from fossil fuels toward building improvements and renewables including batteries for grid-tied peak shaving.

Big Ideas Cont.

Competition

- Initiating the Energiesprong process involves a design/implementation competition, where industry teams develop technical solutions for a specific building, meeting certain predefined parameters. How do we set those parameters/specifications? How broad? How does a building owner participate in the process?
- Competition for end-to-end (design/build/finance/operate) business model for deep energy retrofit model for subsidized housing. The teams will receive a stipend. Winner will do the job with an attractive prize. Select on best value.
- Create panel manufacturing consortium requirement. Outline the needs and capabilities required of a well-defined retrofit panel manufacturing consortium from R&D, to design, to manufacturing, to logistics, to assembly such that the group has a working blueprint to assemble a team that can satisfy the requirements of housing authorities.
- High efficiency appliance package: partner with manufacturers to develop a package of highly efficient smart major home appliances. Can be leased to tenants or part of energy service agreement. Washer, dryer, refrigerator, TV, heat pump, induction cook-stove.
- This group delivers a major project in each climate zone supported with end-to-end case study to market and repeat.



Group Sessions

Risks & Solutions

Priority	Risk	Solutions
	Delays impact tenants	Improve project schedules through standardization
	No one wants the technical solution after industry invests	Reform procurement process away from policies that require selection of low cost bidder
	Components are not available for the technical solution	
	Lack of buy-in at all levels	Coordinate with decision makers
	Solution costs more than planned	Remove current culture of trial and error
	Technical solution has life expectancy less than 30 years	(We currently address this through O&M plans)
High	The solution overcomplicates an already complex financing system	1) Understand current financing processes 2) Develop package that includes financing solution that makes it easy for customer 3) Consider guaranteed/shared savings model
	The solution overcomplicates already complex technical systems	
	Occupants behave differently than planned	We already have experience with this
	Price of energy is too low	
High	Customers don't accept risk of innovation	Policy support may help to mitigate
High	Trades lack buy-in and training	

Risks & Solutions

Priority	Risk	Solutions
High	Change in administration	
	Not addressing liability at the program level	
	Wrong selection of initial prototype/doesn't meet specification	
	Not addressing key innovations in design (e.g. mold/moisture, storage, etc.)	
	Lack of communication and buy-in from local trades	
High	Picking a fight with Preservation	
	Not enough dedicated human resources	Create realistic scope of work and resource plan
	Not working with codes officials	
	Net metering is banned	
	30% tax credit is not renewed	
	Incentives cut back (e.g., rebates, CA fuel-switching, NYSERDA scales down)	

Risks & Solutions

Priority	Risk	Solutions
	Lenders not included in process at early stages	
	Failure to follow user-centered design	
Medium	Poor communications across stakeholders – resulting in lack of right participants	Create clear business case pitch sheet
	Regulatory blocking of ability to use incentives (e.g., split incentives)	
High	Underestimating costs	Leverage real project data to estimate costs
	Not addressing loads during peak demand; not incorporating storage and other innovations	
Medium	Failure to engage utilities	Engage utilities in early design discussions
	Not designed for affordable financing	
	Termites!	

Risks & Solutions

Priority	Risk	Solutions
High	Existing regulations	NYREV
	Business model	Define the problem- do we start with social housing? What's the design, build, operate, maintain blueprint?
	Industry mental models	Industry mental models must change; identify what each stakeholders need to activate their organizations.
	Existing perverse incentives	
Medium	Lease agreements	
	Not having the right team in place, exclude/overvalue certain stakeholders	
	Lack of impartial leadership + authority, undefined purpose/vision/scope	Need for an overarching authority/coordinator of stakeholders. Coalition like NZEC? Company like Energiesprong?
	Procurement conventions	Procurement conventions need to change. Remove focus on lowest bidder. Like Uber changed the idea of car ownership to transportation, we must change housing from box that holds your stuff to income generator/awesome space to be etc.
High	Fall in love with wrong solution	
	Focus on problems, not solution	

Risks & Solutions

Priority	Risk	Solutions
	Do something that's just project based, piecemeal approach	
High	Inability to define customer; don't understand the customer or future demand	
Medium	No balance w/ short and long-term vision	
High	Don't build flexibility into the model, design, think too narrowly, becomes inapplicable to other markets or try to be everything to everyone	
	Dependent on incentives	
	Finance w/ a complex SPV or capital stack	
	Don't consider application here is different than in Europe	
	Keep doing what you know	
	Too rigid about what the solution looks like or get stuck in analysis paralysis	
	Energy prices stay low	
High	Do it government led	
	Miss momentum in the market	
	Limit market demand by starting with the less "sexy" part of the market	

Risks & Solutions

Priority	Risk	Solutions
Medium	Too expensive	
	Not lending - Poor credit quality - High interest rates	- PACE – expand location and max capital - Third party guarantee, e.g. City
	First targets not performing/meeting goals	
Medium	Learning curve too steep for installers	
	Tariff limiting imports	
High	Overly complicated	
	Unhealthy, uncomfortable	
	Trump demoralizes everyone	Create awareness through pilot projects
	Ugly and unappealing	
High	Poor geographic location	
	Unrealistic targets	
	No changes to code and policies	
High	Too much planning required	

Financing Breakout Group

Facilitator – Martha Campbell, Rocky Mountain Institute

Bruce Schlein, Citigroup

Loic Chappoz, New York State Energy Research and Development Authority

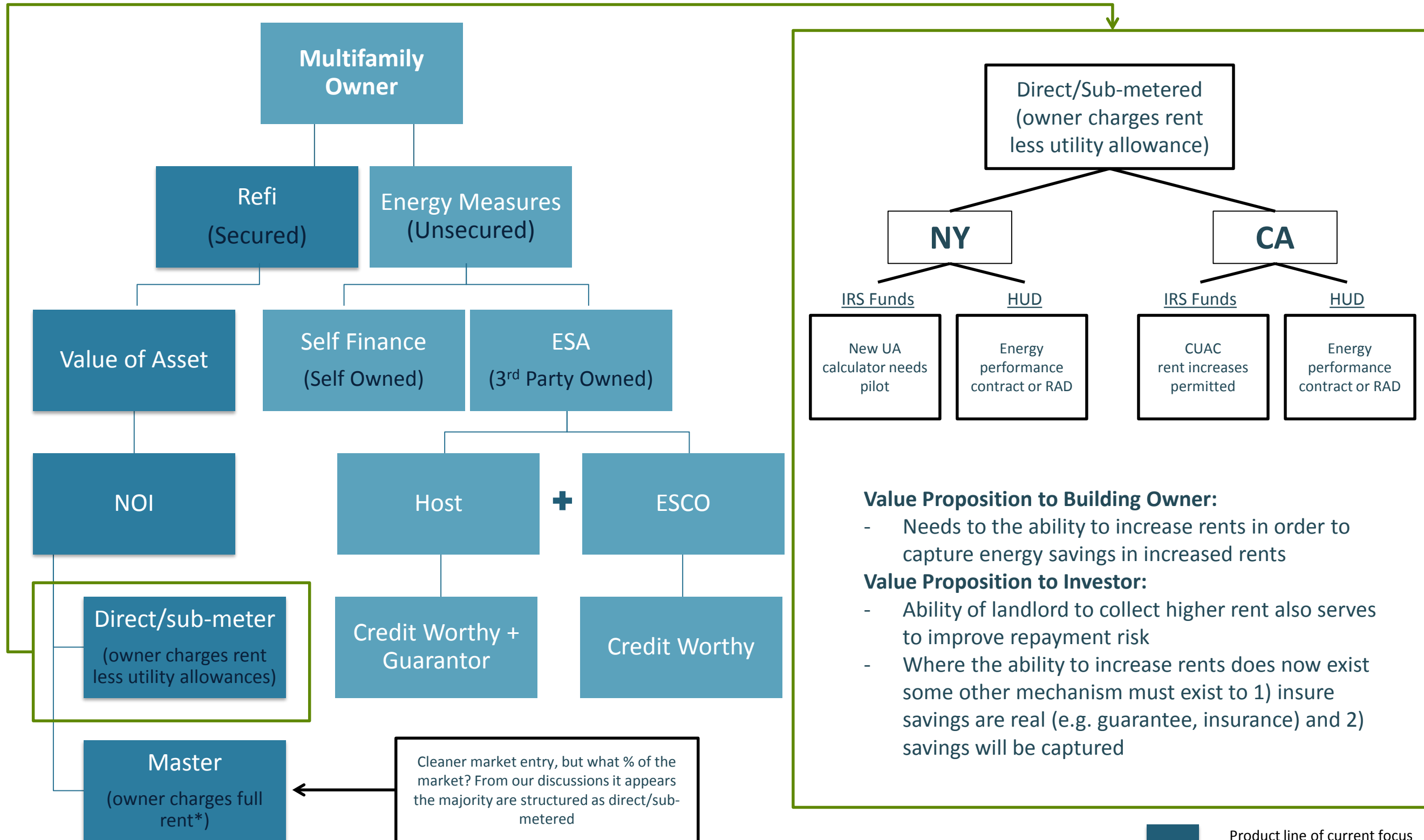
Sean Armstrong, Redwood Energy

Financing: Fundamental Questions

- How can reduced performance risk be used to improve repayment risk?
- Which products make the most sense for our offering?
- What resources are uniquely available to the affordable housing market?
- How do affordable housing resources influence the structure of our offering and a performance guarantee?



Financing: Potential Product Structures



* No more than 30% of low-income tenant's income

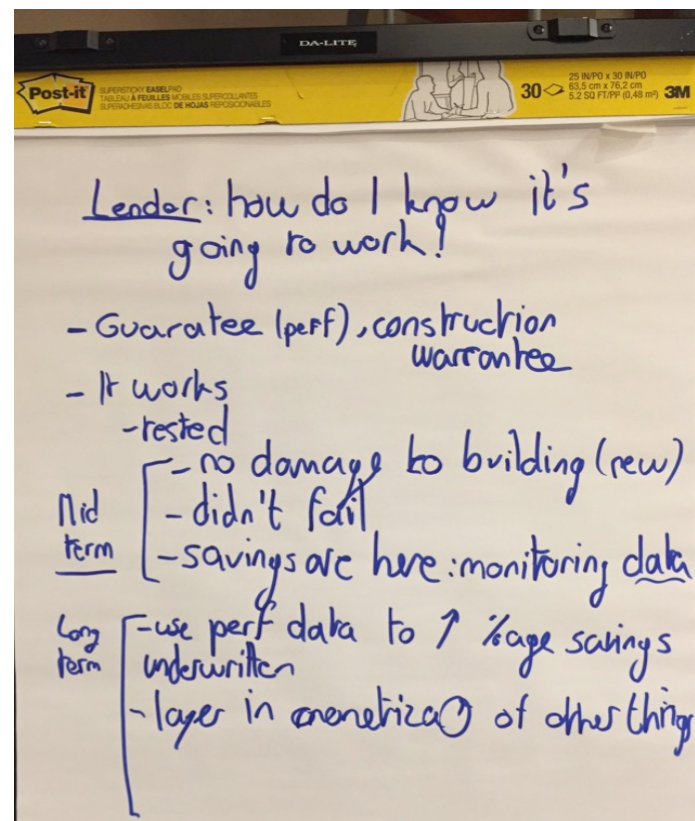
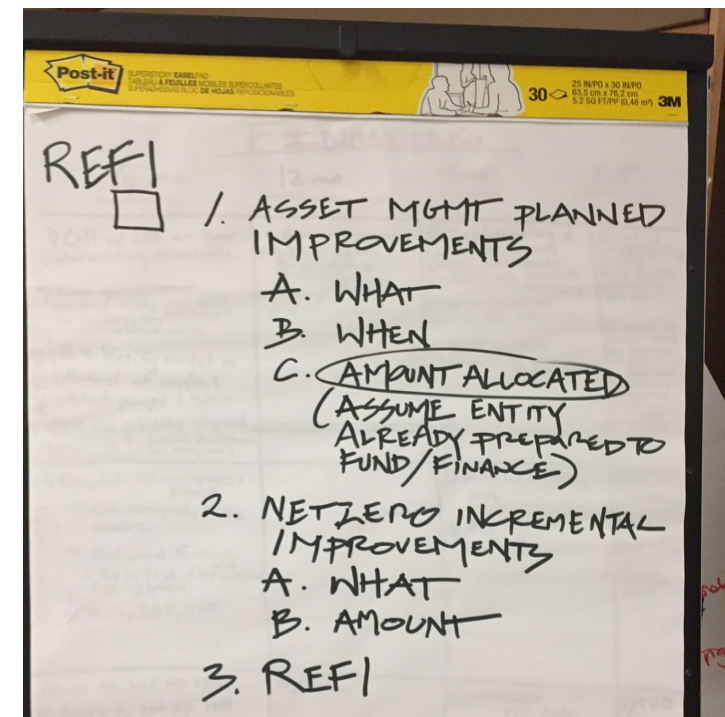
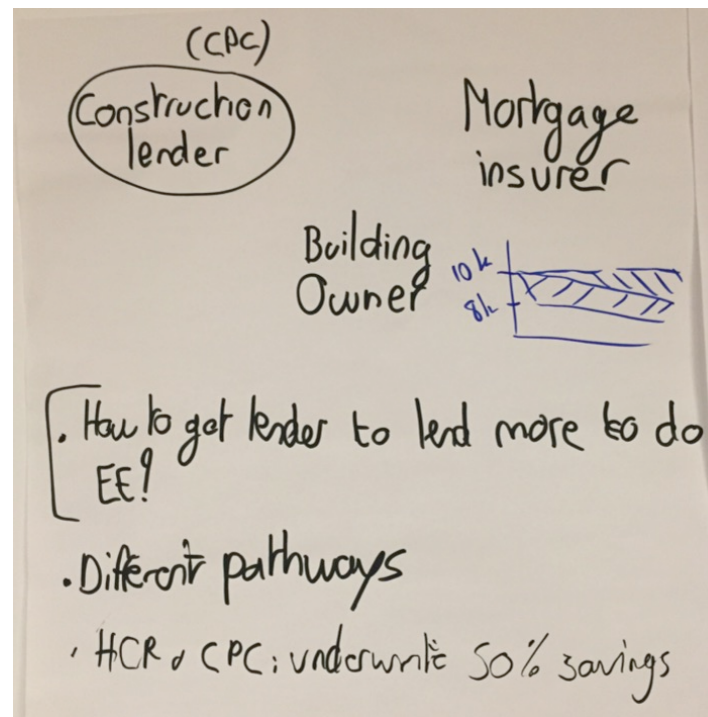
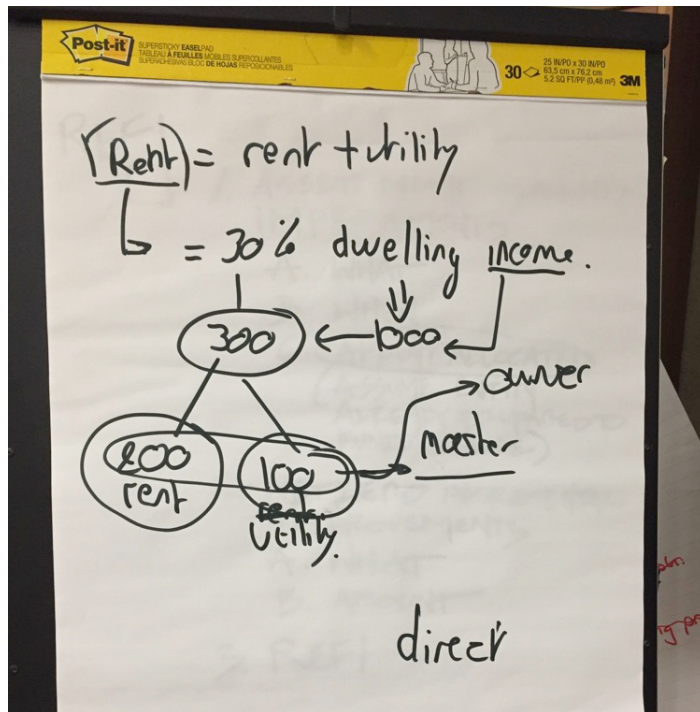
Financing: Coaching Feedback

- Consider PACE.
 - How does the mortgage holder discussion fit into this?
 - Also consider how PACE lacks the full opportunity refinancing provides.
- Appraisal issues.
 - We need to show how these improvements reduce collateral risk.
- Realtor education.
- Consider how to outline the technical specifications for construction lenders.
 - Are there criteria for which products to use?
- Mechanism for lenders to capture savings
- How much capital is currently available for CAPEX in the affordable housing market?
- Consider other factor in total cost of ownership, e.g. decreased insurance, medical benefits, etc.
- What is the volume of business needed for the capital market to get seriously involved?

Financing: Action Plan

	6 mo	12 mo	18 mo+
Activity	1. Set up call with NY Community Preservation Corporation (CPC) on their underwriting standards 2. Understand if guaranteed savings make any difference to lenders, if so how 3. HUD utility stipend (Section 8, Rental Assistance Development Program) 4. Verify model versus actual of central heat pumps and skin	1. Implementing a calculator based utility allowance • Look into HUD calc • Military 2. EE performance comparable database 3. DOE loan guarantee program	1. Build lenders comfort with product • NYSERDA performance data 2. Set up so reinforcing process keeps improving terms 3. Layer in other ways to improve NOI: 1. Insurance 2. Seismic 3. Health 4. Storm water 5. Safety
Stakeholders	1. CPC, Citi multifamily mortgages 2. Citi mortgages, NYC Department of Housing Preservation and Development (HPD), lenders 3. HUD, Rental Assistance Program (RAP), ESP 4. Redwood Energy, Related, CPC, Citi and Kingspan	1. HUD, NY Homes and Community Renewal, HPD, NYC Housing Development Corporation 2. Appraisers and lenders 3. DOE	1. Lending industry 2. Lending industry 3. Insurance, Medicaid/Medicare, reinsurance
Roles	1. Loic to set up call 2. Bruce to set up call 3. Sean, Loic, Greg and Bruce (HUD guarantee) 4. Sean to work with Paul and Brent, NY, SF	1. Loic, Chris and Sean 2. Loic lead 3. Joan	1. NYSERDA 2. REALIZE 3. DOE, NY State, SF/CA

Financing: Photos



Demand Aggregation Breakout Group

Facilitator – Kacia Brockman, City of San Francisco

Chris Mahase, New York City Department of Housing Preservation and Development

Greg Hale, New York State

Micah Lang, City of Vancouver

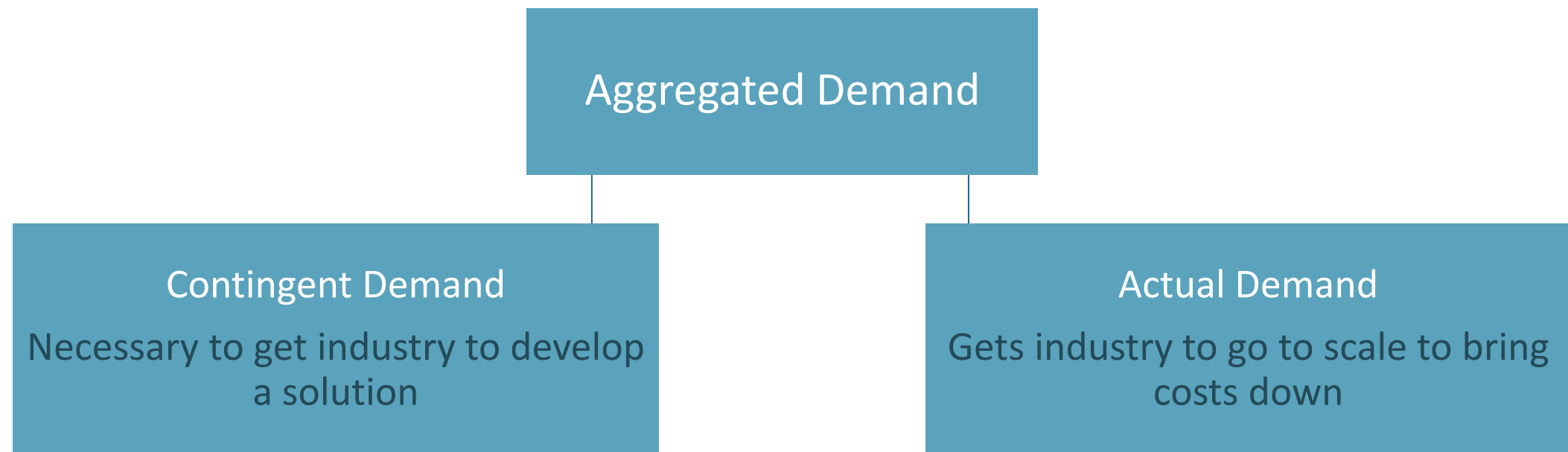
Sanne de Wit, Energiesprong

Demand Aggregation: Fundamental Questions

- What is the value proposition for building owners?
- How do we generate the demand necessary to incentivize industry to develop an integrated solution?
- What are the steps to market maturity?



Demand Aggregation: Value Proposition



Value Proposition:

- Owners meet their performance targets (city/state agencies are driven by GHG goals)
- Lower maintenance and operating costs
- Tenant comfort
 - This could bring Medicare and Medicaid revenue to project
- Help utilities comply with regulations (e.g. NY REV)
 - Could this bring revenue to the project
- Performance guarantee
 - Guaranteed savings
 - Lenders willing to underwrite, loan more
- Leverage building's planned rehab – piggyback EE/RE upgrades for economies of financing, invasive work, tenant disruption

Demand Aggregation: Market Segmentation

Activities:

- Define value proposition (tell the story for the audience)
- Define level of commitment from building owners (roundtable of building owners)
- Define number of units to attract industry (government survey)
- Define target building typology for pilot (consultant analyze building stock)
- Encourage market signals from portfolio holders to demonstrate commitment
- Define performance and process requirements to be met (e.g. North American scale, deployment team)
- Inventory rehab volume per year (government solicit data from owners)
- Secure buy-in from affected agencies (present value proposition to agency contact)

Steps to Market Maturity:

1. Agency/government secure commitment of demand for industry, and commitment of performance guarantee from industry
2. Owners commit to specific pilot projects
3. Government conduct phased pilots to iterate to preferred technical solution, financial solution, and performance quality
4. Increase volume of future solicitations to achieve level necessary to justify policy changes
5. Change policy to require minimum performance requirements that can be met through this solution
6. Policy change leads to mass market demand

Demand Aggregation: Coaching Feedback

- Need a framework and metrics for messaging to different audiences.
- Can we include new buildings in aggregated demand?
- Think about expansion to from public housing to private sector housing.
- What volume of commitment does the industry need to start making investments?
 - Number of units committed over next 3 years.
 - Does it vary by location?
 - Engage stakeholders.
- What development group do you want to attract?
- Is there a benefit to aggregating demand across 3 cities (NY, SF, Vancouver) to get volume?
- What is considered success?
 - Ultimate code/policy change to require ZNE.
 - Market demand from private sector housing.
- What's the incentive for the design/build team, are their risks addressed?

Demand Aggregation: Action Plan

		6 mo	12 mo	18 mo+
Activities		• Convene roundtable of building owners • Understand value proposition • Identify needs • Gauge buy-in • Survey industry – how many units are needed to invest in model • Target companies that will respond to RFP • Understand value proposition • Share information from owners • Solidify buy-in at housing agencies • Present compelling value proposition • Define scope • Build preliminary financial model • Interaction with city/state subsidy • Form local working group • Define terms for pilot competition		
Roles		• Housing agency organize private owners • City/state organize private owners • City/state work with industry • Housing agencies achieve internal buy-in • State and green bank build financial model • City/state oversee working group and pilots		

Demand Aggregation: Photos

Activities:

- Define value proposition
 - tell the story
- Define level of commitment from building owners
 - roundtable of bldg owners
- Define # of units to attract industry
 - govt survey
- Define target bldg typology for pilot
 - waiting for consultant report EoY
- Encourage mkt signals from portfolio holders
 - Demonstrate mkt commitment
- Define perf + process requirements to be met
 - N American scale?
- Inventory rehab volume per year
 - Deployment team
 - govt solicit data
- Secure agency buy-in
 - affected
 - provide agency contact w/ value proposition

6-month

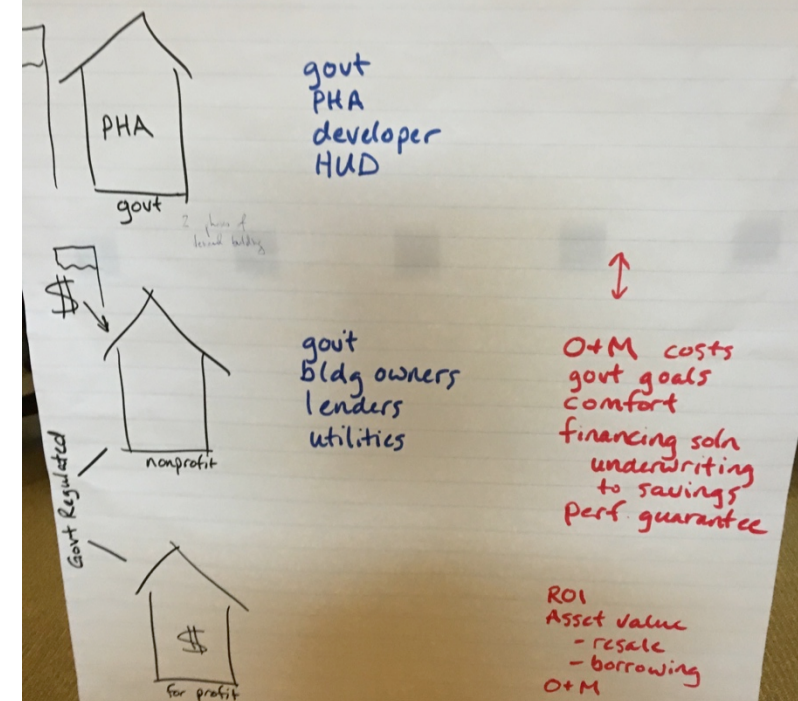
- | Activity | Details |
|-------------------|---|
| housing agency | <ul style="list-style-type: none"> • convene roundtable of bldg owners - understand value proposition - identify needs - gauge buy-in |
| city/state | <ul style="list-style-type: none"> ↳ private owners ↳ public owners |
| state/city | <ul style="list-style-type: none"> • survey industry - # units / level of commitment needed to invest in model - target companies that will respond to RFP - understand value proposition - share information from owners |
| housing agency | <ul style="list-style-type: none"> • solidify buy-in @ housing agency - compelling value prop. - scope |
| State / greenbank | <ul style="list-style-type: none"> • preliminary financial model - interaction w/ city/state subsidy |
| State-led | <ul style="list-style-type: none"> • define terms for pilot competition • form local working group |

Value proposition

- Perf. targets - city driven GHG
 NYC < 60%, electrification.
- mayoral agencies must act
 - state driven
 ⇒ state agencies
- Lower operating costs
- Comfort
- Help utilities comply w/ REV
 - bring revenue to project?
- Maintenance + operating exp.
- Guarantee (credit worthiness of players when can we expect this?) Key element in Neth.
- Lenders willing to underwrite ⇒ ↑ loan

Audience

Value



Delivery Model Breakout Group

Facilitator – Shilpa Sankaran, Net Zero Energy Coalition

Paul Rode, Related Companies

Elizabeth Heider, Skanska

Joan Glickman, US Department of Energy

Barry Hooper, City of San Francisco

Ron van Erck, Energiesprong

Nolan Browne, Sto Corp

Delivery Model: Fundamental Questions

- What organizational infrastructure needs to be in place for success?
- What key partners need to be engaged?
- What is the business model?
- What is the key value proposition?
- How would this be deployed?



Delivery Model: Elements

Organization:

1. Regional Market Development Teams
2. New York Market Development Team (independent public/private entity working with NYSERDA) – or any regional/local market development team
3. National Council– coordinating body growing markets, facilitating knowledge transfer, and national partnerships

Demand & Supply (a.k.a. “The Coalition of the Willing”):

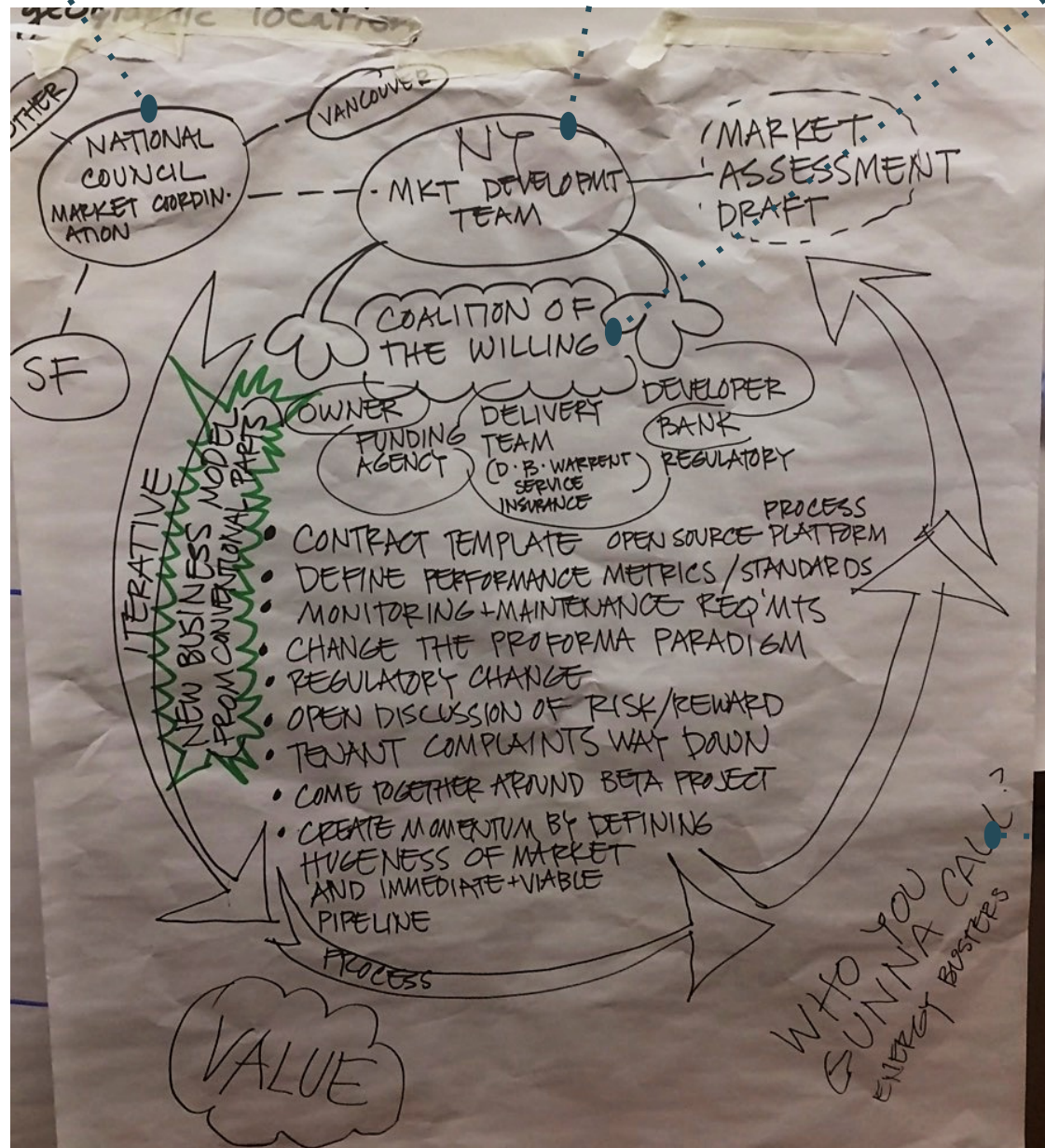
- Owners, funding agencies, delivery team, developers, bank, regulatory agencies, property owners
- Regular communication and coordination to iteratively create market requirement, demand, and product innovation

Scalable Solution:

- By growing a knowledge base across projects, geographies, stakeholders, we create a scalable solution
- Assets are open source
- Included:
 - Contract template
 - Defined performance metrics and standards
 - Monitoring and maintenance requirements
 - New proforma paradigm

Activities:

- Open discussion of risk/reward
- Reduced tenant complaints
- Collaboration around a beta project
- Create momentum by quantifying large market size and immediate, viable pipeline



Who you gonna call? **ENERGY BUSTERS!!**

Delivery Model: Action Plan

6 mo		12 mo	18 mo +
Activities	• Hand select New York Market Development Team (3 people) • Form NY development entity (separate from NYSERDA) • Clarify objectives and create performance standards • Conduct market assessment • Create “pitch” demonstrating value to potential stakeholders and participants • Conduct initial outreach • Set up National Council • Form advisory group (e.g. Governor's Task Force)	• Define criteria for qualified developers • Invite teams to define deal flow • Line up “Coalition of the Willing” • Iterate performance spec – 2.0 • Build overall pipeline	• Retrofit private development project in New York • Scale to additional cities and regions
Stakeholders	• NYSERDA • NY Market Development Team • Energiesprong • Developers, contractors (Skanska, Related) • Suppliers • RMI • NZEC • HPD • EACR • Other cities		

Delivery Model: Coaching Feedback

- How is the market development team formed, paid, managed?
- What regulatory changes are needed?
- Who bears the most risk, who is selling the solution?
- How is the NY market development team different from the building owner/project manager?

Technical Solution Breakout Group

Facilitator – Hayes Zirnhelt, Rocky Mountain Institute

Katrin Klingenberg, Passive House Institute US

Bruce Fowle, FXFOWLE Architects

Sam Rashkin, US Department of Energy

Chris Corson, Ecocor

Chad Gillespie, Mitsubishi

Antoine Habellion, Roxul

Brandon Franks, Goodman Manufacturing

Nolan Agopian, Renewaire

Jasper van den Munckhof, Energiesprong

Adam Stenftenagel, Snugg Home

Brent Trenga, Kingspan Panels

Technical Solution: Fundamental Questions

- What is the best building stock / archetype to start on?
- What does the technical solution look like if we were to do this today?
 - Replacing vs. covering brick facades?
 - Distributed vs. centralized HVAC solutions?
- What technical developments are needed to bring the costs down/enable scaling?
- What are the big process related opportunities that can bring down costs of a retrofit (i.e. timing, getting multiple benefits)?



Technical Solution: Elements

Baseline / Scope:

The group focused on a typical New York six to ten story apartment building, roughly 1960's – 70's vintage



- Brick façade (of questionable quality), CMU inner wall
- Heated with steam radiators, cooled with window AC units, ventilation from exhaust fans and infiltration only
- Shelf angle likely in poor condition
- Structural assessment needed for each building if considering mounting to existing façade
- Under Local Law 11, brick must be inspected every five years, may require replacement

HVAC Solution:

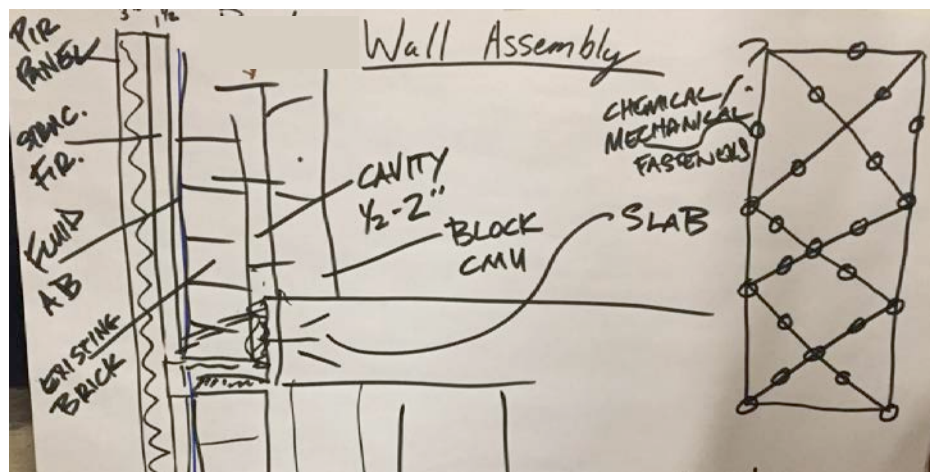
“Magic Box” – distributed, all-in-one unit to provide heating, cooling, ventilation, domestic hot water, dehumidification using high efficiency air source heat pumps



- Integrated into wall panel, one per floor
- Will need to run a small duct to bathroom
- Such a system can be put together with existing technology (possibly with the exception of DHW), but may be a bit clunky
- Will take roughly two years to get a refined version out (need UL listing etc.)

Envelope Retrofit Solution:

- Panel retrofit without removing brick, if brick is in good condition
- Panel retrofit replacing brick (being done now)



- A solution exists and is being done by Kingspan
- Done in complete panels, mounted into slab
- R-26 insulation panel
- High density foam window bucks
- Balconies are a concern for thermal bridging, may be best to cut off and rebuild
- For historic buildings an interior insulation retrofit solution will be needed, but this it doesn't make sense to start here (options like Sto exist that are open to moisture diffusion)

Timing and Process Solutions:

- Leverage Local Law 11, if brick needs to be replaced this presents a large opportunity to bring costs down of NZE envelope retrofit
- Look at database of non-complying buildings
- Look for opportunities to build reduced maintenance into business case
- Typical façade upgrade is \$200/ft², > \$18,000 per unit baseline cost
- Standardize technical requirements to allow for scaled solution development
- Create a visually appealing package to help drive demand and interest
- Provide maintenance as part of the package, i.e. avoid need for users to maintain HVAC etc.

Technical Solution: Action Plan

	Planning / Sketch Phase	Pilot Phase	Monitoring and Optimization	Scale Up/ Long-Term
Activities	• NY design competition • Analysis of building typologies to identify main archetypes by attributes, and challenges to address (plan to retrofit simpler archetypes first) • Façade types • Architectural details, e.g. fire escapes • Structural assessment • Envelope assessment (moisture, durability) • Technical requirements – PHIUS / RMI • E.g. max heating and cooling load, total EUI, etc. • Establish quality assurance process • Potential supply chain map • Set up monitoring plan and assess baseline • Occupant satisfaction (in addition to energy)	• First prototype of “Magic Box” • First pilot complete • Develop monitoring systems and dashboard • Value engineering • Solid ‘visual pitch’ developed	• Monitor pilots • Evaluate results • Post commission • Start second round of pilots • Campaign to promote program	• Scale to market based segment (may start during monitoring and optimization stage as well) • Scale to additional building archetypes

Technical Solution: Coaching Feedback

- Make magic box feature of retrofit, not nebulous element.
- Occupants must understand the magic box or it may not be used correctly (e.g. HRVs have been bypassed or shut off).
- How would magic box be accessible for maintenance?
- When would it make sense to reuse existing HVAC distribution system vs. the distributed magic box approach?
- How can seismic upgrades be leveraged or bundled to make envelope retrofit more cost effective?
- Reskinning can create additional savings due to Local Law 11 in NYC (brick inspection).
- How is the initial building assessment done (including structural)?
- Can you develop an interior insulation solution instead of exterior cladding?
- What could be monetized?
- Is property line encroachment a barrier to issue for exterior insulation retrofits?
 - No, at least not in New York.



This convening was made possible by the generous support of:
Carbon Neutral Cities Alliance
Rockefeller Brothers Fund

Find more information at:
<http://www.rmi.org/residentialenergyplus>



SF Environment

Our home. Our city. Our planet.

A Department of the City and County of San Francisco

Transforming global energy use to create a clean, prosperous, and secure low-carbon future.