Market Development

for

Building Energy Efficiency Retrofits

Concept Paper

December 3, 2008

RW Ventures

O-H Community Partners
Local Planning... Global Solutions

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Foreword

A fully functioning market in energy efficiency retrofits will achieve major reductions in carbon emissions, and also represents an unprecedented opportunity for Chicago to generate billions of dollars in economic activity. This paper includes recommendations to catalyze the emergence of this market, including product innovations to unleash market demand and facilitate supply, institutional models and strategies for implementation, and complementary activities from the civic community and government.

It is, however, only a Concept Paper, emerging from a process designed to quickly capture the input and ideas of a diverse group of experts and market stakeholders, in order to offer a preliminary look at market development strategies for building energy efficiency retrofits. In many respects, reflecting the complexity of issues and ideas, the work goes considerably beyond a concept paper. At the same time, the project was unable to explore other areas, particularly issues related to specific market segments, in any depth.

We are grateful for the participation and support of The City of Chicago, and particularly the dedicated and thoughtful direction and participation of Karen Hobbs; the leadership of the Climate Change Task Force (Sadhu A. Johnston co-chair, Adele Simmons co-chair); the many key contributions of Julia Parzen, who along with Adele also conceived this project; the critical financial support of the Global Philanthropy Partnership; and particularly for the generous time and insightful ideas of our Advisors and Interviewees (listed in Appendices A and B).

We hope that the work will be useful in informing future public and private investments by government, business and non-profit institutions to launch a large scale new green building industry.

I. EXECUTIVE SUMMARY

Many exceptional efforts are underway on parallel, coordinated tracks to address aspects of the City of Chicago Climate Action Plan. One key part of the plan articulates a goal for the energy efficiency retrofitting of 400,000 residential units and 9,200 commercial and industrial buildings in the next 12 years. Despite the fact that energy retrofitting is not just a good deed, but also a good investment, current retrofitting program capacity is only approximately 7,400 residential and 35 to 70 commercial and industrial units a year.[1] In the private market, investment in energy efficiency is the exception, not the rule. Why? More importantly, what can be done to cause retrofitting to occur at a fundamentally different scale?

This particular project was conceived as a high level concept brainstorming, taking nothing for granted, and with a particular focus on market systems. What follows are a few hopefully big ideas on how to fundamentally change – indeed, jump-start – a new market for retrofits, and then on how complementary civic and governmental sector activities might shape, enable and extend these market efforts.

The overall vision is to get the market working at scale. When this happens, every homeowner has the information they need to make rational decisions about whether, how, and how much they desire to improve their energy performance. And suppliers can respond to consumer demand for retrofits with a consistent, efficient and affordable solution.

In essence, two key barriers seem to be preventing this market from scaling up. First, on the demand side, the value of energy retrofitting is not reflected in the market price of homes, largely because of an information imperfection – it cannot be easily and reliably measured and communicated in the marketplace. Second, on the supply side, the "product" of delivering the retrofit is not easily standardized, nor is there a simple and uniform process for "mass customization" and delivery. As a result, the transaction costs make the deal too cumbersome, and the returns too uncertain.

These are solvable problems. First, we need the equivalent of an "MPG" ("miles per gallon") rating for homes that is simple, reliable, easily obtained and whose real economic value is clear. This would be the roll-up of a series of layered information products that describe the value of retrofits with respect to the basic factors that determine energy efficiency. It would ultimately be provided for every home, with different ratings and, if desired, levels of formal certifications. As the ratings reflect genuine savings and equity investment, and as demand grows for higher ratings, their intrinsic value will be reflected in housing markets – and become explicit. Working with the real estate industry – appraisers, brokers, contractors and others – in combination with

[1] The figures reported throughout this paper, as well as the assumptions made to identify costs and savings associated with energy efficiency, are based on the work of others and cited accordingly. The authors of this report accepted these assumptions as a starting point in order to get a broad sense of the size of the market and to develop the concept. In further iterations of this work, the assumptions will be validated with local data.

an educational marketing campaign, it should be possible (as genuine economic value becomes incorporated in the marketplace) to generate large scale demand, fundamentally changing the dynamics of energy retrofitting. People want more fuel efficient cars, and they will want more energy efficient homes, once the value is clear and realizable.

In particular, these ***information products*** would include:

(1) An *energy efficiency "Scoring System"* with a metric that is equivalent to the "MPG" ("miles per gallon") rating for comparing the relative efficiency of homes, which captures all aspects of energy usage levels, including building envelopes, mechanical systems, appliances and occupants' behavior. The metric will be developed, like credit scores, using a model-based approach (rather than a home-by-home full audit approach), based on a combination of utility, assessor, survey, sampled self-reporting and audits and other data, and will continually improve as participation and usage increase, including through an online scoring system and database. The score will be simple, reliable, inexpensive and easy to obtain. Although significant initial investments will be required to build the model, the marginal cost of scoring each home once the model is developed will be negligible. This score will ultimately enable tracking over time and comparison among similar homes, revealing the real economic value of improved efficiency.

(2) *Certification standards for authenticating the energy efficiency capacity* of a building. At the initial stages of market development, a certification system will be available to achieve greater accuracy and confidence in, and specifically authenticate, the scoring for any given building, including with respect to the performance of the building envelope, systems and appliances. Different levels of building performance would achieve different certifications – say, from red to platinum. These certifications will require an energy audit, completed by a licensed professional and will be compatible with existing certification systems (e.g. HERS).

(3) *Energy usage monitoring systems* for tracking and adjusting energy consumption behavior on a daily basis. These products, such as advanced communicating meters and in-home energy networks, give real-time feedback on consumption and electricity prices, are just becoming available, and will increasingly ensure that energy usage levels and the economic impacts are continuously visible and understood by occupants. Over time, this information will influence both homeowner usage behavior and retrofit purchase decisions.

Effort, and perhaps subsidy, will be necessary to jump-start the supply side as well, but we think less so. First, the information products that certify the status, needs and potential of each house will make it clearer to contractors what products are needed. Furthermore, as demand takes off, the supply side will tend to organize itself – that is how markets work where there is money to be made.

Nevertheless, to get started, we propose the creation of new products and services that can simplify and standardize the retrofit purchase and delivery experience for

homeowners, increase product affordability, increase producer capacity to service future demand, and lower associated transaction costs. These products are:

(1) User support services that conform to a more accessible two-step "process" for homeowners. This entails coordinating everything necessary to complete the retrofit from using the Scoring System to assess performance and select improvements to hiring a contractor to prepare the scope of work, provide financing, and perform retrofits. The easier it is for homeowners and suppliers to connect, the less costly and more attractive it is for both to participate in the retrofit market.

(2) Other supply chain development products and services to support the growth of the retrofit "supply chain" (consisting of accredited contractors, special financing, qualified professionals, available workforce, and certified auditors/inspectors) to meet the demands of a 40,000 to 60,000 retrofits per year market.

(3) *New financial products* are also proposed, tailored to the building retrofit market, to address access to capital for homeowners and risk for lenders.

The market system operates in the context of social/civic and political/governmental systems which also have key roles to play, particularly considering the public benefits (in addition to homeowner economic benefits) flowing from the reduced emissions associated with energy retrofits. These roles include market enabling activity, particularly support for information products and subsidies to address the market imperfections; use of the property assessment and tax system, utility bills and building codes, and other governmental and quasi-governmental activity to shape, incent and jump-start the market, and to reduce transaction costs; and subsidies to help the consumer segments (and particularly the lowest income segments) that the market cannot reach.

Finally, a tentative institutional design is proposed for a new organization that would lead the roll-out of the new products and strategies that are needed to jump-start the market for energy efficiency retrofits. These include financial products, information products, user support services, supply chain development and an applied R&D center. In particular, we envision the creation of two new temporary regional institutions (under one umbrella organization) to support retrofit market development in collaboration with a wide range of stakeholders (including for instance local government agencies, civic organizations, realtors, financial institution and utility firms).

- An Energy Efficiency Services Organization (EESO) to support the development and market deployment of information tools; user support services; and supply chain development. In addition to products and services, the EESO will include marketing and communications, as well as a research and innovation function.
- An Energy Efficiency Finance Investment Bank to aggregate capital sources; reduce risk for private lenders; and stimulate the creation of new finance products for building retrofits.

Ultimately, the institution will need to undertake all of these activities in order to achieve the market penetration goals laid out in the CCA Plan. To get started, it will need to focus first on key leverage points, where building owners are otherwise engaged in transactions. It will also have to enable homeowners to proceed incrementally, at their own pace, supporting development of a market that accommodates potential consumers at different starting points, with differing appetites. It is important to note that the mission of this institution will be to seed market activity, and that its services will no longer be needed once the market reaches the desired scale. Therefore, this should be conceived as a temporary institution that will play a vital role early on and then work itself out of business.

This is just a concept paper – much more work needs to be done to fill out and test these ideas, to confirm their feasibility, and to undertake full scale business planning and implementation to bring them to fruition. Yet we are encouraged that this marketplace can be grown substantially and, once started, could readily achieve the retrofit goals while providing a huge economic development boost to the region, resulting in the creation of thousands of new jobs; hundreds if not thousands of new businesses; and attraction of billions of dollars of investment capital. Good ideas that are also good investments, with a little help getting into the marketplace, tend to do that.

II. PROJECT BACKGROUND, SCOPE AND APPROACH

Background

The idea of energy efficient investment as a means to address both environmental and energy consumption issues was first popularized in the mid-70s. Since then, as energy prices rose and concerns about global warming and resource depletion emerged, municipalities across the country began focusing on implementing large-scale energy efficiency measures for both their environmental and economic benefits. Since 1989, the City of Chicago under the leadership of Mayor Daley has been actively working to support emission and energy reduction initiatives.[2]

Section II - At a Glance:

- ***Background:*** The Chicago Climate Action Plan comprehensively builds on a long history of initiatives to reduce emissions, led by the public, private and civic community.
- The CCA Plan establishes a hard target for reductions, and includes as a key strategy the retrofit of over 400,000 residential and 9,200 commercial/industrial buildings by 2020.
- ***Scope:*** This Concept Paper examines whether a private market for building retrofitting can be developed, and if so, what products, services and delivery mechanisms are necessary to cause its emergence. The project primarily focused on what appears to be the most challenging market segment, single family and small multi-unit (2 to 4 units) buildings.
- ***Approach:*** This concept paper is the output of a stage one project, based on heavily staffed brainstorming by a diverse team of specialists who were tasked with generating preliminary ideas and approaches for transformational market activity.

Over the last two years, the City of Chicago has been engaged in the Chicago Climate Action (CCA) Planning Process, an aggressive initiative to establish hard targets, innovative strategies, and a comprehensive plan for reducing green house gas emissions and preparing for climate change. The City emerged from the CCA Planning Process on September 18, 2008 and publicly announced its goal to achieve 25% reduction in 1990 carbon emission levels by 2020. The CCA Plan identifies five principal strategies to achieve this goal: (1) improving the energy efficiency of buildings; (2) increasing the use of renewable energy and standards at fossil fuel plants; (3) reducing the use and increasing the fuel efficiency of vehicles; (4) improving waste and industrial processes; and (5) preparing and adapting for future climate changes.[3]

Given that buildings account for nearly 70% of all carbon dioxide emissions in the City of Chicago, the buildings energy efficiency strategy is critical. Meeting the carbon emissions reduction goal will require energy efficiency retrofitting of approximately 400,000 residential, 9,000 commercial, and 200 industrial buildings. If approached as a fully subsidized public project, the investment required to achieve the residential building retrofit target alone is stratospheric, upwards of $2 billion.[4] There is broad consensus,

[2] Chicago Climate Task Force. *Chicago Climate Action Plan*. Chicago: Consolidated Printing. Pages 1-24.
[3] Chicago Climate Task Force. *Chicago Climate Action Plan*. Chicago: Consolidated Printing. Pages 1-24.
[4] Center for Neighborhood Technology analysis conducted as part of Chicago Climate Action Plan research.

however, that retrofits genuinely are *investments*, in the sense that they generate a return in the form of reduced energy costs and, potentially, in the form of increased equity value of the properties. However, the low levels of market activity do not currently reflect this economic opportunity.

Scope

The first phase of this project was conceived as a high level examination of whether market forces could be harnessed to cause building energy efficiency retrofitting to occur on a much larger scale and, if so, what types of products, services and delivery systems would cause that market to develop. Market activity, of course, is enabled and complemented by the activities of government and the civic sector. Conceptually, three distinct systems – governmental, civic and economic – can be brought to bear to cause retrofits. The City could simply mandate that everyone do it (at least in theory); enormous amounts of funding could be provided to ramp up the energy retrofitting activities of the non-profits who are currently leading the way; or, perhaps, the market for retrofitting can be grown such that homeowners invest in it on their own. In practice, of course, these three systems, if working well, reinforce and complement each other, and new activities in all three will be necessary. Others are focusing, for example, on regulatory strategies. Our focus is on market strategies, and on the other two sectors only with respect to how they shape the market and address its imperfections and gaps.

The scope of this project is also limited to existing buildings (hence, retrofitting). How to assure energy efficiency in new construction is currently being studied and addressed by other groups (and, by the way, more readily lends itself at least in part to governmental/regulatory strategies, as exemplified by Chicago's new Green Building Code). Furthermore, within the existing building category, we have primarily focused on single-family residential properties (including small, 2-4 unit properties).[5] Preliminary review revealed that developing a market in this segment would be most challenging, suggesting that if the project could figure out how to make this market segment work, many of the solutions might translate to larger multifamily as well as commercial and industrial segments (which also likely need much less intervention).

Although this document sometimes references specific projects, technologies, and proposed plans that help elucidate the analysis or recommendations, the project was not intended to and did not thoroughly review or summarize the many outstanding existing building retrofit initiatives, and surely does not do them justice. Our limited focus is on exploring market-based strategies which may complement current activity and lead to fundamental, large scale change in retrofit behavior.

Also, throughout this paper we reference specific numbers associated with costs, payback periods, interest rates, and other assumptions. These numbers are drawn from credible sources (footnoted throughout the document), but they have not been independently

[5] Note that throughout the report "single family" is meant to include these small multi-unit properties. This usage is consistent with that of the City's Department of Housing.

verified. Rather, they are accepted as sufficient for use to illustrate specific points and guide thinking about the market for energy efficiency retrofits.

Approach

This is a concept paper – the output of a stage one project designed as a "quick and dirty" exploratory undertaking, to try to generate some new ideas and approaches, and not yet intended to examine in detail the broad range and complexity of the issues. Rather, we proceeded through a heavily staffed series of brainstorming sessions, informed by targeted literature reviews and interviews. In particular, the project proceeded through:

(1) Convening a diverse team of specialists with experience in market analysis, product development and institutional design, as well as with strong expertise in the areas of energy efficiency, real estate, finance, economic development and energy policy;

(2) Assembling and reviewing selected reports and background information about the City of Chicago's Climate Action Plan, current and proposed energy efficiency retrofit initiatives throughout the country, regulatory models, and funding strategies;

(3) Hosting a series of team brainstorming meetings to develop, discuss, and refine hypotheses about market barriers, potential product and service solutions and institutions to serve as delivery systems;

(4) Conducting interviews with stakeholders in this sector to test hypotheses, including potential and existing customers (i.e. homeowners) and suppliers (i.e. auditors, contractors, etc.), certification firms, nonprofit program operators, and real estate market professionals (i.e. realtors, appraisers, lenders, other experts, etc.);

(5) Synthesizing and codifying key recommendations, relevant linkages, and product/institution development requirements.

Members of the project team are identified in Appendix B.

III. MARKET THEORY & RETROFIT MARKET BACKGROUND

Transformation Systems

Given the dramatic increase in building energy efficiency retrofit activity required to achieve the CCA Plan 12-year goal, there is a clear need for large-scale transformation within this sector. Transformation, by definition, cannot be isolated or incremental; it requires innovations leading to systemic changes and breakthrough results.

Three interacting systems are potentially in play in any large scale transformation of this sort: social, political and economic, corresponding roughly to civic, governmental and market activity.[6] These systems are not mutually exclusive, but symbiotic – dependent on each other for greater success. They each play differing, complementary roles in varying types of transformative activity. It is often the case that some combination of the three systems must be brought to bear to achieve and sustain scale in a particular sector.

Section III - At a Glance:

- ***Transformation Systems:*** Large scale transformation is required to achieve CCA Plan goals. Transformation is a function of three interacting systems – market, civic and government. The focus of this work is to explore transformative market approaches; civic and governmental initiatives will be explored as necessary to generating early stage market activity and addressing market gaps.
- ***Market Theory:*** The principal aim of market development is to simulate a healthy level of transaction activity. To do so, interventions at multiple points may be required to increase demand, increase suitable supply, and reduce transaction costs. "Smart subsidies" are often required for these market-starting activities.
- ***Energy Efficiency Retrofits:*** Currently, retrofit products can include a range of improvements that are often delivered without a uniform process, and the results of which cannot be easily and affordably measured.
- ***Current Reality:*** The retrofit goals in the CCA Plan are unprecedented and are not likely to be achieved as a result of current market activity and/or by scaling existing programmatic efforts.
- ***Economics of Retrofits:*** Retrofits are a good investment.

In particular, the roles that each system plays in generating innovations that potentially lead to breakthroughs and systemic change can be summarized as follows:

- *Market* – The private sector demands, creates and invests in new products and product delivery, and inherently attracts capital and human resources to take them to scale.
- *Civic* – The civic community is often instrumental in early stage research and product development, technical assistance, funding and information resources that shape and drive market activity, as well as addressing issues not suited for market solutions.

[6] These systems, of course, interact with a fourth system – the natural one. In fact, it is exactly this interaction the Plan is ultimately trying to influence. For present purposes, however, we are concerned with human systems, since we are trying to change human activity in retrofitting.

- *Governmental* – The government provides public goods, as well as market infrastructure and regulatory supervision which enables, shapes, leverages and subsidizes civic and particularly market activity.

This project focuses on developing a large scale, self-sustaining market for building energy efficiency retrofits. As part of market development strategies, it will be important to identify civic and governmental initiatives to jump-start and shape market activity, and to address gaps that the market cannot meet.

Market Theory

The term "market development" refers to the use of market-oriented tools to evolve markets to the point where they are self-organizing and self-sustaining, drawing well-established sources of private investment. Developing a market is a very different strategy than creating an enterprise or a program, although enterprises and programs are often elements of a market development strategy.

The ways in which markets evolve are often framed in the context of product and industry "life cycles". Most theories articulate this in several stages of market development (which can be summarized for simplicity as "early market," "growth" and "maturity"), characterized by differences in industry structure and in the type of consumer segments that choose to purchase a given product.[7] In particular, in the early market stage the industry is fragmented, with numerous firms providing specialized services, while demand is limited to innovators and "early adopters." The market grows as demand increases (from "early adopters" to an "early majority" of consumers) and more and more businesses enter the market.[8] The maturity stage is reached when a majority of consumers are participating, fewer firms are entering the market and some begin to leave, and sales volume reaches a steady state.

Market growth is manifested by an increase in the number of transactions taking place between consumers and suppliers, and the minimizing of uncertainties and risks that prevent the robust "transaction abundance" that characterizes healthy markets.[9] In this particular case, we are trying to stimulate building energy efficiency retrofit transactions.

In order to grow this market, our strategies are targeted at:

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[7] See, e.g., Philip Kotler, "Marketing Management," Prentice Hall, 2003; and Everett Rogers. "Diffusion of Innovations", Free Press, 2003.

[8] The growth stage is also characterized by a shake-out in the industry, in which less competitive businesses close and the first mergers take place.

[9] Particularly in the circumstances here, as described below, where energy retrofitting can be made to be a good economic investment (so there could be demand and supply of a product and market transaction that are viable), market-making in its most fundamental sense is about creating a level of trust between buyers and sellers, with a minimum level of friction – and ultimately with as little as necessary a level of involvement by the public sector.

- Encouraging Consumption: increasing building owner/occupant demand for energy efficiency retrofits;
- Boosting Production: increasing the market capacity to supply appropriate, accessible and affordable retrofits; and
- Facilitating Exchange: reducing the transaction costs of efficiently connecting customers with suppliers.

Effective market development activities often have to be multi-faceted, addressing all three of these market functions (production, consumption, exchange) simultaneously to overcome varied barriers to healthy market transactions. Our analysis and recommendations for development of the building retrofit market begins to explore all of these functions:

- Understanding and development of the demand side (e.g. what do users require in terms of a value proposition and how can their confidence in the market be increased).
- Understanding of the supply side value stream and its development, including product development, enterprise development and workforce development.
- Development of information assets that clarify the nature of opportunities, as well as the risks associated with them, to reduce transaction costs – specifically measurement and finding costs.
- Effective organizing of investment vehicles and liquidity instruments at multiple stages of a transaction (often including development of market-specific underwriting models and shared parameters that create some level of standardization in financial transactions).
- Public investments and regulation to provide market infrastructure, confidence and predictability.

The attraction of markets is that they naturally achieve scale and are self-sustaining – they pay for themselves. Nevertheless, subsidy is often required to launch new markets, and to generate activity the market will not cause (such as retrofits for the lowest income households). The key principle here, however, is that subsidy should generate, leverage or address gaps in the market, rather than supplant it. For instance, government funding helped develop the technology that resulted in the creation of the personal computer. However, it did not take government subsidies for the PC to replace typewriters as the technology of choice for consumers: the market took care of that because the PC was a superior product that saved people time and increased their productivity, and as such people were willing to spend the money and buy it.

Use of public and civic funds must be carefully tailored to cause the market to achieve public goals it would not otherwise achieve, or to achieve those goals the market cannot

achieve. In other words, focus on "smart subsidy," and avoid wherever possible permanent, on-going subsidy of transactions.[10]

"Smart subsidies" might include:

- Start-up costs for market development institutions;
- Research and development costs for new products, particularly high risk products;
- Subsidies for users who cannot afford to pay market prices;
- Costs for field development and capacity building;
- Costs for building demand, such as initial consumer education;
- Costs of building capital access.

The preliminary recommendations described throughout the report reflect these principles:

- Start up costs for new institutions to support market development;
- Development of new information products;
- Support for the development of suitable retrofit services, and the necessary contractors and workforce;
- Costs of communication and marketing strategies, and technical support for customers, particularly in the early stages of market development;
- Pooled risk financing to initially lower the costs of capital for retrofits as the market emerges; and
- Subsidies for retrofits for lower-income households.

This project focuses on developing a large scale, self-sustaining market for building energy efficiency retrofits. Once that market fully emerges, it takes over most of these functions, such that most of these are genuinely start-up costs which will not be recurring. As part of market development strategies, it will be important to identify civic and governmental initiatives not just to jump-start and shape market activity, and also to address gaps that the market cannot meet.

[10] For more insights on the use of "smart subsidies" see "Capital Plus – The Challenge of Development in Development Finance Institutions", Development Finance Forum, 2004. (www.dfforum.com). For discussion of market based development generally, the role of information resources in market based development, and aligning market principles and mechanisms with public objectives, see Robert Weissbourd and Riccardo Bodini, "Market-based Economic Development," The Brookings Institution, 2005; Robert Weissbourd and Riccardo Bodini, "Using Information Resources to Enhance Urban Markets," The Brookings Institution, 2005; and Robert Weissbourd, "Into the Economic Mainstream: a Discussion Paper on Bi-Partisan Policies for Inclusive Economic Growth," National Community Capital Association, 2006.

Energy Efficiency Retrofits – Market Background

Ultimately, in order to fully specify products and strategies for transforming the building retrofit market, it will be necessary to address its many distinct segments. These include, broadly: single-family (including 2-4 multi-unit), multifamily (5+ units), small commercial/industrial, and large commercial/industrial. However, the single-family and multi-unit residential segments have significantly distinct sub-segments based on age and type of construction and income of owners. Similarly, the Commercial/Industrial segments must be further segmented by business type, single or multiple users and other factors. Business type, in particular, reflects significant differences in the intensity of energy use and efficiency savings potential.[11] As described, this project focuses on single family and, except for a few observations in later sections, further levels of segmentation are beyond the scope of this concept phase.[12]

Depending on building conditions, increasing the energy efficiency of a building can involve improvements to the building envelope (i.e. walls, doors, windows, ceilings, roof, etc.); mechanical systems (i.e. heating, cooling, hot water); appliances (i.e. lighting systems, electronic devices, etc.); and building management practices.[13] While retrofits primarily address the first two issues, several of the products and services proposed in this paper would also impact energy consumption related to appliances and building management.

The technologies and supplies that are typically used to complete the energy efficiency improvements outlined above include: sealant, insulation, energy efficient windows, high efficiency boilers and furnaces, programmable thermostats, solar or tankless hot water systems, compact fluorescent bulbs, energy efficient appliances, and conservation strategies.[14]

Standard Building Energy Efficiency Measures			
Building	**Mechanical**	**Electrical/Lighting**	**Building**

[11] Center for Neighborhood Technology and the Delta Institute, *Energy Efficiency Implementation in Chicago: An Analysis of Energy Consumption and Financing Mechanisms*, Working Final Draft. August 13, 2008.

[12] Preliminary review suggests that the market for single-family and multi-unit building retrofits is the most challenging, which is to say that this category is where the market failure is greatest and where there has been the least private market attention. This document focuses primarily on this segment because any progress made in stimulating this market will likely be applicable and/or adaptable to other market segments. In addition, this segment represents a large share of the total housing stock in Chicago (67% of all residential properties) and thus could play a major role in contributing to the CCA Plan goal. Section VII begins to explore relevant differences between these segments and not only highlight proposed applications, but also raise additional questions that need to be addressed to identify needed product and service solutions specific to each segment.

[13] "Building management" refers to the lifestyle factors that impact the level of energy consumption in a household. The energy use of a building is not just about the building systems or appliances; it is also about consumer behavior, which includes everything from the number of occupants to how often they use the air conditioner. Chicago Climate Task Force. *Chicago Climate Action Plan*. Chicago: Consolidated Printing. Pages 1-24.

[14] Chicago Climate Task Force. *Chicago Climate Action Plan*. Chicago: Consolidated Printing. Pages 1-24.

Envelope	Systems	& Appliances	Energy Management
• Seal cracks and holes in walls, ceiling, basement • Insulate roof with cellulose • Insulate doors • Replace window frame with thermal pane • Insulate ceiling cavity	• Insulation on heating & water pipes • Lo-flow showers and restrictors • New heating system • Replace vents • Upgrade furnace boiler	• Replace incandescent w/ fluorescent lights/lamps • Install Timers on lighting • New energy efficient Appliances (i.e. television, microwave, refrigerator, etc.)	• Efficient Operation of Equipment, regular maintenance, reducing set-points and conservation of: . Electricity . Gas . Water

Partly due to the variety of operations involved, there is no standard process for completing retrofits in the private market. Practices and experiences often vary based on homeowner needs, sophistication, resources and supplier capacity. In most cases, there are too many steps, multiple unrelated actors, and a complex set of information to navigate. The retrofit experience can involve some or all of the following steps: (1) find and hire an auditor; (2) complete an audit; (3) review the audit; (4) find a contractor or multiple contractors to develop a project scope; (5) review and approve scope and separately hire each contractor; (6) complete retrofit work (i.e. building envelope, mechanical systems, lighting, etc.); and (7) hire an auditor to complete a performance test. In the case where homeowners need financing or are seeking energy efficiency certifications, there are even more steps and suppliers. The time and expenses associated with these steps translate into high transaction costs that often make the activity unattractive and cost prohibitive for both homeowners and suppliers.

Moreover, it is difficult to evaluate the need for, and benefits of, energy efficiency retrofits. Although presently there are scoring systems that evaluate building energy consumption in the marketplace, they all have certain disadvantages and limitations. Generally, these systems utilize metrics and standards that are not easily understood by consumers. Each of the existing scoring systems also has one or more of the following issues: (1) collecting the required data is time consuming and expensive; (2) only building design is measured, and not performance; (3) there is no differentiation between building management and building systems; or (4) the system has limited applicability to particular property types (i.e. multifamily versus single family) and/or properties that are in a particular condition (i.e. newly constructed versus existing buildings). The following table identifies generally accepted industry scoring systems and metrics and notes the main advantages and disadvantages of each:

What is System Measuring?	Does it Measure Design or Actual Performance?	What is the Metric or Standard?	Description of Metric or Standard	What are the Advantages?	What are the Disadvantages?
Building envelope only	Design	R-Value/Code Compliance	Efficiency ratings of insulation, windows,	Can be regulated	Does not reflect installation quality

			building envelope (e.g. R-41 for roof insulation)		or actual consumption
	Actual	Blower Door Test/ Infrared Test	Measured on-sight using equipment to pressurize the house, and identify leaks, measures how tight your home is e.g. your home can maintain 50 Pascals of air pressure	Provides actual data on how tight the home is	Expensive and time-consuming to collect this data, approximately $600/home. The test is not typically done on multifamily housing.
Building systems (i.e. envelope and mechanical systems)	Design	Code Compliance, Green Home Certification, Component of LEED certification	Insulation levels, efficiency of windows, efficiency of heating and cooling equipment	LEED brand is well-known	Expensive and time-consuming to collect this information.
	Actual	Energy Star	Insulation levels, efficiency of windows, efficiency of heating and cooling equipment + an inspection to show it was installed correctly and is operating well. Homes are compared to other like homes e.g. a score of 90 means that your home is better than 90% of all homes like yours	USEPA branded and nationally recognized	Expensive and time-consuming to collect this data, approximately $600/home.
Appliances	Design	Energy Star	Efficiency of refrigerator, window air conditioner, or other appliance	Easily regulated by code	Only has impact at purchase of new equipment
Behavior/Home Energy Management	Actual	Agile Waves Home Monitoring and other systems	Shows real time consumption in energy, dollars and carbon	Extensive information that can change behavior	Very expensive
All Energy Use	Actual	Energy Use Intensity	Kbtu/sq ft	Easy to calculate and could be readily available for every property	Doesn't differentiate behavior from building performance

Current Activity

The retrofit goals in the CCA Plan are unprecedented and are not likely to be achieved as a result of current market activity or by scaling existing programmatic efforts. No other city in the world has attempted or achieved targets of this scale. While more retrofit activity may be naturally occurring in the market than is currently recognized, industry experts suggest that private market activity is low and incremental in growth. Nonprofit programs in this sector have also achieved very low market shares. Based on a study of residential retrofit financing programs commissioned in 2007 by Efficiency Vermont, over 150 surveyed programs reported reaching less than 0.1% of their "potential" customers.[15]

[15] Fuller, Merriam. *Enabling Investments in Energy Efficiency: A study of programs that eliminate first cost barriers for the residential sector*. Efficiency Vermont. August 2008.

The scale of market penetration contemplated in the Chicago Climate Action Plan (400,000 residential units and 9,200 commercial/industrial units) would eventually require an annual rate of residential retrofitting reaching 40,000 to 60,000 units per year and an annual rate of 900 commercial/industrial building retrofits per year. According to a March 2008 report prepared by the Center for Neighborhood Technology and DELTA Institute, in aggregate, current publicly funded energy efficiency programs in Chicago have the capacity to retrofit approximately 7,400 residential units and 35 to 70 commercial/industrial buildings annually.[16] Given current program-based retrofit activity levels, it will take more than a half century to achieve the CCA Plan goals.

Given the subsidy levels that are fueling current retrofit program activity, the performance levels required to achieve the CCA Plan goals cannot be accomplished by simply strengthening and expanding the capacity of existing programs – both because the level of subsidy required would be unrealistic (upwards of $2 billion), and because current strategies are unlikely to achieve significant market penetration regardless of resource levels. Lastly, it is important to note that several leading organizations and initiatives that operate or fund energy efficiency retrofit initiatives in the United States (e.g. Clinton Climate Initiative; Efficiency Vermont; Cambridge Energy Alliance; and others) have identified many of the components required for a potential market-building strategy, but no one has integrated and implemented them at anywhere near the scale contemplated in the Chicago Climate Action Plan.

The Economics of Retrofits

The cost of energy efficiency retrofits, and the exact level and timing of benefits, of course vary a great deal for different buildings. In each case, the relationship between the actual cost of a building retrofit and the amount of energy savings – and so the degree to which the energy savings are sufficient to make the retrofit a good investment – is influenced by a number of different factors, including:

- The condition of the original building (i.e. age, construction type, quality; maintenance history, building size, etc.);
- The life of the retrofit (e.g. how many years will it last);
- The type of energy used by the building;
- The cost of energy;
- The behavior patterns of occupants and building managers; and
- The cost and terms of financing.

According to Clinton Foundation calculations, for residential retrofit projects in metropolitan areas like Chicago, the following is a fair estimate based on three different

[16] Center for Neighborhood Technology, Delta Institute, City of Chicago Department of Environment, *Chicago Climate Action Plan*: *Building a Strategy for Achieving Large Scale Energy Efficiency Retrofits in Chicago*, Preliminary Draft, March 2008.

scopes of work of per unit energy efficiency improvement costs and energy savings potential:[17]

Level of Retrofit	Cost Range	Energy Savings	Efficiency Improvements
Low Cost	$2,000 - $10,000	5-20%	Duct sealing air infiltration Attic insulation Compact fluorescents
Tailored	$10,000 - $20,000	20-40%	Add: HVAC Equipment upgrade Water heater upgrade New windows
Comprehensive	$30,000 - $40,000	40%+	Add: Comprehensive envelope improvements New appliances On-site solar thermal On-site solar PV

In most of the literature analyzing the "returns" on energy retrofits, the return is described in terms of a payback period. In particular, the return on an energy efficiency retrofit investment is usually estimated as a two to five year payback period, where "payback period" refers to how long it takes for the energy savings to match the original investment. For example, if a $2,000 investment produces $400 per year in savings, the payback period is five years.

The payback calculation on its own is necessary but not sufficient from a market point of view. To increase homeowner investment in retrofits, owners should know not only how long it takes to get their original investment back, but what the return on the investment (ROI) is. This return on investment could be captured in two ways: continued energy savings over the entire life of the retrofit; or, if the property is sold, an increase in the asset value of the home. Therefore, another way of presenting the economics of the retrofit investment to make its value more transparent is to present how the ROI translates (or should translate – a key purpose of the demand side of this project!) to an increase in the asset value of the home. [18]

When calculated, the estimated rate of return and potential increase in the asset value of the property from retrofits are substantial. According to a study commissioned by the Clinton Climate Initiative,[19] the big payback of energy efficiency repairs are: air sealing, attic insulation, ES lighting fixtures, and duct sealing. Together these items are estimated to cost $2,700 and save $400 a year in energy costs. Making the assumption that those

[17] Clinton Foundation - Clinton Climate Initiative. *CCI Residential Energy Efficiency Program Draft Proposal*. May 15, 2008.

[18] This is also important because homeowners may not retain ownership of a retrofitted property for the entire life of the retrofit, and so should want to be assured that they will generate a sufficient market return through the increased asset value upon sale.

[19] Clinton Foundation - Clinton Climate Initiative. *CCI Residential Energy Efficiency Program Draft Proposal*. May 15, 2008.

improvements have a 15 year life (either for the existing homeowner or capitalized into the value of the house), then the Internal Rate of Return (IRR) is 12% (not bad in this marketplace!).

Using the same facts, and presuming that the homeowner could finance these repairs at a 6.50% interest rate (the current rate for a 30 year fixed-rate mortgage), then the present value of the project is $3,761, which in a well-functioning market should be reflected in the value of the home (and in this example represents an increase in the home value of over $1,000 above the cost of the retrofit).

In sum, the financial returns associated with building energy efficiency retrofits are real and meaningful – retrofitting is a good investment. So why is this economic opportunity not resulting in more significant transaction activity in the marketplace?

IV. MARKET STRUCTURE, BARRIERS & OPPORTUNITIES

Market Structure

Section IV - At a Glance:

- ***Market Structure:*** varied stakeholders may offer leverage points to influence the emergence of a retrofit market.
- ***Barriers & Levers:*** In essence, two market barriers seem predominant. First, on the demand side, the value of energy retrofitting is not reflected in the market price of homes, largely because of an information imperfection – it cannot be easily and reliably measured and communicated in the marketplace. Second, on the supply side, the "product" of delivering the retrofit is not easily standardized, nor is there a simple and uniform process for "mass customization" and delivery. As a result, the transaction costs make the deal too cumbersome, and the returns too uncertain.

In addition to homeowners and contractors, a large number of actors and institutions affect, or might be influenced to affect, the emergence of a retrofit marketplace.

Energy auditors, building material and mechanical system equipment suppliers, utility firms and financial institutions all play important roles in providing energy and financial services in the real estate market, but do not currently have a well-defined role or consistent involvement in the retrofit market. Although real estate professionals, such as appraisers and realtors/brokers are not directly involved in the retrofit process, they are important stakeholders that establish value for building improvements in the real estate market.

Market Stakeholders

As the project considers leverage points for influencing these markets (more below), it will be important to be aware of the roles played and opportunities presented by these different market stakeholders.

Barriers & Levers

The investment value of retrofits – necessary to generate large-scale market demand – is not readily apparent, nor easily realized. This appears to flow in large part from

information imperfections in the marketplace. It is difficult and costly (in terms of time and money) to readily assess what levels of retrofit activity for specific homes will produce what savings, either for planning retrofit activity or evaluating actual performance. On the supply side, a standardized and convenient process is lacking, making the transaction costs of acquiring or delivering the customized product prohibitive.

The following is a summary of demand and supply barriers and potential levers for addressing these market challenges:

Market Demand

CATEGORY	BARRIERS	LEVERS
Emotional Factors	- Homeowners do not run their homes like businesses - Inertia	- Market the product at a point where something major is happening with the property (i.e. refinancing, acquisition, renovation project, etc.)
Difficult to Measure Savings	- There is no simple metric to measure savings (i.e. MPG)	- Provide a simple measurement and monitoring system
Not a Priority	- Energy costs/prices in the home have not risen to a level that motivates property owners to purchase retrofits	- Couple the retrofit with something property owners want
Lack of Trust	- No belief in the savings potential - Lack of consistent information about the performance, cost, and benefits of retrofits[20]	- Identify and utilize trusted advisors to market and sell (i.e. existing contractors, neighborhood groups, brokers, appraisers, lenders)
Inconvenient	- Lack of knowledge of where to go to purchase - Multiple vendors required to complete the retrofit - Significant time and cost required to assess savings opportunity, find and engage suppliers, and evaluate results	- Establish retrofit standards for qualifying vendors - Provide certification and other incentives and information for supply side of market to develop "mass customization" capacity to deliver simplified process/product packages
Market Actors Do Not Value	- No benefit/value reflected in the appraisal/market value	- Work with the appraiser and brokerage community to incorporate new metrics which quantify savings, and to market the value of energy efficient properties
Affordability	- Lack of affordability for certain market segments - Limited access to capital to support basic retrofits - Limited availability of resources to support "deep retrofits"	- Work with the lending community to establish underwriting standards and guarantee pools for financial products that have a streamlined approval process and do not require additional collateral

[20] Environmental Protection Agency. *Market Barriers to Green Development Report Summary – Draft.* July 2007.

Market Supply

CATEGORY/ BARRIERS	BARRIERS	LEVERS
High Cost of Sale	- Long geographic distances between jobs - Scheduling hassles - Low margins compared to transaction costs	Aggregate demand Bulk buy (installation services and/or products)
Barriers to Entry	- Expertise required to provide qualified auditing and general contracting services for retrofits	Establish retrofit standards for qualifying vendors
Not a Real Product	- The retrofit is not a real product. It is not tangible. "Out of sight, out of mind."	Design and package an integrated process: - Energy audit and equivalents - General contractor or specialty contractor to complete installation services - Post-retrofit performance testing - Certification, if desired - Financing, as needed

In summary, there are two key barriers that need to be addressed in order to develop a thriving market for energy efficiency retrofits. On the demand side, there is a need for more accurate, transparent and accessible information on what levels of retrofit activity will produce what savings for each homeowner, and on how that translates to increased asset value of the property. On the supply side, there is a need for a standardized and simplified process for the delivery of retrofits.

The barriers outlined above suggest that the market does not currently recognize the value of building energy efficiency retrofits and that the transaction costs are so high that they may outweigh the benefits from this investment. Developing this market will require addressing these key barriers.

V. THE VISION

The Vision

Section V - At a Glance:

- ***The Vision:*** Develop a fully functioning market where every homeowner wants to retrofit because the market recognizes the value, the necessary information is available in the marketplace, and suppliers have created products and services to meet the demand.
- ***Goals:*** To cause a market to emerge to meet the goal of 400,000 residential retrofits, every home needs an energy performance score, the scores need to be reflected in real market values, and suppliers need to deliver efficient, reliable and customized retrofits.
- ***Market Size:*** A 50% residential market penetration goal could generate upwards of $2 billion in new investments.

The vision, of course, is to develop a fully functioning market for building retrofits. In this vision, every building owner wants (as in: the market demands) to retrofit his or her home, because they are confident that the retrofit will generate savings, and in fact cause the home to go up in value in the real estate marketplace. Furthermore, they do not just want to retrofit, they actually do it, because the information that they need to make rational decisions about efficiency retrofits is readily available, as is the supply of contractors who provide easily accessible, efficient and affordable retrofits. In other words, the marketplace invests in retrofitting.

The rest of this concept paper explores the products, services and institutions that might accelerate the emergence of this marketplace, as well as address some of its limitations. First, though, a few overall and strategic goals, as well as a rough summary of market impact if these goals are achieved, are described below.

Goals

As stated above, the overall goal is to cause 400,000 residential units to complete basic residential retrofits within the next 12 years. If a fully functioning market emerges, it could easily scale to these numbers and beyond. In order to cause this market emergence, as described below, it will be necessary to achieve some strategic intermediate goals with respect to developing the market, which will serve as important indicators along the way.

In effect, we aspire to have the equivalent of an MPG ("miles per gallon") indicator of energy performance of every home, which would then drive market demand for various levels of energy efficiency retrofitting (some homeowners will still prefer an SUVs to a Prius, but hopefully at least a more energy efficient SUV). This demand, along with a reliable indicator, will then cause the real estate market to incorporate the value of the retrofit in the housing value (as auto values reflect their MPG ratings). The demand, along with clear metrics and measures, will also enable suppliers to more efficiently develop retrofit packages for different types of housing with different performance expectations, and will otherwise reduce the transaction costs in the marketplace. These

processes feed on themselves – as market activity grows, additional efficiencies are achieved, and rapid scaling is possible.

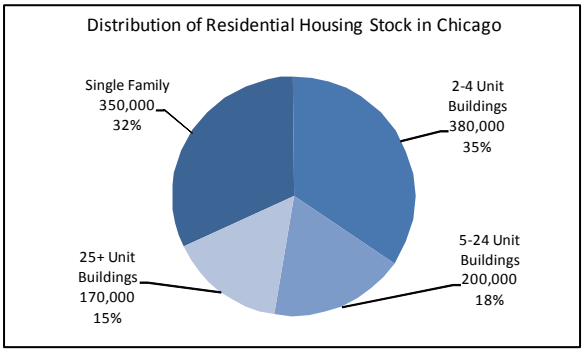
These strategic goals are not yet quantifiable at this project stage, but can be summarized as follows: (1) energy performance scores are established for virtually all homes within the City of Chicago; (2) the energy performance score of homes is a core factor in all real estate transactions; and (3) as demand for retrofits to achieve identified scores grows, and the nature of necessary retrofits becomes clearer as a result of the scoring system, an abundant supply of contractors emerges that can efficiently and reliably deliver customized retrofits. The products, services and institutional delivery systems necessary to achieve these goals are discussed in the next section.

Market Impact

Retrofitting 400,000 residential units, in a fully functioning market, could generate approximately $2 billion in direct economic activity (not including extensive multiplier effects). The following are key assumptions used to estimate the potential size of this market.

- According to the Center for Neighborhood Technology, although there are 1.1 million residential units, because of the age of the existing housing stock and future demolitions, it is predicted that 80% of the current housing stock will still exist in 2020 (approximately 840,000 housing units).

- The residential housing stock is split between single family, small multifamily (2 to 4 units) and larger multifamily (5+ units) as shown below:



- Energy retrofits in single family homes cost more on a per-unit basis than in multifamily homes, because the costs of the larger systems like boilers are spread over more units. Based on Clinton Foundation estimates, the total cost of conducting these retrofits are shown in the table below:

Units in Structure	Typical Retrofit cost per Household	Number of Households	Estimated Total Costs
one	$ 7,000	128,000	$ 896,000,000
two - four	$ 5,000	140,000	$ 700,000,000
five or more	$ 2,500	132,000	$ 330,000,000
TOTAL		**400,000**	**$ 1,926,000,000**

Note: In the table above, the 400,000 targeted units were allocated across the three categories based on the overall distribution in the Chicago housing market (reflected in the pie chart above).

- The total cost of the retrofits is a direct measure of the economic activity that would be generated by this market (approximately $2 billion). This does not take into account additional economic activity generated indirectly through multiplier effects (e.g. increased demand for raw materials needed for retrofits leading to increased production in the industry that produce those materials, and so forth).

VI. PRODUCT IDEAS TO GENERATE THE RETROFIT MARKET

To overcome market barriers and achieve the vision outlined above, we propose a series of new information products, market building services and financial products. Products are needed on both the demand and supply side, but proposed consumer demand solutions will set the stage for supply chain development activities.

Section VI - At a Glance:

- ***Information Products:*** three types of information products are proposed to enable homeowners to asses retrofit needs and performance, make the value of retrofits transparent, and lead to incorporation of the retrofit value in real estate markets:

  (1) Model-based energy efficiency scoring system
  (2) Standardized certification system
  (3) Energy usage monitoring system

  Each offers a less complex, more affordable, and less time intensive solution to assessing energy performance, evaluating potential, setting efficiency standards, and quantifying the benefits of retrofits.

- ***User Support Services:*** On the supply side, it will be important to reduce the complexity and inconvenience of current retrofitting practices. The process can be simplified and standardized by creating a User Support Service that will walk homeowners through a two step "process" and connect them to everything they need, including financing.

- ***New Financial Products and Capital Sources:*** In order to ensure that a broad base of consumers have access to capital to make purchases, financial products are needed for homeowners and risk mitigation products are needed for lenders. We recommend the creation of an Unsecured Loan Product for consumers that is low cost, convenient and can be sold through Certified Contractors and a loan guarantee pool to limit bank exposure.

- ***Other Supply Chain Development Products & Services:*** Other supply chain development products and services need to be created to ensure that once demand takes off, producer capacity issues do not slow or impede the growth of demand.

- ***Low-income Homeowners:*** The proposed information products will also stimulate demand among low-income consumers, but additional financing solutions and grant subsidies will be needed to address affordability issues.

Information Products

On the demand side, we need to address the system-level failure of the real estate market to reflect the value of retrofits, and the related, actor-level failure of homeowners to demand them. Both reflect that the value of retrofits is not transparent, i.e. not easily assessed, verified and transmitted. This is an information problem, calling for better information products.

Homeowners face difficulty and expense in assessing, setting and communicating their retrofit needs and goals. Currently, the primary tool that homeowners have at their disposal to assess and communicate current status, performance potential and energy efficiency benefits is a full energy audit, which can be time consuming and expensive. In addition, a full audit report can be quite complicated, while homeowners may want a set of summary indicators that they can easily interpret in order to make their investment decisions. Lastly, energy audits offer little if any economies of scale, as the cost of each audit is the same regardless of how many homeowners request one. This is a significant barrier given the large number of units that need to be evaluated.

To address these issues, we propose exploration and development of three types of information products: (1) a model-based energy efficiency scoring system, (2) a standardized certification system, and (3) an energy usage monitoring system. These

three products would offer a less complex, more affordable and less time intensive solution to assessing energy performance, evaluating potential, setting efficiency standards, and quantifying the benefits of retrofits than what is currently available. As explained in later sections, once the information products described above are readily available, they should be aggressively marketed to consumers, which will help people gain awareness about their value. Once individuals recognize that these products are valuable tools for determining demand and potential returns from retrofits, they will use them.

1. *Model-based Energy Efficiency Scoring System (Building Energy Performance Measurement)*

Currently, homeowners have difficulty understanding their home's current performance and potential, and thus setting energy efficiency goals. A uniform scoring system that measures the energy performance of homes and translates it to a simple "miles-per-gallon" like rating is needed. In addition to an overall score, homeowners should also receive a detailed breakdown of the rating, so that they can assess each particular energy component and its retrofit potential. From an implementation standpoint, the system also has to be relatively inexpensive to deploy at a large scale. The proposed scoring system is thus distinct from other measurement tools in the market place in three important ways.

First, the scoring system will use a model-based approach, rather than a case-by-case home audit approach. The key difference is that a modeled system would develop a baseline estimate of energy performance based on a sample of homes and using only a subset of the building characteristics that would be used in a full scale audit. Indeed, a similar strategy is used in consumer marketing to target direct mail advertising and in credit scoring to obtain a risk profile for each potential borrower. The common feature in these systems is that every housing unit (or household, or borrower in the case of marketing and credit scoring) can be evaluated using only a relatively small set of easily obtainable factors.[21]

While for any particular home a modeled result would not be as accurate as a full audit report, a well developed model can be accurate enough to enable an assessment of energy performance and guide investment decisions on energy retrofitting. Moreover, while a model-based scoring system will require an initial investment to get started (e.g. by building the information and data capacity, collecting data on actual retrofits and subsidizing full audits for a sample of homes), once the model is developed the marginal cost of assessing the energy efficiency of each individual home is negligible. The model could also be continually updated and refined with new data from additional assessments and retrofits, particularly as the retrofit market expands. As a result, its accuracy would improve over time.

[21] Ideally, all of the model parameters would be easily obtainable by the homeowner, which would simplify the evaluation process. It is also possible that the model will identify parameters that would require a quick assessment by an auditor.

Second, in addition to providing a simple "energy score" (a "miles-per-gallon" or "credit score" like rating), this system will estimate the energy usage of buildings at all four levels, including building envelope, mechanical systems, appliances, and behavior, and would have the ability to assess each level separately. Unlike existing tools, it will estimate the energy consumption of each building component as well as management/behavior for any type of building in any location. Based on current and potential consumption levels, the final score report will offer helpful guidelines about what improvements can be made in each area to increase energy efficiency. The ability to isolate and aggregate the energy consumption of each building component will give consumers a full and deep view of their performance. And it will enable them to make informed decisions about not only whether to improve their performance, but precisely what factors they would like to improve and by how much.

Third, the scoring system will be easily accessible to consumers. Unlike existing systems that can take four to five hours to collect and compute performance results, this system will not be time intensive. It should require no more than 15 minutes to 1 hour, depending on the various parameters that are required for input into the model. Therefore, once a baseline model is developed, this approach will enable rapid deployment and scalability.

There will be three primary ways for a homeowner to utilize the scoring system to obtain a score for their property. Each of these methods will utilize the energy score metric, but the segmentation of energy consumption by each building component and behavior will vary in precision and in the level of detail included in the report.

(1) *Auto-calculate*: Homeowners can log on to a website that scores the energy performance and potential of their home without requiring any input from the homeowner other than their address. This output would be based on the simplest data that can be collected across all homes in Chicago (such as Cook County assessor and local utility data), perhaps combined with a random sample of audits for different housing segments. The model would use this information to develop a simple overall score, which consumers can use to tabulate how each building component and behavior contributes to the score. As such, this method is the most simple but least precise. Although the calculations that homeowners can quickly make using these tools are not exact (because they do not use all of the parameters of the model), they give consumers sufficient information to understand not only their performance, but also the typical financial and environmental retrofit benefits for their particular type of home, as well as the rough facts needed to create improvement plans.

(2) *Self-assessment:* This method would require some additional inputs on the homeowner's part, but would also yield a more precise score. Homeowners can log on to the same energy performance web-based scoring system, pull their basic, "auto-calculate" score, and then adjust and segment that score along the parameters of the model that a homeowner can reasonably be expected to obtain by responding to a self-assessment survey. The survey will pose targeted questions about the building systems, appliances, and building management practices, which may include information about the type and age of mechanical systems, type of appliances, and electricity and gas usage patterns. As a result, the homeowner will obtain good

information on building performance and potential for energy efficiency that they can use to take desired action.

(3) *Basic energy audit:* This method will involve a licensed auditor to visit a home and assess any remaining model parameters that may not be easily obtained by the homeowner. While this step would add considerable tailoring and verification to the modeled estimates, it will not be necessary for many homeowners who have completed the self-assessment step, which will often be more than sufficient to inform them of what retrofit activity makes the most sense for them. If audits are undertaken, the data collected can then be uploaded and tabulated on the website, and then fed back into the model to improve its accuracy.

Owners will of course still have the option of requesting a full energy audit if they so choose, which does not use the model to establish a performance score. Rather, this method will involve a visit by a licensed auditor and provide an exact score on building performance and potential. In fact, a statistically significant sample of audits will be necessary to set up the model and evaluate its performance, and could be fully subsidized. When auditors will visit a home, they will be able to run tests while linked into the energy performance web-based scoring system. The data collected about the property as part of the test can then be uploaded and tabulated on the website.

The final score will be produced by the energy performance web system or registered on the auditor's device, and automatically emailed from the online system to the homeowner/occupant for their records. Because each method yields varying levels of accuracy, the score will also indicate which method was used to obtain the final score. An analogous, integrated, web-based rating system can be found in the automotive industry, where vehicle emissions control inspection stations link to and complete their tests directly within the Illinois Vehicle Services Department's electronic system.

One of the most attractive features of this scoring system is that it will be affordable. Based on CNT data, existing scoring systems are costly, running at about $400 or more. In the proposed scoring system, homeowners using the first two methods will be able to use the system free of charge. The basic energy audit would also be much cheaper because the auditor would have to spend less time in each home.

A great deal of work has already been done on scoring systems, particularly for commercial buildings, which could help inform the specification of the model. However, significant additional work must be done to develop the specific models, data and formulas that will be used to complete these calculations. These are key product design activities for later phases of the project. Generally, the products and services described in this section are highly conceptual – befitting a concept paper – and the research and development challenges in further specifying them, and making them real in the marketplace, should not be under-estimated. Still, the proposed scoring system and metric represent innovations that could address issues of complexity, cost and inconvenience related to measurement in this market.

2. Certification System (Building Energy Performance Standard)

The information products above will help homeowners know their current status with respect to energy usage and, through the website or auditor, will help identify potential retrofit activities and their likely impacts. This alone will generate substantial market demand as consumers can more readily identify the savings associated with retrofits. These products, however, will not yet "certify" a level of performance in a way that can readily be incorporated in an initially reticent or skeptical real estate market.

At least in the initial stages of market development, a simple, uniform certification system to establish building energy performance standards and formally recognize those buildings that meet them is needed. Presently, the certifications available to homeowners rate the energy efficient design of the building envelope, systems or appliances, but not the actual building performance (i.e. Energy Star, LEED for Homes, and even City energy codes). In order to encourage homeowners to improve their scores with retrofits or other improvements, it will be important to have a certification system that also recognizes the actual improvements to the building's energy performance. The proposed certification ranking system will authenticate the performance of the building envelope, systems and appliances.

The system will have a reasonable number of certification levels, ranging perhaps from red to platinum. Each level would be tied to a minimum and maximum energy performance score range. Given that this certification is an official seal, only those homes that have obtained their score through an energy audit (basic or full), completed by a licensed professional, can be awarded certifications. Determining the specific performance levels that will be used to structure this ranking system and the extent to which existing certification systems can be leveraged is beyond the scope of this concept paper; however, these are just a few of the issues that will need to be explored and addressed as this certification system product is further defined.

Moreover, the certification process needs to be very simple and straightforward for people to complete. Once a home's performance score has been computed as part of an audit and stored in the energy performance web system, homeowners can complete an online application for the appropriate certification. In order to ensure that property certifications continue to be an accurate reflection of actual building performance, it may be necessary to require a periodical sampling of re-certifications. In addition, there should also be set triggers, disclosure requirements, and adjustments made to these certifications based on meaningful changes that occur to the building envelope, mechanical systems, and appliances (i.e. addition of a second guestroom, installation of a sauna, or purchase of a deep freezer, etc.).

The certifications need to be accurate and reliable enough so that they can be incorporated in real estate assessments, in materials developed by real estate brokers, and otherwise become a standard "feature" of the home. Over time, as the modeled "energy scores" become increasingly reliable, certifications will either no longer be necessary, or will be much more readily (and inexpensively) obtained through the energy score

process. As these become accepted standards for building energy performance, that translate into specific savings and value, they will stimulate demand for retrofits as buyers take them into account, and homeowners with higher certifications can sell for higher prices. In other words, at this point, the intrinsic value of the energy retrofits will be reflected in the housing market and become explicit.

3. Energy Usage Monitoring System (Real Time Tracking)

Despite the utility and accessibility of simple scores and certifications, there is nothing quite like moment-to-moment feedback in helping to shift priorities and inform homeowner choices. In the longer term, we promote the use of home area networks that use sub-metered technology systems so that property owners can track their energy consumption in real time and adjust performance accordingly.[22] This will mostly enable behavioral (or "building management") change, but a real-time tracking system can also feed data into the central database to substantially improve and continuously update model accuracy. Although there are various efforts to develop such systems throughout the country, none have achieved broad market adoption or become commercially viable (partly for reasons similar to those being addressed by this project).

We envision that this Energy Usage Monitoring system is a screen with real time household energy consumption information, which combines building systems, appliance and behavioral data. This Monitor will enable consumers to measure the real time energy savings impact of any retrofit or behavioral changes. This device can help to elevate the visibility of energy usage and cost, and drive home the concept that it is a variable and thus controllable expense in the household. With the real time information generated by this tool, homeowners will be more sensitive to managing their energy expenses by modifying use and making energy efficiency retrofit improvements. Eventually, when the cost of this Monitoring System is more affordable (and its market should emerge as well with greater demand for energy efficiency), it would be installed in homes along with each retrofit. The Monitoring system would serve as an independent verification of building energy performance, also making certifications less necessary and value more transparent in the real estate market.

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Efforts (and some targeted subsidy) will be necessary to jump-start the supply side as well, but the level of investment required will be lower, for two main reasons: first, the information products outlined above that certify the status, needs and potential of each house will make it clearer to contractors what products are needed. Second, as demand takes off, the supply side will tend to organize itself – that is how markets work where there is money to be made. Nevertheless, to get started, we propose the creation of a User Support Service, a new Unsecured Loan Product for consumers, Risk Mitigation Products for banks, and some Supply Chain Development products and services that can simplify and standardize the retrofit purchase and delivery experience for homeowners,

[22] This energy usage monitor could, but need not, be done in concert with Real Time Electricity Pricing.

increase product affordability, increase producer capacity to service future demand, and lower associated transaction costs.

User Support Services

Once homeowners have the tools they need to decide on whether to purchase a retrofit, it will be important to address issues of complexity and inconvenience associated with existing retrofitting practices. The main issue is that there is no single retrofit "product," in two respects. First, each house will require a retrofit customized to its building size, type, condition, and homeowner preferences. Second, the retrofit is really a combination of a number of different products and services, currently often comprised of many different steps and producers. Although it would be impossible to create a single product, it is possible to focus on uniform process solutions that may lead to "mass customization" where the marketplace is able to deliver customized retrofit packages. To get this process started, we recommend creating User Support Service (USS) that will walk homeowners through a simple two step "process" and connect them to everything they need, including financing; and that will help (along with the information products above) enable suppliers to more efficiently deliver customized products, as well as address their transaction cost barriers (including by providing demand aggregation).

This User Support Service should be well branded and recognized in the market by consumers, contractors, lenders, real estate market professionals, and other stakeholders. Homeowners should be able to contact the USS via 311, Chicago's non-emergency information number, or a"1-800" help line or through the proposed Energy Performance Scoring System website. The USS should be a free resource to homeowners until critical mass is achieved. Once contacted, USS professionals will respond to homeowner questions (i.e. about the scoring system, other information products, etc.) and assist them with any and all retrofit service needs.

The User Support Service will coordinate a two-step retrofit service process. This two step process includes: (1) Homeowner uses the Energy Efficiency Scoring System to assess energy performance and select retrofit improvements; and (2) USS puts homeowner in touch with a licensed Contractor to prepare a scope of work, provide financing (if needed) and perform the retrofits. After the work is complete, USS can also arrange for Certification, if desired. As described below, this 2-step system simplifies the retrofitting process for homeowners. In place of the traditional full-scale audit, homeowners can consult the web-based Scoring System to assess their energy performance, and get information on what types and levels of retrofitting activity will likely produce what savings. Then, rather than a confusing, multi-step process for engaging multiple suppliers, the homeowner need only contact the USS, which will put him/her in touch with a licensed Contractor that can address all of his/her needs.

After seeing an ad marketing the Energy Performance Scoring System website as well as the 311 - User Support Service number, the following is an illustrative example of how the retrofit process could work for a typical homeowner:

First, the homeowner visits the Scoring System website, types in his address and gets a score for his home. Also, the website will provide him with valuable information, such as the ROI benchmarks for different certification levels and scores, which will help him set an energy performance goal. Based on his goals, he will decide on specific retrofit improvements.

Second, he calls 311 and talks to a USS professional who finds him a licensed Contractor. The Contractor visits the home and develops a scope of work for the retrofit. If needed, the Contractor provides the homeowner with special retrofit financing (see below for more information on the special financing product), and assists him with completing the financing application. Once the payment terms and financing have been set, the licensed Contractor (directly or indirectly through subcontractors) completes all of the improvement work.

Once the retrofit work is complete, the licensed Contractor uploads post-retrofit information about the home to the web-based Energy Performance Scoring System. Based on the new information, the Scoring System model recalculates the home's energy performance score, and the contractor can verify other attributes through auditing procedures. If the home achieves a score that meets the Certification system criteria, the homeowner will receive the appropriate Certification.

This User Support Service will simplify the retrofit process for homeowners while leveraging all of the information products and financial products that are needed to complete the transaction. The easier it is for homeowners and suppliers to connect, the less costly and more attractive it is for both to participate in the retrofit market.

These User Support Services imply development of a licensing system for energy retrofit contractors. This particularly deserves more attention in later phases of the project, and may prove unnecessary (or only necessary in the very first stages of market development) if various consumer assessment and other self-regulating market mechanisms are put in place.

Other Supply Chain Development Products & Services

As demand rises, and the desired products are clearer, suppliers typically emerge and organize to meet this demand. However, supply chain development takes time: it can often lag and, thus, slow or impede market demand. As consumer demand for retrofits grows, suppliers must be capable of responding and servicing this demand. Existing supply chain needs in the retrofit market need to be assessed and a comprehensive set of products and services should be developed to ensure producers will be able to support future consumer demand. Although there is a diverse array of producers in the market place, ranging from small, mom-and-pop contractors and mid-size firms to large equipment and materials suppliers (like Lowes and Home Depot), it appears as though the volume of retrofit capacity, in aggregate, is still low relative to the goals laid out in the CCA Plan.

A preliminary review of supply side capacity challenges revealed four key types of supply chain issues, including: 1) customer acquisition costs; 2) limited number and capacity of qualified auditors and retrofit Contractors;[23] 3) limited number and capacity of qualified retrofit workers/professionals; and 4) lack of financing available to support start-ups and existing contractor growth. Various product and service solutions have been identified and discussed to address some of these issues; however, current capacity needs to be assessed and these product and service ideas need to be further explored and tested with suppliers and lenders.

Supply chain development ideas include: a system to market and refer consumers to Contractors (which is one of the functions of the User Support Service), licensing process for Contractors and auditors, training for auditors and Contractors, workforce training for retrofit professionals, and special financial products for retrofit contractors.

Although solutions like bulk buying and place-based demand aggregation were also proposed, interviewees on the supply side provided at best a mixed response about the potential benefit of these strategies. In the case of bulk buying, some suggested that savings achieved from purchasing materials in bulk at below market pricing will be more than offset by increased distribution and logistics costs (i.e. warehousing, transport, etc.). As for place-based demand aggregation strategies (such as organizing to do retrofits block-by-block), some suggested that because of the differences in building conditions of every home, regardless of location, there would not be sufficient savings associated with the audit or the retrofit work. In addition, they suggested that the client acquisition cost is still very high, given that the contractor still has to be involved in much of the one-on-one homeowner education and marketing. Despite this initial feedback, we would suggest further study and analysis of these potential solutions.

Although there are supply chain development issues, the energy efficiency retrofit market represents a $2 billion opportunity. Contractors, auditors, manufacturers and real estate professionals of all types and sizes need to be engaged in developing the businesses and workforce needed to fulfill market demand. As detailed later (Section IX), the institution leading the market development work must actively involve and be driven by the private sector in working to develop supplier capacity.

New Financial Products & Capital Sources

Once the users have the information and support they need to purchase a retrofit, there may still be financial barriers. Given that even the most basic retrofit can range in cost from $2,500 to $10,000 per unit, depending on building size, type and condition, the average consumer is unlikely to have funds readily available to cover the full cost of this investment. Working with banks, a simple consumer loan product should be developed,

[23] The term Contractors used throughout this document, includes General Contractors (GCs) who are a critical part of the retrofit market supply chain. GCs play a coordinating role for many retrofit jobs that require multiple specialty contractors.

and guarantee or capital access pools should be created to reduce the exposure of banks that provide this product.

In particular, the next project phase should explore creation of an unsecured loan product to finance basic retrofits that is low cost, convenient and can be marketed through approved Contractors. The application and approval process for this product must be "hassle free," and it must be possible for the approved Contractor to quickly underwrite and deliver it – the retrofit financing comes with the retrofit if needed. This means the product should be made available with no collateral requirement, and the creditworthiness of the borrower should be determined based on simple criteria, including utility or tax payment history. When possible (e.g. when the mortgage is held by a participating bank), the product might be an addition to the existing mortgage.

Given the potential market risks associated with providing this product, Risk Mitigation Products will be necessary to enable lending institutions to limit their exposure while continuing to provide Unsecured Loan Products to eligible consumers in the marketplace. Depending on lender preferences, these products could include either a (1) loan loss reserve pool, which is an individual loan guarantee pool, or a (2) Capital Access Program (CAP), which is a portfolio loan guarantee.

A strong "real world" example of the financial product that we are proposing is the Federal Housing Administration (FHA) Title 1 Home Improvement Loan. This instrument has all of the characteristics proposed for the building energy efficiency retrofit Unsecured Loan Product and it includes a Risk Mitigation Product for participating lenders. The following is a brief description of the FHA Title 1 Home Improvement Loan product:[24]

- Provided by only HUD approved lenders
- Contractors, realtors, and others partner with banks to market the financing product to consumers
- Used to finance building improvements that enhance or preserve the basic livability or utility of the property, including remodeling, room additions, plumbing, electrical or heating repairs, and fire safety equipment
- Used for manufactured homes, single-family, multifamily homes, and nonresidential structures
- Qualification criteria were not too stringent (i.e. no foreclosure in 3 years, no bankruptcy in 2 years, etc.)
- No appraisal required
- Allowed for:
  - Single family loans of up to $25,000
  - Multifamily loans (at least one owner-occupied unit required), maximum $12,000 per family unit and combined amount cannot exceed $60,000 for the entire structure

[24] Sure Trak Lending. http://www.suretraclending.com/fha_title1_improvement.html. Copyright © 1998 - 2008. A Blue Mortgage ™ Company

- Backed by a 90% loan guarantee from the Federal Housing Administration for up to 20 years on single family and multifamily
- No pre-approval required for loan originators (presumably because they pay into an insurance or guarantee pool)
- Fixed interest rate
- No collateral or property liens required
- No prepayment penalty or seasoning restrictions

Although the FHA Title 1 Program has been discontinued, it stimulated a tremendous amount of rehabilitation activity with over 35 million loans, totaling $43.6 billion.[25] Given the accessibility of the proposed building energy efficiency retrofit Unsecured Loan Product, it will be important to create controls that protect against fraud and abuse. While the FHA Title 1 Program was used responsibly by many lenders throughout the country, there were instances of abuse including "unscrupulous contractors performing shoddy work, falsifying documents, overcharging homeowners, and using deceptive advertising."[26] Requirements like contractor approval and energy performance verifications could serve as meaningful safeguards for homeowners and lenders in the marketplace.

A number of promising new financing systems and mechanisms (i.e. On-Bill, Property Tax-Bill, and so forth) are actively being exploring by others in Chicago and across the country. These primarily focus on funding the retrofit costs for consumers and obtaining repayment through the actual or projected annual energy savings. These strategies, if successful, would create major alternative sources of financing for the proposed retrofit process.

Finally, as noted elsewhere, new financial products may be desirable for supply chain development, such as investment products for retrofit contractors. Determining the need for and appropriate types of financial products for these purposes is an important later step in the project.

Low-income Single Family Homeowners

The low-income segment deserves special attention because low-income families tend to occupy the least energy efficient housing and to be least able to afford retrofits. Currently, private sector retrofit activity among low-income consumers (i.e., individuals below 80% of Area Median Income or below 150% of the Federal Poverty Level) is as low, if not lower, than the general marketplace. The operating premise, however, should be to include this segment in the overall retrofit programs wherever possible, rather than creating alternative programs that may further isolate these homeowners.

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[25] Sure Trak Lending. http://www.suretraclending.com/fha_title1_improvement.html. Copyright © 1998 - 2008. A Blue Mortgage ™ Company

[26] Sure Trak Lending. http://www.suretraclending.com/fha_title1_improvement.html. Copyright © 1998 - 2008. A Blue Mortgage ™ Company

With respect to information products, low-income consumers, just like the general market, are in need of information in order to make informed retrofit purchase decisions, and the same information products will stimulate desire for retrofits. Energy efficiency scores, certifications and monitoring systems will help assess current energy performance, set goals and select desired retrofits.

However, the desire to purchase retrofits is not, in itself, demand. Market demand manifests itself when there is both the desire and the money to purchase the product. By definition, low income consumers will need additional financial assistance to enable retrofitting. The low income segment, of course, is itself highly differentiated, with respect to levels of income, credit risk and needed retrofits, among other things. The standard financial products (discussed above) should be made available wherever possible, but subparts of this segment will not qualify.

The principle of "moving people to the mainstream," rather than creating alternative programs, should still be applied to the extent possible. Based on income and credit risk, additional financing products, such as forgivable and low-interest loans, should be developed and delivered – generally through the same banks, contractors (for and non-profit) and other intermediaries – to low income families to drive the demand for retrofits.

Creating subsidized financial products, rather than just fully subsidizing through outright grants, may also be necessary to reduce overall costs. Based on market assumptions outlined in Appendix C, scaling existing subsidy programs would require anywhere from $242 to $322 million in funding over the next 12 years to cover the cost of retrofits for 50% of low income owner-occupied housing units that are at 50% of Area Median Income and below.

Even with innovative financing solutions, there will likely be a significant number of low-income homeowners who are not served by these products. In parallel, we will need to scale existing civic and public sector program models (i.e. CEDA, DELTA Institute, etc.), which offer partial (75%) or full (100%) grant subsidies to low-income homeowners for retrofit purchases

VII. APPLICATIONS TO MULTIFAMILY, COMMERCIAL & INDUSTRIAL MARKET SEGMENTS

Although the recommendations in this document focus on the single-family market segment, many of the same general principles apply or can be adapted to the large multifamily, small commercial/industrial, and large commercial/industrial segments. Much like the single-family market, the value of retrofits is not transparent in each of these segments.

On the demand side, information products are needed to assist property owners and renters in understanding the potential returns on the retrofit investment. However, because of the diversity of uses within these segments, more product customization is required.

On the supply side, in most cases, existing producer activity suggests that these supply chains are further along in their development and will likely need less capacity building support than the single family segment. Also, transaction costs are less of a barrier because the costs of the retrofits are much larger. Only preliminary observations are offered here with respect to these segments: much more work is needed to identify specific product/service solutions for the market development of these three segments.

Section VII - At a Glance:

- ***Multi-Family:*** The multi-family segment has similar demand side barriers as the SF segment with the exception of a split incentive issue that can be addressed, in part, with the proposed information products and in part by making the asset value premium of retrofitted multi-family buildings explicit in the marketplace.

  On the supply side, because of the added complexity and sophistication of building systems, higher touch, more customized User Support Services are needed for building owners.

- ***Small Commercial/Industrial:*** Although similar in scale, this market is very different than the SF segment. Given split incentive issues, variation in types of energy usage and often higher retrofit costs, information products must be more customized, and translate to higher asset values to drive demand in this market.

  User Support Services that are more specialized by business type will be needed to address supply side issues. Low-cost commercial financing like the SBA 504 loan with guarantees for lenders will also be needed.

- ***Large Commercial/Industrial:*** The large commercial/industrial segment is by far the most advanced segment. Information products are further along for some sub-segments, but split incentive and economic benefit issues present further barriers. Supply side products need complete customization, but the large scale of projects means transaction costs are less of a barrier.

Multifamily (5+ units)

The multifamily segment has similar demand side barriers as the single-family market, and should be amenable to the same types of product and service solutions. However, this segment presents the added challenges of split incentives between tenants and building owners. The proposed information products will still be effective tools, but of course will need to be tailored to the characteristics of this segment, and will also ultimately need to be translated into explicit indicators of retrofit value in the form of

higher asset values and sales prices in the real estate market. As the scale is larger, keeping the financing simple is not as critical, but tailored financial products may still be needed. As a result of the complexity and sophistication of building systems, more customized, higher touch User Support Services may also be required. More multifamily research is needed to define segment-specific solutions, including return economics, different sub-segment characteristics and requirements (i.e. by number of units, programming-mixed-use, etc.), existing producer capacity and needs, and so forth. A bit more detail, filling out these observations, is provided below.

Context

Chicago's multifamily buildings contain about 370,000 apartments, representing one third of the total number of housing units. This market segment is diverse and for the purposes of this brief overview can be sub-divided into small and large multifamily. Small multifamily, defined as buildings with 5-24 units, are typically brick, three story, walk-up buildings and are more than half of the multifamily housing units in the city. These buildings are more likely to be owned by "ma and pa" building owners who may have less access to conventional financing and property management expertise. The large multifamily market, defined as buildings with 25 or more units, range from brick multifamily walk-ups to lakefront high-rises with more complicated building systems. Owners of these larger buildings are more likely to have more expertise in building management and greater access to resources.

Barriers

The demand side barriers in this marketplace are largely the same as the single-family/multi-unit segment, including savings measurement challenges, lack of belief in the savings, low priority, the fact that the value is not reflected in the real estate market, and affordability. However, there is one major difference: in multifamily buildings, the building owners and the occupants often have a split incentive, depending on who is paying the utility bills. In rental buildings, the tenant often pays their unit and a pro rata share of the common area utilities. Thus, the rental building owner does not derive any energy savings benefits from completing a retrofit. Similarly, in multifamily condominium buildings, individual condo owners pay assessments to cover the utility bills for their unit and a pro rata share of the common area. Thus, the multifamily condominium building association does not derive any direct energy savings benefit from retrofit improvements. Ultimately, the incentives need to be aligned. For example, over time large building owners (particularly short-term owners) and condominium associations may be able to capture the benefits in higher rents (but lower overall costs, as tenant energy costs decline) or in an asset value premium in the market for energy efficiency retrofitted buildings.

On the supply side, the cost of sales, single product/standard process and other transaction cost barriers are not as substantial. Given the size of multifamily buildings, the cost of the retrofit will allow for a higher cost of sales than in the tight budget single-family/multi-unit segment. However, multifamily buildings have more complex building envelope issues and mechanical systems than single-family buildings, often requiring a more customized process.

Products

Given similarities in the demand side barriers, Information Products will likely help to stimulate demand in this segment. They are likely to have the greatest effect on individual condominium owners because they behave most like single family homeowners. The demand response from multifamily rental property owners and condominium associations will depend upon the information revealing the savings they can in fact realize (depending on split incentives), or recognizing the value of the retrofits in the real estate market.

On the supply side, the User Support Service (USS) will be more limited in scope for individual condominium owners who can only retrofit building systems within their units. The proposed resources and support level offered through the USS will have to be substantially adapted for the needs of multifamily users, and likely more often go beyond phone-based User Support Services, requiring on-site, key account services. Given the retrofit investment requirements, low cost consumer and commercial financing will still be needed for individual condominium owners and multifamily rental owners, respectively. The condominium owner loans may still be unsecured, but the multifamily rental building financing, given potential loan sizes, would require collateral. As for supply chain development, we do not currently have sufficient information to assess what type of capacity building is needed, if any.

Small Commercial/Industrial

The small commercial/industrial market is comparable in scale to the single-family/multi-unit segment, with important similarities in the market characteristics. Small commercial/industrial owners, like the average single-family homeowner, will benefit from Information products that elucidate the costs and returns of different retrofit investments. Split incentive issues and the range of potential economic benefits by sub-segment will require more customized information products to affect demand, and achieve a corresponding reflection of the value of retrofits in this market place. Supply side solutions also must address the specialized building system requirements of this segment. As with multifamily buildings, because of the larger scale, transaction costs should be less of a barrier. Further study of the small commercial/industrial market is needed to define segment specific solutions, including return economics by business type and by tenure, existing producer capacity and needs, and so forth.

Context

The small commercial/industrial segment is also very diverse. It includes small-scale or storefront retail, office, restaurants, entertainment, hotels, factories, and many other diverse uses, with highly varied energy using systems and consumption. In this industry, build out and rehab decisions can be made by the owner and/or tenant. ComEd has approximately 100,000 commercial customers. Over 90% of those customers are small

commercial customers including offices, retail, social services, small medical offices, and other users with energy bills ranging from $10,000 to $30,000 annually.[27]

Barriers

The same demand side barriers exist in the small commercial/industrial market. However, the potential energy savings and rate of return from small commercial/industrial retrofits will vary widely based on the type of business, because different businesses consume more or less energy as part of their operating models. Creating information products to assess the varying uses and benefits of energy retrofit investments is more challenging and requires much more customization. This segment also experiences the split incentive problem, as the tenant generally pays the utility expenses (either directly in a triple net lease arrangement or in the form of common area maintenance expenses to the owner), and as a result no direct energy savings are passed on to the property owner who invests in the retrofit.

On the supply side, the small commercial/industrial market is more complex and specialized than the single-family/multi-unit segment. For example, the building envelope and mechanical systems of buildings differ greatly by business tenant (for instance, stoves and ventilation systems, lighting, and specialized equipment vary greatly between restaurants, dry cleaners and apparel stores). This complexity will make it impossible to have a single product and difficult to have a streamlined process for delivering retrofits. On the other hand, the potential savings are often much greater, and the transaction costs are lower proportional to the size of the investments.

Products

The information products in this market segment will be helpful tools for understanding current performance. And for those owner-occupied small commercial/industrial properties with significant energy savings potential, the information products may be enough to drive demand. For this segment, the information products will need to be customized by type of business use. Also, for the majority of tenant-occupied small commercial/industrial properties, it is likely that the market will need to demonstrate a meaningful rent and/or asset value/sales price premium in order to stimulate demand. On the supply side, the low touch, generic User Support Service product will not be sufficient to address the diverse and complex needs of the small commercial/industrial segment. However, User Support Services specific to the small commercial/industrial market segment, providing on-site, industry specific support could be a valuable alternative for this segment. Low cost financing will still be needed. And commercial financing products like the SBA 504 program that provides competitive, long-term, fixed-rate loans for major fixed-assets, such as land and buildings, could be attractive for this market segment. Given the loan size and associated risks, this financing product is unlikely to be unsecured. However, lender risk could be reduced using special instruments, much like the 40% SBA guarantee for the SBA 504 loan.

[27] CNT analysis conducted as part of Chicago Climate Action Plan research.

Large Commercial/Industrial

The large commercial/industrial segment, while differing substantially from the single-family segment, exhibits some of the same market demand challenges. Also, the large commercial/industrial segment is much further along towards market-driven retrofits than the single-family market. Demand barriers range from split-incentives to unclear economic benefits, some of which can be addressed by a more customized version of the proposed information products.

On the supply side, User Support Services are much less necessary: the scale of retrofits attracts suppliers as demand emerges, and aspects of user support are less applicable or suited to the complex building systems and production processes. However, explicit indicators of the value of retrofits in the real estate market and financing with risk mitigation instruments for property owners will help drive demand in this segment. More research should be conducted in this segment to better understand the issues and to design segment specific solutions, including the return economics by building use, the performance of existing financing products in this market, current market penetration, whether investment funds are needed to help grow the ESCO industry and other issues.

Context

The large commercial and industrial building market includes large retail, entertainment, institutional, municipal, and industrial buildings. Commercial and industrial buildings account for approximately 50% of the GHG emissions from the building sector.[28] Ten percent (10%) or less of ComEd's commercial customers fall into the "large" segment, including those with energy bills that are over $30,000 annually.[29]

Of all of the segments, market development activities for the large commercial and industrial segment are by far the most advanced. The LEED certification system was pioneered in this segment and there are fairly well established relationships between building owners and financing institutions around strategies for the retrofitting of large commercial and industrial buildings.[30]

Barriers

Much like in the single-family/multi-unit market, there is no explicit value for retrofits reflected in the large commercial and industrial real estate market, though some observers report that this is changing, particularly for LEED certified buildings. This market in particular is subject to the split incentives problem: on the demand side, the large commercial and industrial market is largely a rental/lease market where energy costs are paid by tenants. Thus, the benefits of conservation to owners are less direct and need to

[28] This definition includes the federal and "MUSH" market (municipal, universities, schools, hospitals).
[29] CNT analysis conducted as part of Chicago Climate Action Plan research.
[30] Many of these observations are taken from a May, 2007 review of the ESCO market by the Ernest Orlando Lawrence Berkeley National Laboratory: "A Survey of the U.S. ESCO Industry: Market Growth and Development from 2000 to 2006."

be translated to higher rents and/or higher asset values and sales prices in the marketplace.[31]

It appears that the actual economic benefit of retrofits in this segment may not always be compelling. For instance, in some buildings, energy costs are not a large enough percentage of overall operating costs to be high on capital investment priority lists. Also, the pay-back time frame on energy efficiency retrofits (sometimes up to 20 years) may exceed the life cycle of building ownership, or the risk horizons of owners. As a result, owners may be less willing to make long-term capital commitments that they cannot clearly link to increased asset value.[32] Further study is required to identify which sub-segments of the large commercial/industrial market generate significant economic benefits. However, this dynamic suggests that a more targeted, industry specific retrofit market development approach is needed to realize desired emission reductions in the large commercial/industrial segment. Finally, on the supply side, much of the energy consumption in some of these buildings (particularly industrial) is not linked to building systems design, but rather to production processes. This means that solutions are highly process-specific and difficult to aggregate.

Products

On the demand side, given the scale and complexity of building systems, the information products contemplated for the single-family market would of course have to be substantially adapted and tailored to stimulate demand in this market. Specialized measurement tools, certifications, and monitoring systems based on business type would be more appropriate given the central role the production process plays in energy consumption levels. Regardless of the information tools used, given the required investment costs, demand will be largely dependent not only on the size of the potential energy savings, but also on the likely reflection of the value of the retrofit in the real estate asset value and sales prices.

On the supply side, User Support Services may not be necessary, given the size of the deals, and the emerging ESCO industry, but, to the extent that they are provided, USS will need to be customized, specialized by business type, as well as available on-site. Given the size of the investments in this segment, financing will be needed to support purchases. It is important to note that regardless of how attractive the financing product is, building owners must first be sold on the notion that the retrofit investment will translate to higher asset values and/or sales prices. Without this fundamental belief in the returns, mass consumption of retrofits by large commercial/industrial property owners is unlikely. In addition to the financing products, special risk reduction instruments for the building owners and/or lenders are also needed. One type of risk reduction product that is currently being used in this market are Energy Performance Contracts (EPC), which guarantee a certain level of savings to the building owner against baseline retrofit costs over a specified timeframe. There are a number of financing vehicles that can be used in

[31] There is some evidence from our interviews that owners recognize that energy costs are important enough to affect their leasing market, even if the costs are paid by tenants.

[32] In one interview a building owner indicated that any payback period of longer than 18 months would exceed their "window" for acceptable capital risks.

EPC arrangements, including lease-purchase agreements, capital leases, leasing pools, revolving loan pools, and Power Purchase Agreements (PPAs). This type of guarantee product only works if the guarantor and the owner can explicitly agree on all of the assumptions on which the savings projections are based. Given the scale and capacity needed for a producer to supply to buildings in this segment, it is likely that contractors, auditors, and other components of the supply chain are already very well developed and do not require significant additional capacity building to support current and future demand.

VIII. COMPLEMENTARY CIVIC & REGULATORY ACTIVITIES

Section VIII - At a Glance:

- The market operates in the context of social and political systems which play key roles both in enabling the market and in addressing non-market objectives.
- There are a number of civic programs and governmental activities already underway (and some that are in the planning stages) that stimulate demand for building retrofits and will complement proposed product solutions and market development

Although the focus of this document is on market development for the energy efficiency building retrofit market, the market alone cannot produce the results outlined in the CCA plan. As discussed earlier in this document, the retrofit market operates in the context of social/civic and political systems which play key roles in supporting and supplementing the retrofit market, particularly considering the public benefits (in addition to homeowner economic benefits) flowing from the reduced emissions associated with energy retrofits.

The civic sector, led by non-profits and philanthropies, often plays a critical role in field building, assisting customer segments that the market does not reach (i.e. low and moderate-income families, etc.), supplier development, and jumpstarting market activity. As expected, Chicago's civic sector is already playing a lead role in carrying out many of these functions. Philanthropies have actively partnered with the City to undertake definitive research and plans like the Chicago Climate Action Plan. This field building work has educated local stakeholders and set the stage for action. In addition, non-profits and philanthropies have long been on the frontier of providing retrofit education, services, grants and other financing to low and moderate-income families. Recent work conducted by Katzenbach, a Seattle-based management consulting firm, reveals encouraging information about the number and activities of non-profit retrofitting programs. Many of these non-profit programs – including, but not limited to, the Center for Neighborhood Technology (CNT), CEDA, the DELTA Institute, and the Chicago Bungalow "Green Model Block" – provide a full range of retrofitting services to low-to-moderate income families, and will likely be key Contractors, among many other roles, going forward.

Beyond facilitating specific transaction activity for hard to reach market segments, civic organizations are hard at work studying, organizing, and developing the supply chain. From the DELTA Institute's green contractor training programs to CEDA's and CNT's contractor prequalification systems, non-profits will continue to serve as important partners in building producer capacity. In addition, there are a number of philanthropies funding research related to green workforce development opportunities and strategies. These early investments in understanding supplier and workforce capacity needs will ensure that as market demand grows, supply is ready and available to respond.

In general, building upon its existing investments, the civic sector will have a critical role to play in jumpstarting market activity. Resources and thought leadership from philanthropies will be needed to help fund the design and early implementation of the proposed products and institution needed to catalyze market development efforts. In

addition, non-profits are among the key stakeholders who will need to continually be engaged in design and delivery of retrofit products and programs.

Much like the civic sector, government agencies and elected officials in Chicago are already taking action and demonstrating tremendous leadership in the area of retrofits. Often, government undertakes initial R&D and advocacy to help shape the field, then uses incentives, policies and codes to enable, shape and jumpstart the market, and to assist customer segments (i.e. low and moderate-income families, etc.) that the market does not reach.

Through the vision and leadership of the Mayor's Office, the Department of Environment, and various other agencies, Chicago supported the creation of the Chicago Climate Action Plan. The government's unified stand in support of the energy performance goals and strategies articulated in this Plan has been critically important in defining and building the field. Also, Chicago, through the work of the Department of Environment, has provided funding and technical assistance to support a wide variety of non-profit retrofit programs. Recently, the Department of Environment commissioned Katzenbach to inventory and evaluate its current portfolio of retrofit programs and to provide recommendations on where and how to focus future funding. It is critical that the City continue to play an active role in building the field and addressing market gaps.

In addition, the City also is playing and should continue to play a lead role in shaping and jumpstarting market activity. A mix of interventions that both encourage and mandate will be required to respond to early market development needs. These range from the green building code, which will influence demand for green buildings generally, to providing resources and expertise in order to create an independent institution to lead market development activities (more on this below). Also initially, the City will need to assist in recruiting the leadership team for this institution and building its credibility and clout in the marketplace. In addition to its support of the institution, the government can also create an environment that is receptive to the proposed information products that this institution will develop. For example, a point of sale energy use disclosure requirement could accelerate homeowner use of the energy performance Scoring System and certification systems. Other Cities are considering these types of policies. In select Cities, even more aggressive legislation is under review, including point of sale energy efficiency standard requirements.

Aside from codes, Chicago also has instituted some attractive incentives to stimulate market demand, including expedited permitting for "green" improvements and building permit rebates and feebates. Other potential incentives, that would need to be offered in partnership with the utilities and County, include "whole home" utility incentives, rate payer funding, and property tax relief.

Many less traditional incentives could be conceived. As an example, the City can offer additional incentives through channels that are currently used for non-energy or retrofit related transactions, including water utility payments, vehicle and sticker registration, parking ticket payment, business license renewal and so forth. Or the City and civic

community could offer highly visible incentives to recognize and encourage leadership in the market place, ranging from awards to special events or opportunities.

Civic and governmental involvement is critical to the success of any market development strategy. In the feasibility assessment and business plan design phase of this work, it will be important to work collaboratively with civic and governmental leaders to make sure complementary activities are being designed and to coordinate efforts.

IX. DELIVERING THE PRODUCTS

Proposed Implementation Strategies

In order to quickly jump-start market activity and demonstrate success, we recommend pursuing two top-level implementation strategies: (1) identify and tap into leverage points where consumers are otherwise engaged in activities concerning their homes; and (2) allow for incrementalism – homeowners don't have to do everything all at once.

First, key leverage points are those places and points in time when homeowners are already doing something with their homes. By tapping into these events, such as property acquisition, refinancing, remodeling, building code inspections and upgrades, we can significantly reduce the transaction costs associated with engaging consumers and purchasing retrofits. This should be done by fully engaging the range of market stakeholders involved at these leverage points, including real estate brokers, appraisers, home inspectors and others.

Engaging the full range of stakeholders in the real estate market will be important for other reasons as well: as the information products begin to take hold, it will be critical to work with these stakeholders to help translate demand into market value. For example, in order to introduce and integrate proposed building energy efficiency retrofit products in the real estate market, we will need to:

- Encourage home inspectors and assessors to include building energy performance assessments into the core components of their review
- Engage appraisers in including the information products, and applying some version of a net present value (NPV) calculation
- Work with the Multiple Listing Service (MLS) to create a listing requirement related to building energy performance

Section IX - At a Glance:

- ***Implementation:*** In order to quickly jump-start market activity, we recommend focusing first on creating demand for energy efficiency retrofits and implementing two top-level implementation strategies: (1) identify and tap into key leverage points, where homeowners are otherwise acting on their properties; and (2) allow for incrementalism; homeowners don't have to do everything all at once. A continuum of products and services should be created for different consumer entry points.
- ***Institutional Capacity:*** In order to carry out these strategies and roll out the products that are needed to grow the market for energy efficiency retrofits, we recommend creating a new institution. This institution must be inclusive, tap multiple skills, remain close to the market and the ground, be credible, be professionally managed, and be entrepreneurial.
- ***Structure:*** In order to ensure that this institution has the access, resources, and authority it needs to deliver, the structure should be a 501(c)3 with strong, committed, and integrated involvement from private, public, and civic sector leadership. Three organizational models are suggested for further exploration.
- ***Functions:*** There will be two organizations within the institution: (1) Energy Efficiency Services Organization (EESO) and (2) Energy Efficiency Finance Authority. The EESO has five divisions, including information products, marketing & branding, user support services, supply chain development, and an applied research and development center.

Second, given that consumers will have different motivations for retrofitting and will often be at different levels of readiness, we need to be prepared to offer a continuum of building retrofit products that accommodate potential consumers at different starting points. It is also important to recognize that different consumer segments will enter the market at different points, and that marketing efforts and product development should be tailored to their preferences and motivations.[33]

The following are some examples of different types of potential consumers with different motivations for purchasing retrofits. A variety of product solutions to serve consumers with different needs and preferences will have to be developed.

Consider for example the following hypothetical consumer segments:

a. *Green owners* – personal commitment to the environment
b. *Change of seasons* – increase comfort and/or savings
c. *Point of sale* – to attract buyers or improve a recently acquired property
d. Home remodel or addition – low marginal cost
e. *Emergency replacement of system or appliance* – existing system or appliance stopped working

Each of these segments will have different motivations and be interested in specific retrofit products, as detailed in the examples below.

- *Green owners* – Some property owners have the resources and personal motivation to undertake improvements for the sake of being green. These owners are most likely to deliberately incorporate energy improvements in their home projects and may be inclined to undertake a whole house retrofit at once – even if it means replacing functional systems before the end of their useful life.
    - *Potential Retrofit Product:* Whole house retrofit

- *Change of seasons* – As winter approaches, property owners may be motivated to make improvements by either a desire for a more comfortable, less drafty home or by the threat of higher than expected heating costs.
    - *Potential Retrofit Product:* Insulation/air sealing package

- *Point of sale* – A buyer or seller may make improvements to a property in preparation for a sale or immediately following it. In the single family market, the party most

[33] It is particularly important to recognize the differences between innovators and early adopters and all other consumers. Marketing theory refers to this as a "chasm" in the innovation adoption curve. Simply put, a number of consumers will jump at the opportunity early, either because they are motivated by ideological factors or simply because they are more inclined to innovate anyway. However, reaching beyond this group to the majority of consumers will require a qualitatively different effort. See, e.g. Geoffrey A. Moore, "Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers," HarperCollins, 2002.

likely to make the improvements depends on the strength of the market. In a strong market with plentiful credit, buyers are likely to make improvements following acquisition. In the current market with slow home sales and tightening credit, sellers are being forced to make improvements in order to attract buyers.

  - *Potential Retrofit Product*: Green Improvement Guide – for each type of common home improvement, the guide would offer options and standards that connect to the to-be-established certification levels. The users of this guide would include property owners, contractors, sales persons, and real estate professionals.

- *Home remodel or addition* – If homeowners are already undertaking significant work on their unit, the marginal cost of retrofitting will be much lower. For instance, if an owner has to break into the walls to remodel a unit anyway, the additional expense of insulating heating and water pipes will be much lower. Given the lower cost of the retrofit, the return on investment for this segment will be greater, making the purchase more appealing.
  - *Potential Retrofit Product*: Same as above.

- Emergency replacement of system or appliance
  - *Potential Retrofit Product*: Same as above.

Owners who undertake home improvements for purposes other than becoming more energy efficient may be less likely to seek assistance from the User Support Service and may not be working with an approved Contractor. It will be important to connect with these consumers as well, in order to influence the scope of work to include some energy efficiency improvements. Three paths could be taken to connect these types of improvements to the energy efficiency retrofit process recommended in this document:

- Green Improvement Guide (described above)
- Owner Incentives – Vouchers to encourage the purchase of high efficiency systems or appliances; voucher to reduce the cost of work performed by a approved Contractor
- Contractor incentives – Contractors could be a valuable source of data regarding improvements and they are also known to have a great degree of influence over product selections made by property owners. Incentives could be offered to encourage and reward the installation of high efficiency systems.

Institutional Capacity

So far the paper has outlined a set of barriers that prevent the energy efficiency retrofits market from working as well as it could, a set of products that should be developed to address those barriers and develop the market, and a set of strategies related to getting

those products to the market. However, it has not addressed a very important question: who should do all of these things?

Given the complexity of the multi-pronged approach suggested here, and the lack of a clear existing entity that would have the interest and the capacity to carry it out, we propose to start by creating a new institution that would be tasked with carrying this work forward. Its mission would be to lead market development efforts in the retrofit sector with the primary objective of designing and delivering the proposed product solutions. As such, this institution should encompass three core functions: develop and roll out the information product, develop the supply chain, and act as a financial intermediary. Despite the complexity of its functions, this is not meant to be a large, bureaucratic institution that will exist in perpetuity. Rather, it should be a nimble and entrepreneurial organization that will coordinate and spearhead the work of existing stakeholders, and do "in house" only functions that are not already present in the field. Its prerogative should be to quickly get in the marketplace; figure out what works and what doesn't; seed market activity by developing and rolling out the necessary products; and "work itself out of business" once the market reaches the necessary scale and supply and demand begin to self-organize.

Given the diverse landscape of stakeholders and the dynamic nature of this environment, the governance of this institution must adhere to a set of design principles that enable it to remain effective.

- *Be Inclusive, Grounded and Connected:* To be successful, the Institution needs to engage and collaborate with a diverse network that includes private sector institutions, policymakers, civic organizations, trade associations, and real estate industry groups. Structures and modes of operation need to be established to ensure that activity stays "close to the ground" so that its work is informed by end-users and has maximum utility for the field.

- *Tap Multiple Skills:* The Institution will fund and oversee disparate kinds of activities: product development, support service design, product financing, supplier training, etc. It is unlikely that one organization would alone possess the requisite skills and competencies needed to move these activities forward. Thus, it is essential that the governance and management structure of the Institution permit collaborative relationships with existing organizations and stakeholders that are both broad and deep.

- *Remain Close to Other Initiatives:* The Institution is designed to build upon existing work that is already underway. The governance structure of the Institution must ensure that opportunities for synergy be maximized and the potential for duplication be minimized.

- *Be Credible:* The Institution must speak with authority and be credible to federal and local policymakers and key business leaders.

- *Be Professionally Managed:* As market development is the driving force behind the Institution, professional management and financial expertise are crucial to the viability of the enterprise. The Institution will be managing large sums of money, and funding and investing in diverse activities. This means that, while structures for broad participation should be created, they must not impede professional management.

- *Be Entrepreneurial, Nimble – A Market-Maker*: The Institution must be flexible, specialized, continually innovative, and self-inventing; it must be able to spot opportunities and act efficiently. It must be in, and continually learning from, the marketplace. To this end, it must always work in close collaboration with the end-users of the information products, support services, and financing tools it produces. In effect, we need an inclusive, grounded, learning organization that listens well and which, at the same time, acts as an entrepreneurial, professional organization that gets things done.

Given the cross sector collaboration that is required and the subsidies that will be used to seed market development efforts, the governance structure of this institution should be a nonprofit 501(c)3 with strong, committed, and integrated involvement from private, public, and civic sector leadership. The leadership of this organization must have the access, resources, and authority needed to raise funds and drive large-scale action in the private, civic and public sector. Of the different organizational structures that meet these guidelines, there are three options that we recommend. Future work should evaluate the costs and benefits of each structure and recommend one of the three models outlined below.

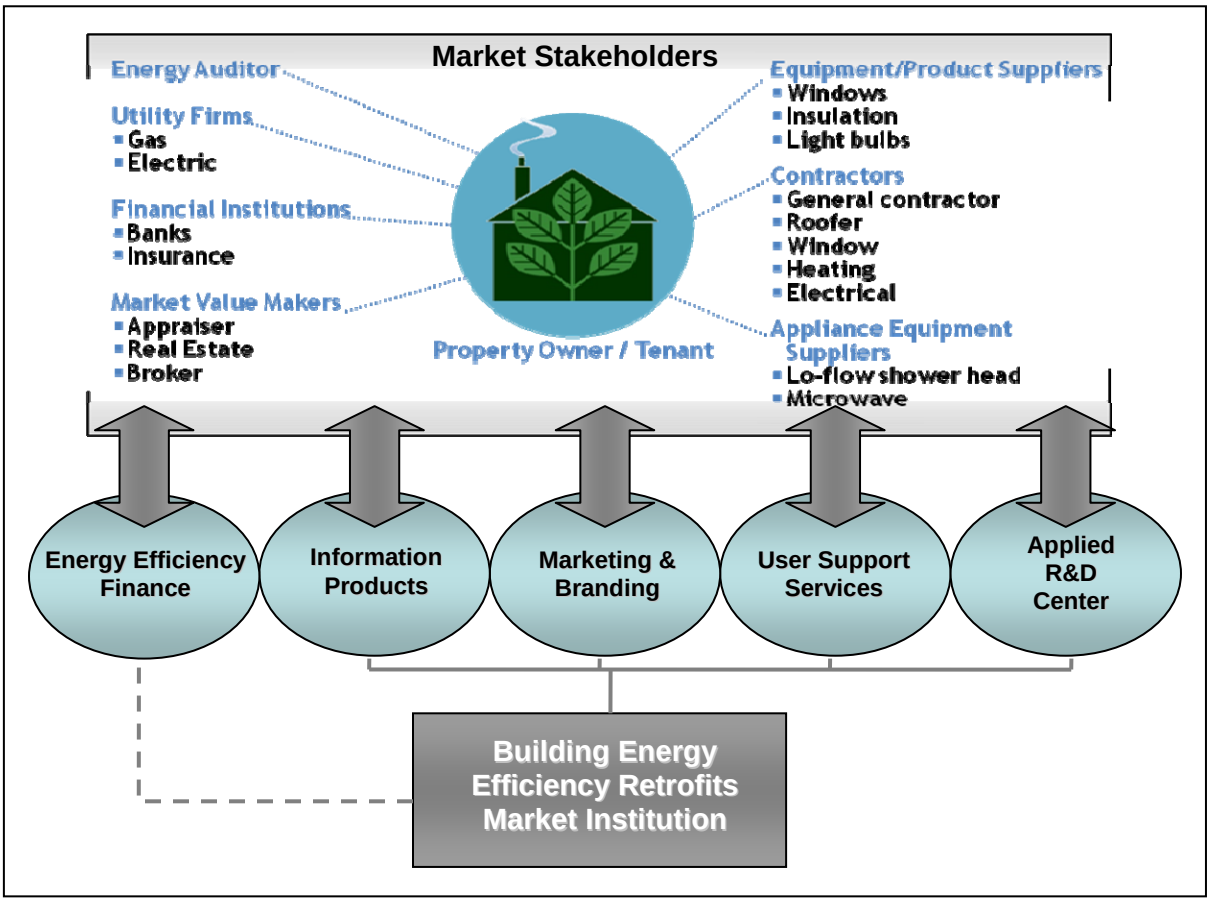
1. *Pseudo-Governmental Nonprofit Organization*
    - 501 (c)3 status
    - Seed funding from government and foundations
    - Mayor recommends and appoints board members
    - City Council approves board members
    - City Commissioners serve as ex-officio board members
    - Staff support provided by City Department(s)
    - *Example 1:* Chicago Low-income Housing Trust Fund
    - *Example 2:* Chicago Community Land Trust

2. *City-Sponsored Nonprofit Organization*
    - 501 (c)3 status
    - Seed funding from government and large civic organizations
    - Incubated by large foundation
    - Mayor recommends and appoints initial board members, who are then self-perpetuating
    - City Commissioners are included in initial appointments (and may get reserved seats)
    - Independent staff

3. *Independent Nonprofit Organization*
   - 501 (c)3 status
   - Seed funding from government and large civic organizations
   - Coalition of civic, trade association, and private sector leaders
   - City officials are not by requirement represented on the Board
   - *Example 1:* Chicago Alliance to End Homelessness

Organizational Functions and Structure

Given the diverse set of functions that the new institution should perform, we are proposing in effect the creation of two institutions under one umbrella organization. One is an Energy Efficiency Services Organization that will be responsible for (1) the Information Products, (2) User Support Service, (3) Marketing & Branding, (4) Supply Chain Development, and (5) Applied Research & Development. The second is an Energy Efficiency Finance Investment Bank, which will focus on raising and placing capital into strategic areas of the market.



The following is a brief summary of each of the business unit functions. It is important to note that not all of these functions will necessarily be performed in house, both to minimize duplication of services and to limit staffing and overhead. Rather, whenever

possible, the institution will work with existing businesses and organizations that can take on selected aspects of the work.

The **Energy Efficiency Finance Investment Bank** will aggregate or coordinate large amounts of capital, including equity, carbon credits, public bonds, New Market Tax Credits, and so forth, and use it to make transformative investments to develop the market. It will work with lenders to design targeted financial products for this market and provide risk mitigation products to reduce lender exposure. It will develop and deliver whatever supply-side investment products are needed. Finally, it will subsidize the other products and activities described here.

The **Information Product** division will focus on inventing the scoring system, designing the standardized certification system, and assessing existing energy usage monitoring systems. This department will also work to integrate these products and key metrics into the real estate market.

The **Marketing & Branding** function will design and implement a campaign to educate consumers about energy efficiency and retrofitting, as well as about the information products, user services and other activities of the initiative.

The **User Support Service** will work directly with consumers via a call center or through a website. They will respond to resource questions, educate consumers about the benefits of retrofitting, and refer clients to qualified contractors to perform retrofit work. In addition, they will contract with third party auditors to complete energy performance tests and certifications for homeowners.

The **Supply Chain Development** division will engage suppliers in a range of capacity building services and initiatives, including contractor training and certification, professional workforce development, and so forth. Considering the existing organizations addressing many of these issues, it will be particularly important that this division, like the rest of the organization, include, coordinate with and utilize existing institutions wherever possible.

The **Research & Development Center** will position Chicago as an advanced applied research environment for innovative building retrofit products, services and business designs. This department will identify key product development and applied R&D opportunities linked to the building retrofit market. It will create organized sets of “lead users” that can serve as “Voice of the Customer” cohorts for partnerships with private sector companies and Intellectual Property commercialization partners. This department will also develop structured partnerships with private companies to use the Chicago retrofit market development environment as an opportunity for advanced product/service development and testing. Lastly, this division will develop structured partnerships with sources of Intellectual Property and opportunities for Intellectual Property commercialization linked to the building retrofit market.

Future phases of the work should develop much more detailed specification of activities, as well as associated staffing, financial and other projections.

X. CONCLUSION AND NEXT STEPS

Conclusion

All indicators suggest that the energy efficiency building retrofit market in Chicago is ripe for development and holds the promise of billions of dollars of economic activity. From the sound return fundamentals that underscore retrofit investments to the City's bold emissions reduction goal to the strong and active leadership of the civic sector, there is no better time to engage in an effort to achieve large scale transformation in this industry.

With innovative information products, streamlined product delivery processes, special financing, and supply chain development products, the market will begin to recognize the value of retrofits and the transaction costs in the single family market place will become manageable. However, strong institutional capacity and active collaborations with government and civic actors are needed to get the early market starter work accomplished and to fill in where the market fails.

Next Steps

Although the ideas laid out in this Concept Paper make a strong case in favor of specific market development strategies, there is still much work to be done in designing and testing proposed product solutions as well as in building the institution needed to implement them. Overall, the next phase of this market development project should include two basic types of work:

(1) *Information Products:* Conduct a feasibility analysis and develop a prototype for the proposed information products, including the energy performance Scoring System and certification system.

(2) *Institution:* Benchmark, design and, ultimately, organize the market development institution.

The following is a more detailed description of the key activities that are involved in each of the proposed Phase II work streams.

1. Information Products – Feasibility Analysis & Prototype Development

The next steps in doing feasibility and prototype development on information products will involve the following key tasks:

- Develop the information and data capacity needed to develop the models.
    - Work with energy auditors, home builders, utility companies, the assessor's office, and others to investigate the various building components that would affect the energy auditing and retrofit process.

- Catalog a data inventory that can be efficiently and readily collected by the institution to develop the model and by homeowners and auditors to deploy the model. This step will include a review and comparison of all of the existing building energy efficiency scoring systems in the market to inform what factors should be measured.

- Gather a sample of full energy audits needed to build a baseline model. This will include:
  - Building a database of any homeowners in Chicago that have already completed an energy audit – in these cases, we can simply solicit these households for information.
  - If required, expanding the sample with additional homes until a sufficient number is reached to ensure that the modeling works, and subsidize them to perform a full audit.[34]

- Work with auditors and experts in the energy efficiency field to build a basic energy efficiency model. This model will need to be rigorously tested for accuracy before being released as a prototype. Because the model can be used by homeowners in a variety of ways (i.e. auto-calculate, self-assessment, and so on), the model developers will also work with website designers and the marketing team to highlight features of the model that would be relevant to homeowners and auditors.

- Assess the feasibility of energy usage monitoring technology. We will conduct a review of the existing technologies available for this purpose, including their costs, and recommend a technology development and implementation strategy.

2. *Institution – Benchmarking, Designing, and Organizing*

There are three key next steps in the creation of the market development Institution:

- Benchmarking Other Institutions. We will start by identifying and benchmarking comparable initiatives and organizational models like the Clinton Climate Initiative Residential Retrofit Program, Efficiency Vermont, Cambridge Energy Alliance, and others. In particular, we will study their mission, role and functions, organizational structure, staffing, budget, accomplishments, challenges, and other lessons learned. Our benchmarking findings will influence the proposed design of the Institution. In order to ensure that the Institutional structure is appropriate to Chicago's unique environment and culture, we will also research comparable organizational models for other industries in Chicago, such as World Business Chicago, Chicago 2016, the Low Income Housing Trust Fund, and others.

[34] Figuring out which homes are needed for the model will largely depend on sample size: the model will need a representative sample of homes across various housing types and energy characteristics to ensure that the model will be accurate.

- One Year Start-Up Plan. We will create a 1-year start-up plan for the Institution that will further detail the functions of this organization, and describe the proposed governance structure, management team qualifications and roles, and start-up budget. Given that the activities of this Institution will eventually be varied and dynamic, we will provide focused information about the year one milestones and activities that are most critical to the overall market development effort. In addition, we will explore in greater detail the role and involvement of the City and civic sector in creating and supporting the work of the institution. Key area of institutional design that will need to be detailed in this process include:
    - Development of operating detail on the User Support Service – how it would function; staffing; information support systems; etc.
    - Outlines of a marketing and branding strategy and related costs.
    - Detailed understanding of the supply chain requirements for a 50,000 unit/year retrofit market, including strategies for ramping up the current supply chain to avoid bottlenecks.
    - Design of the Energy Efficiency Finance Investment Bank – functions; staffing; capitalization amounts and sources; relationships with private finance markets.
    - Business strategy for applied research and development activities, including target projects and strategic relationships with private sector players and R&D institutions.

- Begin Organizing the Institution. Lastly, we will help organize the Institution. Given the dynamic and entrepreneurial nature of institution building, there is no way to completely predict the type of activities and support that will be required in establishing the Institution. However, we expect that early in the Institution building process, the City will use the proposed Institutional design as a guide to recruit a highly effective and influential Board, hire a visionary and skilled Director, and begin engaging market stakeholders. We are prepared to support the City in any and all of these efforts, including:
    - Presenting and/or pitching the Board membership opportunity to a targeted group of business, civic, and government leaders.
    - Vetting and interviewing Director candidates.
    - Facilitating retrofit market development briefings and action planning meetings with market stakeholders, including construction, equipment and product supplier, real estate brokerage, utility, banking, insurance, and other industry leaders.

APPENDIX A

Building Energy Efficiency Retrofit Interview List

1. Alan Miller	Real Estate Developer
2. Andrea Geller	Sudler Sotheby's International Realty
3. Anthony Corso	Consultant for Chicago Green Homes program
4. Ben Barlow	Clinton Foundation
5. Chris Berry	University of Chicago (Harris School of Public Policy)
6. Craig Sieben	Sieben Energy Associates
7. Dick Voith	Econsult Corporation
8. Faith Foley	Historic Chicago Bungalow Association
9. Jim Bringley	ShoreBank
10. Joel Freehling	ShoreBank/Triple Bottom Line Innovations
11. John Brauc	Checkmate Realty
12. Kevin Dick	DELTA Institute
13. Mike Bielawa	Community Investment Corporation
14. Mike O'Connor	ShoreBank
15. Mike Scobey	Illinois Association of Realtors
16. Rick Helwig	DNR Construction
17. Rob Bennett	Clinton Foundation
18. Robert Held	Property Manager of MDA City Apartments
19. Ron Goldstein	Sudler Sotheby's International Realty, certified ecobroker
20. Sean Penrith	Earth Advantage
21. Steve Clark	Informed Energy Decisions
22. Taylor Watkins	Appraiser
23. Vicki Brooks	Deborah's Place/Multifamily Property Owner
24. William Adkins	Bungalow Owner

APPENDIX B

Core Working Group

Anne Evens	Center for Neighborhood Technology
Bob Weissbourd – *Project Director*	RW Ventures, LLC
Chinwe Onyeagoro – *Project Manager*	O-H Community Partners, Ltd.
Dave Shryock	SB Partners Capital Fund, LP
John Cleveland	Innovation Network for Communities
Marti Wiles	Independent Consultant
Marty Cohen	Independent Consultant

Contributing Associates

Cathy Katona	O-H Community Partners, Ltd.
Michael He	RW Ventures, LLC
Riccardo Bodini	RW Ventures, LLC

Advisors

Donna Ducharme	Delta Institute
Joel Rogers	Center on Wisconsin Strategy
Julia Parzen	JP Consulting
Karen Hobbs	Chicago Department of Environment
Mary Houghton	ShoreBank
Tim Brown	Wabashco LLC

APPENDIX C

Estimated Costs of Subsidizing Low Income Segment Retrofits

Typically, eligibility for publicly-subsidized housing programs is based on a household's income as a percentage of the area median income (AMI). As an example, the income limit for the Emergency Housing Assistance Program (EHAP), Chicago's existing program that replaces furnaces for lower-income households, is 50 percent of AMI (based on household size). Based on a household of three people (the average household size in Chicago), HUD's 2008 Income Limits for the Chicago Metropolitan Area are listed below.

2008 HUD Income Limits for a Three-Person Household		
Percent AMI	**Household Income**	**HUD Classification**
30%	$20,350	Extremely low-income
50%	$33,950	Very low-income
80%	$54,250	Low-income

As an alternative to AMI, the income limit for CEDA's weatherization program is based on the federal poverty level. Households with incomes below 150% of the federal poverty level are eligible for the weatherization program. For a household of three, this amount is $26,400. The table below shows the number of renter and owner-occupied households by income, using the income thresholds described above. Low-income households make up a significant proportion of the approximately 1.1 million households in Chicago.

Number of Households by Income[35]				
Tenure	**30% AMI and Below**	**150% Federal Poverty Level and Below**	**50% AMI and Below**	**80% AMI and Below**
Owner-occupied	58,372	85,317	115,627	201,454
Renter-occupied	189,410	235,263	284,406	377,356
TOTAL	**247,782**	**320,580**	**400,033**	**578,810**

More data is required to accurately estimate the cost of retrofits for lower-income households in Chicago. Ideally, the number of households by income and by number of units in structure is needed - for both owner-occupied and renter-occupied households. In

[35] Analysis based on 2007 American Community Survey, U.S. Census Bureau

the tables below, the number of units in structure was estimated by assuming the distribution of units in structure for lower-income owners is the same as the distribution of units in structure for all owner-occupied households. Please note this calculation also assumes that 50% of low-income homes will be retrofitted.

Estimated Retrofit Costs All Lower-Income Owner-Occupied Households in Chicago			
		Percent of Costs Subsidized	
Household Income	**Number of Households**	**100%**	**75%**
50% AMI and Below	57,777	$ 322,151,448	$ 241,613,586
51% - 80% AMI	42,886	$ 239,124,878	$ 179,343,659
TOTAL	**100,663**	**$ 561,276,326**	**$ 420,957,245**