SEIZING THE OPPORTUNITY (FOR CLIMATE, JOBS, AND EQUITY) IN BUILDING ENERGY EFFICIENCY

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Nobody seriously disputes the facts that: (1) buildings are the site of gigantic energy consumption and greenhouse gas (GHG) emissions in the U.S. and grossly inefficient in their energy use; (2) efficiency is the cheapest, most reliable, and climate-friendly way of meeting energy needs; (3) prudent investment in improving building energy efficiency can save utility customers (especially the poor) lots of money and earn investors an attractive return, (4) "retrofitting" buildings with current materials and technology to gain energy efficiency requires a lot of labor — ranging from essentially unskilled to very skilled — which has to be done here.[1]

So you might think that building energy retrofits would be a killer app, of appeal to anyone concerned about climate, energy security, helping the poor, making money, or growing domestic employment. But it's not. Compared to the size of the opportunity — at its limit, covering all *300 billion square feet* of building space in America with cost-effective retrofit measures — the amount of retrofitting that goes on is tiny. This is so even in our cities, which account for most global warming and consume most of their energy in buildings.[2]

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[1] On these various claims: (1) Buildings account for 40 percent of total U.S. energy consumption (70 percent of U.S. electricity consumption) and 43 percent of U.S. carbon emissions — a larger share than either transportation or industry; (2) Efficiency savings on the order of 20-30 percent are readily achievable by better insulation, lighting, and HVAC equipment and controls; more intensive interventions can achieve savings on the order of 50-60 percent on a cost-effective basis (i.e., savings paying for the measures during their lifetime); estimated annual savings from improved U.S. building efficiency are somewhere north of $200 billion; that's a lot of waste; (3) Efficiency costs less than 3 cents per kWh of energy saved; measures are usually one-time and often low maintenance (e.g., insulation); the cleanest power plant is one not built; poor households devote a disproportionate share of income to energy costs both because they have less money to begin with and because they tend to live in less efficient buildings and use less efficient appliances; common industry estimates show 20-30 percent improvements in efficiency paying for themselves through realized savings in 3-5 years, and 50-60 percent improvements paying back in 8-10, implying internal rates of return of 10-33 percent; (4) Every $1M spent on retrofits generates about 14 person years of employment in direct installation of efficiency measures and another 3-4 person years in the production of relevant materials; buildings don't usually move.

[2] Globally, on about one percent of the earth's surface, cities contain 50 percent of the world's population (by 2030, at least 60 percent), consume 75 percent of its energy, and account for 80 percent of its GHG

Why is this? And what is needed to get building retrofits done at scale? In what follows I assume a market test on financing — that loaned or invested capital for the work needs to generate a risk-adjusted market rate of return.[3] So another way of asking our question is this: Why doesn't the market for retrofits work, and how can we fix that?

WHY THE MARKET FOR RETROFITS DOESN'T WORK

An old joke has it that an economist spots a $20 bill on the sidewalk but doesn't bother to pick it up because she knows it can't exist. In a world of complete competitive markets with only coordination problems standing in the way of increased wealth (problems that markets solve brilliantly), such unclaimed values aren't possible. In the real world, of course, markets are beset by "imperfections" (i.e., departures from the competitive market ideal) and "failures" (i.e., limits to that ideal in optimizing social welfare) that routinely miss values. The economist's failure to distinguish theory from reality is the joke here, and it's on her. Ha ha.

Retrofitting buildings for greater energy efficiency is something like that $20 bill. The opportunity is there and people don't pick it up. But this isn't because they're in the grip of a theory so strong that it makes facts disappear. It's because they don't even see the bill, or lack the strength to pick it up, or discover that they must run about the block several times before getting near it, only to have somebody else snatch it away from them. What's funny about that?

But so much for an overtaxed metaphor. The reason building energy retrofits aren't a killer app is that in the real world there are all sorts of barriers to realizing their value. Among *tenants and owners* of buildings, these barriers include:

1. Poor information (on net savings from efficiency investments, and trustworthy people to do the work involved);
2. Lack of capital or access to capital (capital markets for building efficiency are not well developed, and only the Nobel committee gives a prize for banking on the poor[4]);
3. Split incentives (you pay the energy bills but don't own the property, or vice versa);
4. Limited tenancy or ownership (why invest in your home or other property if you may be leaving or selling before you get your money back?);
5. Fear of disruption (who wants somebody tromping through her office or home?);
6. Risk aversion and general skepticism (people are much more sensitive to losses than

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emissions; as a share of local energy consumption by cities, buildings regularly account for more than 60 percent; in dense cities like NYC, they account more than 80 percent.

[3] This test may strike some as unduly demanding, but I think it's recommended on both practical and normative grounds. Practically, the prospect of entirely "free" capital (i.e., capital with no interest or repayment obligation) is vanishingly slim, especially in the amount needed for a big effort. Normatively, even less demanding capital should be spent wisely. A market test helps ensures that.

[4] I refer to receipt of the 2006 Nobel Prize in Economics by Dr. Muhammad Yunus, whose Grameen Bank helped establish microcredit as a tool in economic development. Yunus' first (personal) loan of $27 was to 42 self-employed craftspeople; $6 billion in like loans after, Grameen's default rate is < 1 percent.

gains, especially if gains require the cooperation of other people to be realized);
7. Lack of interest, or competing alternative uses of capital (if you were given $1,000 tomorrow, would you first spend it on an energy retrofit?).

External *investors* in energy efficiency have some of these same problems, but they also have the barriers of:

8. Disaggregation (highly dispersed potential energy savings, each with negotiation costs on capture, rather than a single big opportunity);
9. Fear of creditor default (we all know what that is).

Of course not all situations or people have these problems. Some may have none of them — say, an adventurous young homeowner in expected permanent residence, in good health and flush with money, whose best friends include many electricians and HVAC contractors. But most people have some of these problems, and poor people tend to have a lot of them.

HOW TO FIX THAT

If that's why retrofits aren't being done anywhere near the scale we desire, how might we fix that? Many things are desirable, but two are most critical:

(1) For tenants/owners, radically lowered risk and transactions costs — to permit high participation and the targeting needed to minimize disruption while preserving workflow. That means transparent turnkey solutions to getting the work done right, requiring little to no advance spending by program participants, that work even with changing tenancy/ownership, and guarantee net savings on current energy bills.

(2) For external investors, aggregation and reliable capture of savings to pay for the investment needed to achieve them, without removing tenant/owner incentive to make those investments in the first place.

Are these things achievable? Yes they are. Here is a relatively simple organizational model with six players (and four contracts among them). In rough order of appearance, the actors are:

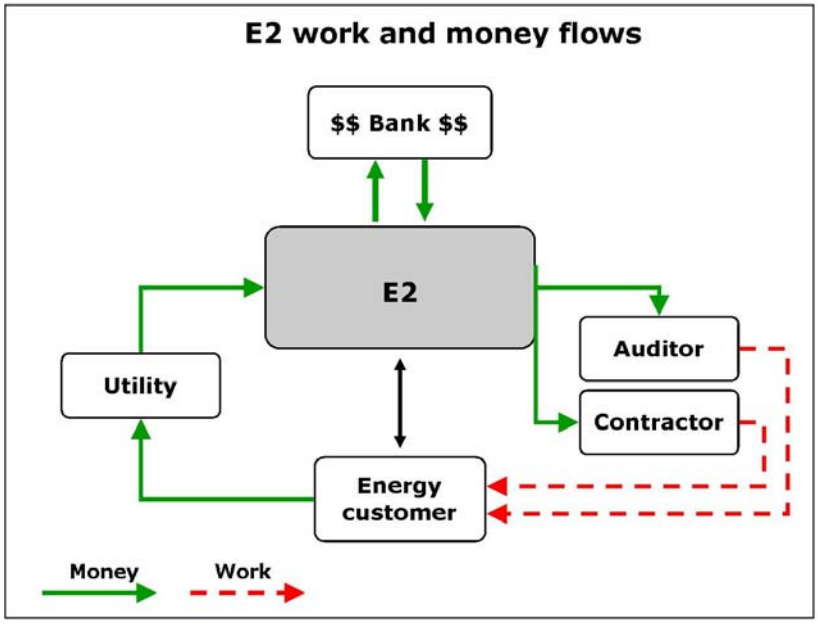
1. A coordinating entity, here called **E2** (for "Energy Efficiency"), responsible for the project. E2 could take any number of legal forms: a government entity or public-private partnership of some sort, a private for-profit or non-profit, a coop, etc.
2. A **utility** that regularly bills tenants/owners of properties for energy or other services and is willing to put a charge for E2 efficiency services on that bill and forward collections on to E2. This could be a conventional energy or water utility or a government.
3. An **energy customer** willing to pay for the retrofit work on her utility bill if the regular repayment obligation is always lower than estimated energy savings[5] and applies to her

[5] Savings from prior consumption are estimated from verified past average efficiency gains from like measures. We could alternatively measure before/after consumption directly. But there are problems in getting to such direct measurements and greater efficiency also raises a threat of moral hazard, with

only during her tenancy/ownership, after which the unpaid obligation attaches to next tenant/owner or, in case of sale, is wrapped into the sale price.

4. A **bank** that is willing to loan money to E2 for the work if it aggregates a large number of such customers. This could be an actual bank or group of banks, or a government, foundation, private investor, pension fund, or community savings pool, or any combination thereof.
5. A certified and bonded energy **auditor** to recommend proven retrofit measures and verify afterward that the work was done correctly.
6. A certified and bonded **contractor** to do the work.

The model works like this (the four contracts are numbered in parentheses, in bold). With agreement from the utility, E2 recruits customers willing to pay for approved work on the above terms **(1)**. The bank loans E2 money at interest for use as operating capital **(2)**. E2 contracts with the auditor to determine scope of work and verify its performance **(3)** and, after customer approval, with a contractor to do it **(4)**.[6] Work is done and verified, repayment by customer begins, and utility forwards payments to E2, which repays the bank. The figure below illustrates the flow of money (in green solid lines) and work (in red dotted ones); the two-sided black arrow simply represents the ongoing E2 relation with the customer.



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consumption potentially increasing because of lowered costs. Relying on verified past average efficiency seems like a fair, and certainly simpler, way to administer this.

[6] Here at least (experience will tell how wise this is) we separate the auditor, contractor, and financing roles to avoid the conflicts of interest and potential for opportunism intrinsic to most ESCOs (energy service companies). Along with seeking the highest return (which favors quick payback measures over the deepest energy-savings ones), ESCOs typically perform both the auditor and contracting functions, charge for use of their capital in the performance contracts they offer clients (but typically not on terms visible to them), and produce or vend for a producer of the recommended efficiency equipment.

This model gets rid of most of the barriers noted above. It takes all risk away from tenants/ owners, guarantees them immediate net savings, is indifferent to the length of their tenancy/ ownership, aggregates potential savings, and assures external investors a low default rate on repayment of loaned capital. By putting all responsibility for administrative functions in a single entity, it also dramatically lowers transactions costs. For investors the value proposition is: "If E2 organizes and aggregates a large pool of potential savings and assures you of repayment, are you willing to loan on that at risk-adjusted market rates?" To tenants/owners the proposition is: "If E2 fronts you the costs of achieving energy savings, and guarantees them and net gains to you on your current energy bill, are you willing to begin paying back those costs while you're here?" Both propositions are straightforward and attractive.

Here's what this would look like for an individual tenant/owner, say a homeowner. Assume the homeowner's pre-E2 average monthly energy costs are $200. She approves E2 retrofit measures that achieve a 25 percent increase in the home's energy efficiency, saving her $50 on energy consumption. Assume that the cost of the applied measures was $2000, using capital loaned at an 8 percent rate of interest, and a 7-year amortization schedule, which on that capital at that rate of interest would mean a monthly payment of $31.17.[7] Assume finally some modest administrative charges added by E2, here set for convenience in rounding at $3.83 (at a bit over 10 percent of flow, actually quite reasonable). The customer's utility bill would include a summary that looks like this:

Pre-E2 energy consumption	**$200**
This month's E2 energy savings	**($ 50)**
Your consumption this month	**$150**
E2 repayment charge	**$ 35**
You owe this month	**$185**

Now, $15 a month ($180 a year) may seem like too little to motivate anybody. But it's still found money from the standpoint of the customer, and after amortization would rise to $50 a month ($600 a year). And if energy costs rise, which seems very likely, the E2 deal only looks better. Say that costs double, so that our homeowner (absent E2 participation) would face charges of $400 rather than $200. Now the bill would look like this:

Estimated energy consumption absent E2 participation	**$400**
This month's E2 estimated savings	**($100)**
Your consumption this month	**$300**
E2 repayment charge	**$ 35**
You owe this month	**$335**

While the top line on consumption looks worse, the second line on savings looks better. Simply,

[7] Of course, different amounts of borrowed capital, interest payers, and amortization schedules are all possible. We chose a rough mid-point in the payback on typical retrofit measures, including those getting the deeper savings we are after, a standard market rate of interest.

the 25-percent efficiency gain is applied to twice the base as before ($400 vs. $200), so savings from it have doubled from $50 to $100 a month ($600 to $1200 a year). The homeowner still doesn't pocket all those savings during amortization. But since her repayment schedule has remain unchanged while energy costs have risen, she actually sees a good deal more of them, Specifically, net savings during amortization have more than quadrupled, rising from $15 to $65 a month ($180 to $780 a year). These numbers are probably big enough to get almost anyone's attention.

There are also ways to sweeten this deal further for E2 participants. I'll explore some of these below. In the meantime, let's take the model to be clear and attractive enough to ask about its implementation.

GETTING TO SCALE

So how do we get to wide implementation of something like this model?

Most of its antecedent conditions already exist. Along with countless examples of achieved savings from improved building energy efficiency; "shared savings" programs utilities run with customers; and energy-efficiency codes for building construction and rehabilitation; we have examples of on-bill repayment schemes, via energy utility bills or property-taxes; evidence of political demand for greater building efficiency, especially from mayors; and evidence of interest from private capital in financing projects with large aggregated savings.[8] We also, of course, have lots of energy customers worried about rising energy bills, plenty of poor people looking for green pathways out of poverty, and general if diffuse public interest in doing something about climate change.

What are chiefly lacking, still, are the E2-type entities to combine and harness these different design elements and public interest into programs that work at scale. We lack some relevant *management/organizing* capacity to run E2s — to persuade local civic leaders, recruit and service customers, negotiate with banks and utilities, target services at different points in building tenancy and ownership, monitor auditors and contractors, and otherwise handle administration on the terms indicated. There are also challenges/opportunities in realizing the *equity* promise of building retrofits, in improving their support in *policy*, and in achieving "*deep participation*" in building efficiency projects, by which I mean the joint maximization of investor/tenant/owner involvement *and* the depth of available savings achieved.

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[8] On these claims: (1) New Hampshire, Hawaii, and Kansas now require at least some meter-based repayment of efficiency costs (see www.paysamerica.org); (2) Berkeley, CA now has a program to pay back investments in residential solar through property taxes (see www.cityofberkeley.info/sustainable); (3) nearly 800 cities have joined the Climate Protection Agreement (see usmayors.org/climateprotection/), and virtually all make building efficiency a key part of reaching their goals; the national model that is NYC's climate action plan (www.nyc.gov/html/planyc2030), for example, includes retrofitting some 900,000 buildings; (4) the single most dramatic signal from financial markets remains the $5B committed by banks to the Clinton Foundation's building retrofit efforts with C40 cities (see www.clintonfoundation.org/), but it is hardly alone.

Let's now consider these challenges/opportunities, and some of the work needed to meet/realize them. What follows is by no means intended to be exhaustive of the problems and promise, just a look at some of the work ahead.

Management/Organizing — E2 entities can again take different legal forms and organize their diverse corporate function in different ways. But they will all need the capacity to develop business plans, handle money, negotiate deals, and navigate the complicated politics of what could soon be very large projects. This is considerable management/organizing capacity, beyond many of those with interests in building energy efficiency. We should be looking for potential allies in assembling that capacity (e.g., utilities, national or local ESCOs, progressive unions, community groups, etc.), and anticipate and encourage experimentation with different organizational models for finding the right combination of business competence and soul.[9]

We should also be prepared for some failures (the greatest source of learning), but work to minimize unnecessary ones by widely sharing knowledge of what's been tried before and shown to fail. More generally, we should dedicate ourselves to building an effective learning infrastructure for the new community of practice we hope to engender among E2-led efforts. This means building an easily accessible (inevitably web-based) wiki-like point of information, or clearinghouse, to display information on past efforts in building efficiency, emerging projects, current industry practice, major technology changes, etc., and to support this new community's development of shared performance metrics, evaluation routines, program refinements in light of evaluation, benchmarking, and other ongoing information sharing.[10] Nobody knows precisely what they're doing here — at least nobody interested in achieving the ambitions we have — so we should admit our uncertainty, proceed as transparently as possible with the best available knowledge, and learn better how to learn together.

Especially since the field is moving so quickly, there will be need for more advanced sorts of technical assistance (TA) — in new financing possibilities, application of new technologies, new governance models, etc. — to the community of E2s. Where this capacity exists it is scattered among multiple, often competing, and often for-profit organizations. There's need for thought on the design of some sort of cooperative (or, if you prefer, open source, peer production, etc.) model for its delivery — pulling from each TA provider what they are best at and combining it with contributions from others — at a cost that fledging E2s can afford.

Finally, we should explore whatever potential economies of scale and scope can be realized by

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[9] Indeed, it would help immediately to have a list of alternatives — different legal structures for these entities, different financing mechanisms at different points in their development, an inventory of the sorts of ongoing technical capacities they need, guides to assembling those capacities in different communities, estimates of costs of getting started, standards for outsourcing their necessary functions, etc. — that can be revised through future practice.

[10] The Clean Energy Jobs and Service Collaborative hopes to have the beginnings of such a clearinghouse up and running in the next few months. It will be housed initially at Green For All (www.greenforall.org), a member of the Collaborative.

direct program collaboration among member of the E2 community of practice. Among such points of exploration, we should consider: (1) economies in joint training of their management/organizer leadership; a shared labor market, and recruitment to it, for the staff jobs they will have; peer-to-peer cross-site training; etc.; (2) economies in joint public education and advocacy work (e.g., on the benefits of building efficiency, the costs of present policy); in the use of shared technologies in community outreach (organizing the community of potential participants is obviously a major issue throughout); in pooled response to new opportunities (in policy, financing, etc.) or challenges; (3) economies in developing shared tools or research capacity for community assessment, targeting, business planning; (4) economies in the training needed for the actual work involved in projects (e.g., shared community college or other training curricula, assessment and screening tools for job candidates, routines on job placement and monitoring, training delivery modes); (4) economies in aggregating project finance on a multiple-site basis, to spread risk and further reduce capital costs. I doubt all of these will prove equally promising, but am also sure that this is only the beginning of a possible list of gains to be had through better cooperation. The point is to keep an eye out for them all, and get the capacity to explore the promising ones.

If this field takes off, the costs of all these things — management/organizing capacity-building, learning infrastructure, advanced technical assistance, economies of scale and scope from more intense program coordination — can eventually be competed away or absorbed into general program administration. But the field is certainly not there yet. This suggests a natural role for private philanthropy[11] or even public capital.[12] The bottom line is that to advance this model and get wide replication we need a few examples of doing this right and infrastructure for doing more of it, along the lines just described. Neither is likely to come — at least, again, on the ambitious terms proposed here — from private markets.

Equity — To realize the equity promise of this work (i.e., its potential for poverty reduction and opportunity expansion for the poor and working class) we need capacity to recruit, train, and credential individuals seeking work in the building efficiency field (as regards training, in most cases, community college training as an energy auditor or HVAC technician is a good start); to place and retain them in institutions doing that work (companies, unions, others); and to assemble the additional social supports needed in both areas.

We have good models on all these elements from other industries, but again there's need to harvest past experience for lessons and to measure and diffuse good practices as applied to this

[11] Since the field is effectively new, it also presents an opportunity for philanthropy not just to help, but to improve its own practice — with a cooperative initiative drawing money from multiple sources but sharing realistic expectations on the duration of support (conditioned on measurable progress on goals, and transparency on those goals), eligibility for support (including local matching requirements), metrics on progress, discipline in their enforcement, etc.

[12] I think public capital should generally be reserved for other tasks: auxiliary supporting services (e.g., training of program participants) and help in reducing the costs of private capital (e.g., through credit enhancement). But at least some might reasonably be devoted to this purpose.

one. We immediately need, for individual sites: plausible projections on new job demand from building efficiency projects; maps of their existing recruitment/training/placement/mentoring capacities; design of cost-effective ways of increasing that capacity; assessment of community college, employer, and other institutional interest in helping do this, and the terms of their help. Again and throughout, we should also be looking to realize economies of scale and scope and cross-site learning. To take some immediate examples: (1) there is no reason on earth why standardized detailed templates on all the tasks just mentioned should not be available to all; (2) no reason why job estimates done in one city are not shared with others; (3) no reason why those involved in different cities in the equity aspect of their respective programs should not be comparing notes.

There are also governance issues around equity, specifically whether the chief responsibility for achieving it should lie with E2s or with some other organization. On the one hand, the issue is important enough to command attention at the center of project administration. The success of E2s depends on high participation and community support, and that support is unlikely without some real equity gains to that community.[13] On the other hand, there are natural tensions between satisfying these equity concerns and the market test that E2s must meet to survive. The latter will naturally incline E2s to select for service providers already prepared to do the work, potentially shortchanging the additional training and other services for those most in need. Mitigating those tensions is another natural role for government or philanthropic support, with such public-minded entities assuming some of those training and support services.

A different but related issue concerns tradeoffs between job quantity and job quality. The real equity goal is not employment *per se* — after all, as generations of civil rights leaders have pointed out, slavery was a full employment system — but employment in decently-compensated jobs with real opportunities for advancement. Getting to decent compensation requires cementing alliances with those unions, community organizations, high-road employers, and political leaders with interests in the same, and negotiating workable standards that they are all prepared to help enforce, e.g., prevailing wages and employer neutrality on organizing. But while such standards are now widely accepted in many public contracts, they are far from universal, and getting to that point will in many cases require a fight. Getting to career ladders will be even more complicated, since it will often require changes in the practices of the allies in that fight (e.g., unions and high-road employers). Again, there are useful lessons to draw from other industries in how community, business, and union support for both standards and career opportunities can be organized, even under sharply competitive conditions and widespread desperation for any employment. But be assured that even under the most favorable conditions this is tough work, and a good deal more complicated than persuading someone to retrofit their house. We need to get ready to do it.

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[13] Of course, one way to generate jobs for the community is to assign them tasks in project administration itself, as against the actual retrofit work. For example, community organizations could be paid to help recruit program participants. But we think this role, while important, should not come at the expense of getting to the "real" jobs in construction, plumbing, electrical work, etc., and assume that most community residents would agree.

Policy — While our model can generally work under current law, there is every reason to improve the legal environment for building efficiency. That would among other things mean: (1) mandating efficiency investments (e.g., through tougher builder and appliance standards, or requirements to meet those standards at property point-of-sale or major rehab[14]); (2) removing barriers to those investments (e.g., by aligning the treatment of energy costs and building improvements under federal tax law, removing state and municipal land use laws that discourage dense development or transit-oriented development, internalizing the infrastructure costs of sprawl to the developers who lead it, getting full cost accounting on all new building construction, and life-cycle accounting on new infrastructure, removing barriers to value purchasing); (3) requiring full net-metering for customers (i.e., permitting customers to sell capacity to the grid as well as buy it, and to realize value from peak load reduction or other gains from efficiency of value to utilities) and the availability of utility billings systems to non-utility-led E2s, while compensating utilities for gains in energy efficiency and not just increased energy sales; (4) developing markets for the "secondary" value of greater efficiency (e.g., emissions trading markets, efficiency trading markets, forward capacity markets[15]) and giving E2s the right to play in them; (5) encouraging greater cost transparency throughout the energy system, from real-time energy pricing for consumers to valuation of externalities (positive as well as negative) of different energy generation/conservation practices.

These are all complicated issues, involving many legitimate differences on the precise elements of best design. Part of work ahead is to get closer to a sophisticated and consensus public interest view on them. But one thing is already clear. While all these changes are in the public interest, and many offer "win-win" opportunities for the public and the energy industry, there will also be a fair amount of industry resistance to many if not all such reforms. So in addition to figuring out more precisely what we want, we need to frame the issues in ways that are understandable and motivating for the public[16] and to organize the public to achieve reform despite opposition.[17]

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[14] Just one point here, to emphasize both the availability of proven efficiency practices and the slowness of their diffusion: it is now more than a *quarter century* since San Francisco enacted its Residential Energy Conservation Ordinance (RECO), which requires upgrades at point of building rehab or sale (see www.sfgov.org/site/uploadedfiles/dbi/Key_Information/19_ResidEnergyConsBk1107v5.pdf).

[15] Cap-and-trade systems on GHG emissions and raise-and-trade systems on energy efficiency work on the same general principles. A standard on permissible activity is set and then moved over time in the direction favored by policy, with permits awarded or auctioned to those engaging in the activity, and those on either side of the standard allowed to trade (buy and sell) these permits to reach universal compliance. In GHG emissions trading, where emissions are capped and lowered over time, those above the permissible level buy permits from those below it. In efficiency trading, where the standards are raised over time, those above the mandated level sell permits to those below it. As used here, a forward capacity market is a market for meeting expected future energy demand that values quantities of demand avoidance (i.e., conservation) as highly as those of new generation capacity.

[16] A simple frame might be this: (1) consumers have a right to know the cost of their energy consumption in real time; (2) energy efficiency should be valued at least as highly as energy generation.

[17] In building that public will be important, as on other "environmental" issues, to emphasize the equity, productivity, and security gains from less energy consumption as well as the public health and climate

Deep Participation — Finally, we need to find a workable means of maximizing *both* external investor and owner/tenant participation *and* the depth of energy savings achieved. High participation for very modest efficiency goals (skimming) will not do; neither will deep savings in a tiny share of population. What we're after are high participation rates that leave as little unclaimed efficiency behind as possible.

The problem is that deep savings usually imply greater disruption for existing tenants/owners, and often a longer payback period, i.e., a lower internal rate of return for investors. External investors don't care about disruption but are concerned about liquidity and rates of return. For tenants/owners the interests are opposite, or very nearly so. They don't care about investor liquidity or return, and on our model — since amortization schedules can easily be adjusted to get them net savings throughout, and the remaining obligation goes elsewhere on vacancy or sale — should be willing to accept long paybacks[18] But they do care very much about disruption. High participation can help overcome both the investor and tenant/owner problems. With a big enough pool of participants, it's easier to adjust the mix of applied measures to get quicker buy-down of debt and an average payback that satisfies capital without sacrificing opportunities for deep savings. A large pool also permits targeting the application of measures to periods of low occupancy activity (e.g., during temporary vacancy, or already-scheduled rehab, or sale) while ensuring a steady flow of work.[19] Such targeting, which obviously avoids disruption, also allows greater cost-effective deep savings by reducing their cost.

But how do we get to high tenant/owner participation if direct energy cost savings aren't motivation enough?

One way is to require it. Pass a law requiring that all buildings, within a given period or upon major rehabilitation or sale, meet a certain standard of energy efficiency — and then keep raising that standard. That's simple enough. All is needed is public will.

Another way is to elicit highly voluntary participation by further reducing its risks and increasing its return for key players. That means reducing external investors' risk of default or increasing their effective return (ideally to the point that they are willing to free up capital at lower nominal interest rates), and/or increasing the ability of tenants/owners to capture benefits in addition to

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ones. Energy consumption is heavily regressive and now hurts the working class as well as the poor, waste in production is lost value of no benefit to any business except the energy one, and the distortions of our foreign policy that follow from our oil dependence are, perhaps, too well known to require comment. These facts should be known and acknowledged in ordinary, not just elite, public debate.

[18] We don't mean to overstate this. Especially among owners of residential properties (i.e., typical homeowners), and despite the built-in assurances of the model, there is probably some psychological limit to their tolerance for really long paybacks. But in truth we don't really know this either, so it's another place where more experience and evaluation are needed.

[19] Alternatively, if this is unduly restrictive, one could make the contract with tenants/owners two-staged, with immediate application of less disruptive measures and postponed (but obligated) application of more disruptive ones upon such periods of occupancy activity.

lower energy costs. For external investors, risk can be reduced by using less demanding capital (e.g., public money or philanthropy) for credit enhancement, including guarantees on expected defaults. Return can be increased by awarding their investment favored tax treatment. For tenants/owners, we've already taken out all risk in our model. But return can be increased by tying participation to benefits other than energy cost savings. Participants might for example be given favored public service, financial credit, or tax treatment — from accelerated permitting of property development, to better credit ratings by financial institutions, to partial relief from local property taxes. They could be awarded value for the contribution their efficiency makes to peak load reduction or service reliability (something highly valued by utilities), or to the ends valued in the current or anticipated markets mentioned above (e.g., markets in GHG trading, efficiency, forward capacity), or to values in new markets we can imagine to value the positive local externalities of building energy efficiency (e.g., its contribution to the health and productivity of their occupants[20]). And, looking beyond energy efficiency, the model described here can easily be wedded to almost any other way of producing value within buildings. One obvious way is to use buildings as a source of distributed energy generation, e.g., anything from solar panels to micro-CHP (combined heat and power, aka cogeneration). No doubt there are others.

In combination, such efforts could substantially improve the payback to tenants/owners. Consider a revised and frankly fanciful version of our first homeowner example. This assumes the same basic numbers as in that first bill — with a $2,000 retrofit on a home with prior monthly energy costs of $200 a month, realizing a 25 percent increase in efficiency. But it also assumes cheaper financing: say at 5 percent instead of 8 percent, which would drive the monthly payments down to $28.27; modest gains in administrative efficiency (perhaps following from wide participation), so administration adds only $1.73 in additional costs (again, obviously, for ease in rounding). And it assumes homeowner participation in (1) GHG emissions markets, (2) forward capacity or other efficiency markets, (3) some local program that values the positive externalities just mentioned, and (4) sale of energy back to the grid — with $40 coming from each activity monthly. Then the bill might look like this:

Pre-E2 energy consumption	**$200**
This month's E2 energy savings	**($ 50)**
Your consumption this month	**$150**
(1) This month's GHG credit	**($ 40)**
(2)This month's efficiency credit	**($ 40)**
(3)This month's local positive externality credit	**($ 40)**
(4)This month's sale back to grid	**($ 40)**
E2 repayment charge	**$ 30**
You owe this month	**$ 20**

[20] This is not a joke. Greater building energy efficiency makes buildings more comfortable and healthy for those within them. And less stressed and physically uncomfortable occupants, with fewer sick days and longer attention spans (among students, higher achievement scores!), are cumulatively much more productive. Gains to productivity here are widely estimated at 15 percent. Applied to a national economy of ≈ $15 trillion annual GDP, that represents a bit over $2 trillion in added value.

So now we're talking *serious* money savings: $180 a month ($2160 a year) during amortization, $210 a month ($2520) thereafter. Indeed, after amortization, the homeowner's energy bill effectively disappears. Instead of spending $2400 a year on this household necessity, she's netting $120 a year.

Beyond mandates and more material incentives, finally, there is moral persuasion and appeal to the public good. Battle-weary partisans of social progress often forget that such "soft" arguments are at least as powerful as "hard" material ones, finally indeed far more powerful, in directly motivating people to change their behavior. That the partisans forget is curious, of course, since it was precisely such moral arguments — for decency, regard for others, a concern for justice, a "blessed community" of equals, etc. — that made them partisans in the first place.

In any case, we should not be so forgetful and weary. As we strive to master the arcana of local landlord-tenant law, emerging energy markets, and new energy technologies; to get the individual material incentives right; to develop the market tested business model; to capture the greatest possible number of secondary benefits; etc. — we should not fail to make as well the social and moral argument for building efficiency. Along with making economic sense, building efficiency is an obvious way to contribute to community health and shared prosperity and to reduce the U.S. contribution to the global disaster of global warming, which will be visited most horribly on the poor and entirely innocent — children and future generations. That it is a small and mundane step toward healing our communities and planet makes it no less worth taking. Indeed, mundane is good. However improbable as this may sound, we should be aiming to make building energy efficiency as basic a norm of civil behavior as obeying traffic lights, not driving drunk, and not blowing cigarette smoke in a baby's face. It's pretty basic.

But enough. Meeting/realizing the challenges/opportunities of *management/organizing, equity, policy,* and *deep participation* is the work ahead, and obviously there's a lot of it. But the good news remains that the terrain on which this work would be moving has recently fundamentally shifted on terms favorable to its advance. There is both elite and popular demand for doing something about climate change, and widespread hope that the clean energy economy can be more equitable than the dirty one. Building retrofits and their associated green pathways out of poverty and reduced consumption costs for the poor are a natural way to meet both these interests. This opportunity is especially evident in our cities, whose dense supply of inefficient buildings, poor people, generally progressive politics, and political leadership on climate mitigation all recommend them as the natural place to start. And as just shown, there is in fact a plausible model for doing such building retrofits at scale — with most of its separate elements, if not their combination at scale, already proven — that can meet a market test on performance and attract private capital.

That is a nice point of departure.