Center on Wisconsin Strategy

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IMPROVING BUILDING ENERGY EFFICIENCY

Why building retrofits don't happen at scale, and how to fix that

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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 for greater energy 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 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]

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

[1] On these various claims: (1) Buildings account for 70 percent of U.S. electricity consumption, 40 percent of total U.S. energy consumption, and 43 percent of U.S. carbon emissions (a larger share than transportation or industry); (2) At least 20-30 percent savings are easily achievable by better insulation, lighting, and HVAC controls; more intensive interventions can achieve savings on the order of 60-70 percent on a simple cost-effective basis (savings paying for the measures); (3) Efficiency costs less than 3 cents per kWh of energy saved; measures are typically low maintenance; the cleanest power plant is one not built; (4) Poor households devote a disproportionate share of income to energy costs because (a) they have less money to begin with in meeting this necessary consumption item and (b) live in less efficient buildings with less efficient appliances; (5) 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; those payback numbers internal rates of return of 10-33 percent on invested capital; (6) Buildings don't usually move.

[2] Globally, on less than 1 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 greenhouse gas (GHG) emissions; cities are thus natural targets of climate mitigation efforts and, all else equal, their density aids in their organization; as a share of local energy consumption by cities, buildings regularly account for more than 60 percent, and in dense cities like New York, more than 80 percent.

risk-adjusted market rate of return. So another way of asking our question is why the market for retrofits doesn't work, and how we might fix that.[3]

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 the imagined world from this real one 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 really there and people really don't pick it up. But this isn't because they're in the grip of a theory so strong 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. There's nothing 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 *occupants and owners* of buildings, these barriers include:

1. Poor information (on net savings from efficiency investments, and trustworthy people to do it 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. Limited tenancy or ownership (Why invest in your home or apartment if you're leaving it, or your home or building if you're likely to sell it before you get your money back?);
4. Expected disruption (Who wants somebody tromping through their office or home?);
5. Split incentives (you pay the energy bills but don't own the property, or vice versa);
6. Risk aversion (people are much more sensitive to losses than gains);

[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., a gift with no expectation of repayment or interest/return) is vanishingly slim, especially in the amount needed for a big effort. Normatively, even if less demanding capital is freed up (e.g., from proceeds from the auction of carbon emissions permits), it should be spent wisely; a market test, even an implicit one, is a convenient way to achieve that.

[4] We refer to the award of the 2006 Nobel prize in economic to Dr. Muhammad Yunus, whose Grameen Bank pioneered the use of microcredit as a development strategy. Yunus' first loan, taken out of his own pocket, was for $27 distributed to 42 self-employed craftspeople. Some $6 billion in similar loans since, Grameen has a default rate of less than 1 percent.

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

7. Disaggregation (requiring many little deals, each with negotiation costs, with eats up returns, rather than a single big one);
8. 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? While many things are desirable, two are really needed.

> (1) Radically lowered transactions and risk for building occupants and owners, to permit high participation, aggregation, and the targeting needed to minimize disruption while preserving workflow. That means transparent turnkey solutions, requiring little to no advance spending by program participants, which realize immediate benefits to them and work even on condition of transient tenancy and ownership.
>
> (2) Reliable capture of enough of those savings to pay for the investment needed to achieve them, without removing occupant/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 in the model's operation, the actors are:

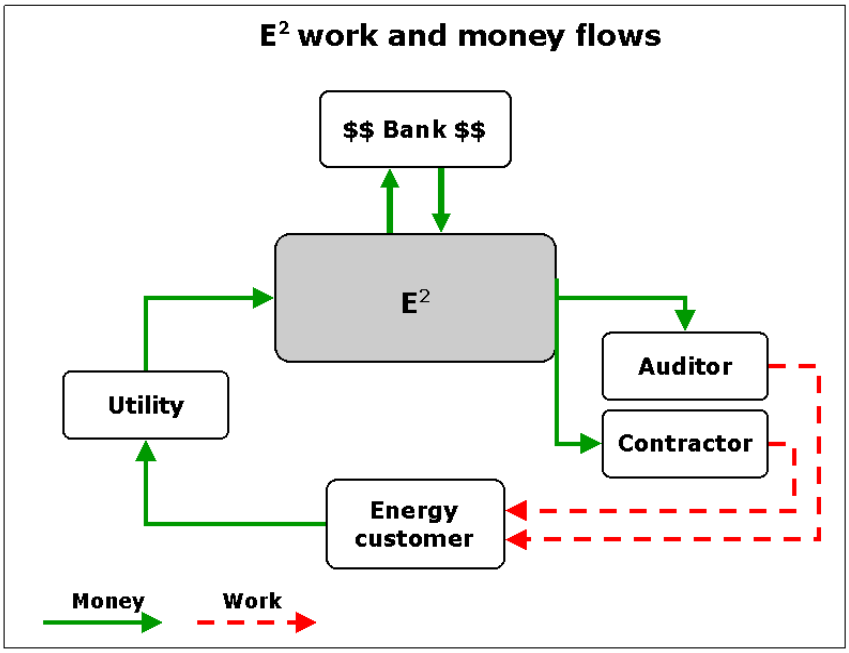
1. A coordinating entity, here called **E^2** (for "Energy Efficiency") to take responsibility for the project. E^2 could be a private for-profit or non-profit or a government entity.
2. A source of capital or **bank**. This could be an actual bank or group of banks, a group of foundations, a government, private investors, union pension funds, or some combination of all these.
3. An **energy customer** willing to pay for retrofit work, on her utility bill, at least as long as her repayment is lower than estimated achieved savings,[5] with an obligation that extends only so long as she maintains occupancy/ownership, after which it "follows the [utility] meter" to the next person connected to that meter.
4. A certified and bonded energy **auditor** — ideally, with no financial stake in the particular

[5] Note that the savings here are estimated, based on past performance of like measures. They could of course be measured directly, by comparing average monthly consumption of energy before and after installation of efficiency measures. But there are widespread problems in getting this measured accurately, and perverse consumption effects of increased efficiency (analogous to people driving faster with improvements in car safety). A commonly available and verifiable schedule of *average* efficiency gains for different measures seems like a fair, and certainly simpler, way to administer this.

work being done — to recommend proven retrofitting measures and verify afterward that the work was done correctly.

5. A certified and bonded **contractor** to do the work.
6. A **utility** (energy or other) with a meter at the property, to capture the savings.

And the model works like this (the four contracts are numbered in parentheses, in bold type). The bank loans E^2 money at interest for use as operating capital **(1)**. E^2 recruits customers willing to pay for approved work on the above terms, with payments to the utility forwarded to E^2. With a large enough pool of potential customers, E^2 then contracts with the auditor to determine desired scope of work and verify its performance afterward **(2)** and signs a contract with customer and utility on scope and cost of work and billing and repayment process **(3)**. E^2 contracts with contractor to do the work **(4)**.[6] Work is done, savings are verified, and repayment by customer begins. The figure below illustrates the flow of money (in green solid lines) and work (in red dotted ones).



Getting from here to there

So how to get to wide application of something like this model? With the exception of E^2, all the above actors already exist. So do examples of the elements in the model: no upfront costs to consumers, meter-based recapture of costs at rates lower than expected monthly savings, communities committed to doing comprehensive retrofits of their residential building stocks, larger-scaled retrofit projects in major cities, and actual or declared interest of major financial

[6] We separate the auditor and contractor roles here to avoid the temptations to skimming and conflicts of interest intrinsic to most ESCOs (Energy Service Companies), e.g. Johnson Controls, Honeywell, Siemens. Maximizing profit, ESCOs naturally center on work with quick payback (i.e., high returns) over work that gets the deepest cost-effective savings. They also typically combine the auditing and contractor role and vend for particular suppliers of energy efficiency systems and equipment, so have natural opportunity and incentives for opportunism.

institutions in participating in paying for them.[7] What are lacking are the E^2-type entities with capacity to combine these elements and take them to scale — to assemble customers, negotiate interest rates with banks, target services, monitor auditors and contractors, and otherwise handle administration on the terms indicated — and the community of practice, across different sites, that would give this effort cohesion and prominence, and political heft, while realizing natural efficiencies in its own organization.

As noted above, E^2 entities can take different legal forms and organize their key functions in different ways. We should be experimenting with different models and testing to see what works best under different conditions. It would probably help to have a list of alternatives — 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 is widely shared. More generally, a web-based clearinghouse on design alternatives and new and emerging best practices, with plenty of room for comment and improvement, would be helpful. There's also need for some resources to put competent E^2-type entities together in the first place, and enable their planning and other organization of different projects. Both these information and organization and planning investments are not the sorts of investments that private markets typically provide, and suggest a possible contributing role for private philanthropy — one would hope with some clear guidelines on what was being looked for, demonstrations of local matching support, etc. We should also be looking for economies of scale and scope that might be realized by cooperation across diverse sites of the model's application: (1) shared management and organizer leadership training for these projects, and a more visible labor market for those with the needed skills; (2) economies in the training needed for the retrofit work itself (e.g., shared curricula, credentials, delivery modes, etc.); (3) joint public education on the desirability of energy efficiency and the costs of present policy disincentives to it; and (4) ways of aggregating project finance on a cross-site basis, to spread risk and further reduce capital costs; etc. Call all this the *organization agenda*.

To realize equity concerns we also need capacity to recruit, train, and credential poor individuals seeking work in the building efficiency field (in some 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. We have good models on each of these elements from other industries, and there seems nothing intrinsic to this one to prevent their efficient assembly here. But again, there's a need for better diffusion of this experience and comment on it. There are also two points of tension in this aspect of program which may bear note. One is that, while it might be natural and appropriate to assign these functions to E^2, possible tensions between their effective discharge and the business

[7] Meter-based bill payment systems are now required in NH, HI, and KS (see www.paysamerica.org); Cambridge plans a comprehensive retrofit of its residential buildings www.cambridgeenergyalliance.org/; NYC's plans include extensive retrofitting ((www.nyc.gov/html/planyc2030). Cambridge Energy Alliance already has local bank participation in the revolving loan fund that will finance its effort. The Clinton Foundation's Climate Initiative project with the C40 group of cities has the most substantial commitments of private capital (http://www.clintonfoundation.org/).

demands on E^2 may recommend assigning them to other organizations.[8] Two is that, especially in an emerging industry and especially in regards to the poor, we can expect tensions between job quality and availability. Since the presumptive goal here is not just employment but employment in quality jobs with career opportunities, it is all the more important to cement alliances with those unions, community organizations, high-road employers, etc. with interests in the same. The experience of organizations with past success in navigating these tensions can again be plumbed for lessons in how those alliances are best made and preserved. Call all this the *equity agenda*.

While the described model can work under the current *general* tax and regulatory surround, there is also every reason to change that surround to encourage building efficiency. This first means getting public service commission orders to utilities to put the payback bills on their meters. But it includes as well: pricing carbon; decoupling utility gains from energy generation and demand side management; more demanding construction and appliances standards; developing forward capacity markets outside New England; requiring at least point of sale efficiency upgrading of buildings; and changing the federal and local tax and land use codes to encourage dense development, owner incentives to efficiency, etc. Call all this the *policy agenda*.

Finally, for different capital markets, we need to find a workable vector of maximizing *both* investor and owner/tenant participation and the depth of energy savings. There are several issues here. There's the implied rate of return from payback periods, with more ambitious interventions often implying longer payback and a lower rate of return to investors. There's the disruption implied by more intensive interventions. There's the rate of amortization of loaned capital (think a 30 year mortgage vs. a 15 year one), with its effects on consumer retained savings and credit market tolerance. We should be investigating different ways of reducing the cost of capital (e.g., through use of less demanding capital for credit enhancement or direct reduction of default risk, or favorable tax treatment) and increasing retained participant/investor value. The latter can be helped by inclusion of energy efficiency in property valuations and credit ratings, and customer capture of whatever monetary value is assigned its secondary benefits, e.g., carbon reduction, reduced generation need, lower infrastructure costs, etc. The model could also easily be wedded to other sources of value produced by or within buildings, including green roof carbon sinks, distributed renewal generation, combined heat and power, etc. Along with these ways of increasing the monetary value of participation, we should be working with community organizations, unions, and political leaders to emphasize the social benefits of all this. However improbable it may now sound, building efficiency should become a norm of good citizenship. And then, of course, and going back to the policy agenda, where financial incentives and "friendly persuasion" fail, there is legal force. However done, there is no underestimating the importance of driving up participation rates (and the interest and capital needed for that) while

[8] And then again, it may not. Demonstrated positive effects on poor communities is important to E^2's political standing, and one such effect in on employment opportunity for their residents. So E^2 has an interest in building in this equity concern. The conflict is between satisfaction of E^2's primary contractual obligations to customers and investors and the additional cost implied by such affirmative action to remediate inequalities in employment opportunity. This seems like a natural place for the "free" money (i.e., direct public subsidy) elsewhere excluded from the model. In the limiting case, however, it would be desirable if E^2 operated at a scale able to absorb these costs, and certainly the community's political contribution to this — that is, to securing a high participation rate by building owners and especially tenant occupants — has value. There is no reason the community should not get a "return" on this contribution, just as the investor gets a return on capital.

avoiding skimming. Call all this the *deep participation agenda*.

So that's the work ahead — advancing the organization, equity, policy, and the deep participation agendas — and there's a lot of it. But the good news is that the terrain on which this work would be moving has recently and fundamentally shifted on terms favorable to its advance. There is both elite and popular demand for doing something about climate change, and significant demand for distributing the opportunities of the clean energy economy more fairly than in the dirty one. Building retrofits are a natural place to meet both these interests, and cities the natural place to begin trying that, and with those cities — some 700 of which have announced commitment to ambitious climate mitigation/adaptation efforts — there is particular demand for doing this. And as just shown, there is in fact a plausible model for building retrofits — with most of its separate elements, if not their combination at scale, already proven — that would survive a market test on performance.

That is a nice point of departure.