Thank you, Harvey. It's a great pleasure to be here to talk about energy efficiency in Boston.

Let me start by saying that I do not oversee the City of Boston’s work on energy efficiency. That responsibility belongs to my colleague Brad Swing, the City’s Director of Energy Policy and Programs, who will be participating later in today’s event. Also here from City Hall are a 2012 graduate of DUSP, Nikhil Nadkarni, who last year joined the Environment Department to implement our new Building Energy Reporting and Disclosure Ordinance, and Lourdes Lopez, the Renew Boston Community Outreach Coordinator. I encourage you to seek them out for their thoughts on our energy programs.

What I do is oversee development and implementation of the City’s climate action plan, of which energy efficiency, as we’ll discuss, is a vital part. The current climate plan was released in 2011, and we have just started the public process that will lead to an update by the end of the year. I invite you to join an online discussion about updating the plan at engage.greenovateboston.org and to learn about other public activities related to the update.

Let me tell you about my house, built in 1874, in Jamaica Plain. Last year, we had to replace our old gas-fired steam boiler. After some research and discussions with the heating contractor, we identified a similar, more efficient replacement model. One of the features that makes new models more efficient is, of course, electronic ignition; the old boiler had a pilot light that burned all the time (though I did shut it off in the summer). But, although it consumed fuel even when the boiler was not supplying steam, the pilot also was linked to a thermopile that produced enough electricity to run the thermostat and the boiler’s switches. Consequently, during a winter blackout, my house would still have heat. I asked the contractor whether the new boiler had a built-in backup battery to run the system in an emergency or whether there was an override that would allow me to light the furnace manually. The answer to both questions was no. Because I would prefer to stay warm and in my own house during a blackout rather than go to an emergency shelter, I asked the contractor to get me a model with a pilot light. He then told me that the Commonwealth of Massachusetts no longer allows new boilers with pilot lights; electronic ignition is mandatory (probably for safety reasons—which which I am fully sympathetic.) As a result, I now have the benefit of a more efficient boiler, but at the cost of my family’s being less prepared for winter storms. (This may be an opportunity, if you’re looking for one.)

Boston's 2011 Climate Action Plan established policies and programs to reduce the vulnerability of Boston to the foreseeable effects of climate change—sea-level rise, higher temperatures, and more intense storms. It also set a goal to reduce greenhouse gas emissions 25 percent below 1990 levels by 2020 and 80 percent by 2050. Energy use by buildings accounts for about three-fourths of current emissions. Of the measures that, in 2011, we thought would get us to the 25-percent goal, energy efficiency in buildings and transportation accounted for most of the reductions. From 2005 to 2012, the last year for which we have a complete inventory, GHG emissions were down about 14 percent, and we were right on the straight track to meet the 2020 goal. Unfortunately—or is it fortunately?—almost all of the reduction came from fuel switching—that is, from oil and coal to natural gas in the production of electricity and network steam and in the direct heating of buildings. And that, as you know, was due to changes in the energy market completely independent of City policies. Energy consumption itself—measured in BTUs rather than tons of carbon—has remained basically flat. However, from 2005 to 2012, Boston's population grew about seven percent and employment grew about five percent. Increased energy efficiency in all its forms was sufficient to compensate for that growth. Going forward, fossil fuel
switching cannot accomplish much more for GHGs—though, of course, we want to be able to count on accelerating installation of renewables. This means that energy efficiency will have to do more.

In thinking about ways to expand energy efficiency investment, it's useful to think about scale and about motivational tools. The scale at which the action of efficiency applies varies enormously. We can go, for example, from an individual light bulb; to the design of the HVAC system; to the building itself and how well, or not, it is insulated or sealed or oriented in space; to the trees planted around the building that could shade the air-conditioning units; to the proportion of green infrastructure and cool roofs in the whole city, which determines the degree of the urban heat-island effect; to the design and components of the entire electric grid. In transportation, we can think about individual cars, the design of a street or intersection, the establishment of a single bus route or subway line, and the creation of a dense multi-modal regional network. Somewhere in there—indeed, in many places—we need to include the individual who decides whether to shut the light when he leaves the room or whether to put on a sweater instead of turning up the heat. Just as important are groups of people whose collective behavior affects the efficiency with which a city operates, say everyone who leaves work at 5 to create rush hour.

To motivate action, we—a government body, a professional organization, a non-profit, a community group, an individual—similarly have a wide variety of tools. These include: direct action, education, social pressure, opportunity creation, economic and social incentives, market measures, and direct and indirect regulation.

To see the interplay of scale and motivation, consider these examples:

- The City is upgrading its own buildings and streetlights.
- The Building Energy Reporting and Disclosure Ordinance compels building owners to learn about their energy performance and about efficiency opportunities.
- The federal Energy Star program provides information (teaches) about the relative energy performance of appliances.
- The City has established partnerships with business organizations to promote sustainability within various business sectors, a combination of education and social pressure.
- The Hubway bike-sharing network provides travelers the opportunity to travel around the city more efficiently.
- The Mayor’s Carbon Cup will recognize outstanding achievement in GHG reductions by businesses and institutions.
- Massachusetts utilities, through state law and in partnership with the Renew Boston program, provide rebates for energy efficiency investments for all sectors of the community.
- Perhaps, one day, a federal carbon tax will have a role in shaping the energy market.
- The City's energy stretch code and its green building zoning code impose direct and indirect requirements, respectively, for efficiency.
- The Grow Boston Greener program has established a goal of increasing the city’s tree canopy twenty percent by 2020, and various City programs plant trees, provide grants for trees, or persuade or require developers to plant trees.

Of course, any specific program might use a combination or progression of means, as that last example shows. And in 2005, the City started working to increase the proportion of hybrid vehicles in the taxi fleet. We started by providing information to cab owners about the economics of more efficient vehicles.
(Those of us unfamiliar with the industry quickly learned about the differing interests of owners and drivers.) We then offered grants—small ones, actually, relative to the entire cost, to assist the purchase of hybrids; and to provide operating incentives, Massport allowed hybrid cabs some first-in-line privileges at Logan Airport. We designed very nice CleanCab stickers, which you can still see on our taxis. After that, we tried to require that all cabs be hybrid—but a federal court declared that to be illegal; it violated federal prerogatives under the Clean Air Act. Finally, we changed the standards for all cabs in the city—that is, they had to be newer—which reduced the relative premium for hybrids and the market barrier to a cleaner fleet. Today, more than half the cabs in the Boston fleet are hybrid.

The economist Herbert Simon wrote in his book on *Administrative Behavior*:

“...there are practical limits to human rationality, and...these limits are not static, but depend upon the organizational environment in which the individual's decision takes place. The task of administration is so to design this environment that the individual will approach as close as practicable to rationality (judged in terms of the organization's goals) in his decisions.”

Given the multiplicity of tools and scales and the great reliance that we have on voluntary action for energy efficiency, we might amend that statement to say in regard to energy efficiency and climate policy: *The task of government is so to design the legal and economic environment that the individual will approach as close as practicable to rationality (judged in terms of the community's goals) in his decisions.* To this, we need to add a section about the development of technology, not just in relationship to energy directly, but the ways it is changing the social environment.

Energy efficiency is important for more than just greenhouse gas reduction. It has an important role in climate preparedness and resilience. Notwithstanding the example of my new boiler, the right approach to efficiency could increase preparedness. A better insulated and sealed building will remain habitable longer—summer or winter—in the event of a power outage. And the energy needs of an efficient building could be more easily met by PV panels, or, at least, add less to the strain on the electrical grid during a more intense heat wave, thus contributing to the community's preparedness. Though it is not energy efficiency, district energy and microgrids are becoming increasingly important in Boston's energy policies, and their contribution to preparedness and resilience is a salient point.

Independent of its relation to climate-related issues, efficiency has other important benefits. By reducing the need for the burning of fossil fuels, it improves air quality and public health and makes the city cleaner and more attractive. To the extent that efficiency in transportation and land-use planning induces people to walk and bike more, we will have healthier residents.

Efficiency can also be an important economic driver—and as important as we may think climate and energy issues are, our political leaders more often lead with the economy. So, the need for energy efficiency produces good local jobs for retrofits, spurs innovation (don't forget about my boiler), promotes the creation of new academic programs, lowers expenses, and, as Governor Patrick likes to point out, keeps money local. I'm sorry to have missed this morning's workshop on green economic development.
We have already mentioned some paradoxes of efficiency, to which we should add the rebound effect—for example, a car owner who drives more because driving per mile has gotten cheaper. We need to be alert to these and other unintended consequences.

It's great to be here. I look forward to the rest of the day's program and to hearing your ideas.

Thank you.