March 18, 2022
Commissioner Patrick Woodcock, Chair
Massachusetts Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

Re: DOER document entitled "Building Energy Code Straw Proposal: Updated Stretch Code and Specialized Opt-in Code," dated February 2022

Dear Commissioner Woodcock:

Thank you for the opportunity to provide suggestions, to help in your drafting of a final building energy code that fully meets, in a desirable, effective, and cost-efficient manner, the Commonwealth's goals as defined by the 2021 Climate Roadmap Law, as well as our ongoing laudable energy efficiency goals.

These comments reflect my MIT faculty teaching and research, including a Systems Dynamics Project intended to inform the MA Transition to Clean Heat at scale. And as well, these reflect my long-time practice in the energy efficiency field, including leadership roles in Xenergy (1980's/90's), Nexus/Aclara (2000's), as Board member of Conservation Services Group, and as member of the Wayland Town Climate Committee. In that role, we are implementing a Spring 2021 Town Meeting resolution to achieve carbon neutrality goals here in Wayland in a creative, equitable, effective, and timely manner.

These comments describe our view of what currently constitutes a *good new building*: cost-effective and energy efficient construction, while acknowledging that we should allow for consumer choice. As an outline, here is a list of the code suggestions below. Note that we don't explicitly address the three codes put forward, as *in our view these principles should apply to all construction:*

1) We should be requiring more "smart" building features that can adjust use of electricity on short notice in response to grid congestion.

2) If a building will be air conditioned, we should require installation of cold weather heat pumps instead of standard air conditioning . And for equity, in urban multifamily and/or low income housing, air conditioning provided by heat pumps should be a requirement.

3) Electric resistance auxiliary heat should be prohibited.

4) We recommend minimum prescriptive thermal efficiency features in all new buildings.

5) It is reasonable to allow towns the option of prohibiting new pipeline gas hookups. But where pipeline gas is allowed (which we don't recommend), then at minimum we should require that the home or building design *provides a place for a tank when pipeline gas comes to an end.*

Discussion of these five suggestions follow below:

1. We should be requiring more "smart" building features that can adjust use of electricity on short notice in response to grid congestion.

A concern with *Net Zero* terminology is that it suggests that what happens moment-to-moment is of less concern than the annual net zero balance, but this is certainly not the case when considering the need for grid stabilization. To mitigate the costs associated with grid upgrades in support of electrification, we need our homes and buildings to provide a form of *virtual peak power;* some combination of batteries, controlled water heaters and car chargers, and demand-responsive thermostats, as examples. Over time, we will be able to orchestrate these to accommodate periods of grid congestion, without interfering with comfort or activities in the home or building.

We see potentially even more impactful opportunities emerging that increase the potential for virtual peak power, such as vehicle-to-home devices that permit emergency power to be drawn from the EV battery during outages. And another promising opportunity is to unify the control of ductless mini-split heat pumps and backup heating systems. With these things, we should be able to fully avoid the need to expand our electric transmission and distribution systems to accommodate growing winter electric heat load. And as well, such systems will provide value to consumers, and resilience to the building.

2. If a building will be air conditioned, we should require installation of cold weather heat pumps instead of standard air conditioning - since these are the most efficient and economic alternative in new construction, as well as the most decarbonizing.

In new construction, the modest upgrade from AC to heat pump, at minimum, can fully heat the building with electricity for at least 2/3 of the winter at a cost lower than any fossil fuel. By stepping up further, to cold weather heat pumps sized properly for heat (about twice the size needed for AC only), all new buildings can heat with electricity through the entire winter at a similar cost to fossil fuels. And since no fossil heat system needs to be installed in an all-winter heat pump home, first costs are lower as well.

And for equity, in urban multifamily and/or low income housing*, air conditioning provided by heat pumps should be a requirement.* We need to acknowledge, and value, the health benefits of providing air conditioning for vulnerable populations. And for fairness, we can't fail to address this population while providing benefits of incentivized heat pumps for all other consumers who can afford air conditioning. If necessary, incentives should be increased to ensure equitable access for this segment.

3. Electric resistance auxiliary heat should be prohibited; given the exponential impact on the future grid during peak winter conditions.

Such systems, such as resistance coils in air ducts, and supplemental electric baseboard heaters below heat pumps, are installed frequently to provide extra heat during extreme cold weather (this isn't referring to a devices such as a bathroom heat lamp on a timer). When heat pumps are properly sized, no auxiliary heat should be needed in thermally efficient new construction. We can't allow the practice of under-sizing heat pump systems, and then relying on auxiliary heat for the coldest 50-200 hours per year. This may reduce first costs, but doing so adds an additional 3-6kw grid peak contribution per home during peak winter cold, creating growth in grid carbon emissions as well as, once we heavily electrify, the need for new generation, transmission lines, substations, and transformers. Such peak growth also increases the potential of winter power loss during subzero weather, a time of critical power reliability for health and safety. As a result, electric resistance, as backup to heat pumps, *needs to be discouraged for existing buildings as well*, when new heat pumps are being installed.

4. We recommend minimum prescriptive thermal efficiency features in all new buildings.

New homes should routinely have the latest well-proven air sealing technologies, mitigation of thermal breaks, energy recovery ventilation, cost-effective insulation, and high R-value windows, as examples. While performance goals are laudable, these sometimes create an *inefficiency permission* – allowing less use of highly proven, cost-effective thermal efficiency technologies because of site-specific circumstances that reduce heat loss and make the achievement of performance standards easier; such as limited window area, shared walls or cube-like structure configurations. And adding solar to the roof, though laudable, should never be a reason to allow a less thermally efficient building below it.

5. It is reasonable to allow towns the option of prohibiting new pipeline gas hookups.

Pipeline gas heat in new construction is unnecessary, expensive, risky, and carbon-emitting. We should acknowledge the possibility, even likelihood, that the gas network will shut down in stages well within the life of these buildings. In the meantime, pipeline gas will be increasing in price relative to all other fuels, as our transition to heat pumps at scale makes gas demand *peakier*.

We acknowledge that some consumers may desire fossil heat services for perceived benefits of economy, baseboard hot water heat quiet and comfort, use of gas for cooking, hot water, fireplace inserts, dryers, barbeques, and resilience during power outages. But perhaps a better alternative if the consumer demands this is *propane heat in a tank* as a supplement to heat pump use. Although higher in cost per unit for heat now compared with pipeline gas, the cost difference will likely shrink over time. And as well, there are more likely paths towards increasingly carbon-neutral substitutions for tanked propane or heating oil than for pipeline natural gas.

If/where pipeline gas is allowed (which we don't recommend), then at minimum we should require that the home or building design *provides a place for a tank when pipeline gas comes to an end.* It is a modest requirement for building plans, and plan review, to indicate how the building will be *future-ready* should the gas pipeline system in that area shut down. Especially if most of the winter is heated by heat pumps, which is both likely and what we need for climate, the size of fuel tanks needed should be modest. Having an identified location, and a connection from that point to home gas plumbing, should be identified on the building plans.

If designed well, our code will benefit new building owners and occupants, and the Commonwealth, by creating long term value, promoting equity, and protecting our environment. We would be happy to discuss any of these suggestions with you. Thank you for moving the Commonwealth forward towards a model climate solution.

Respectfully submitted,

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