Scott Greenbaum, PE, CPHC, CEM, GBE, and CBCP

Professional Engineer, Certified Passive House Consultants, Certified Energy Manager, Green Building Engineer, and Certified Building Commissioning Professional

Greene Energy Consultants, LLC

40 Damon Rd. Scituate, Ma 02066

My primary professional of expertise is in the design, construction, and retrofit of building for sustainable operation. I have over 40 years of experience. I have worked on almost every building type from single family residence, multi-family, commercial and industrial, and municipal buildings, and campuses from a 1,000 to over 2,000,000 sqft.

The Proposed Stretch Code while a big improvement from the existing code does not go far enough to begin to address the requirements of buildings performance required to meet the 2050 climate goals. The buildings constructed to this proposal will have to go through extensive and expensive renovation prior to 2050. The most expensive and intrusive work will to be the shell to insulate it. The proposed stretch code appears to be influence by developers and builders are afraid of change and the challenges of new techniques. They believe that high performance buildings are much more expensive than conventional building to build. A myth that has been dispelled by PHIUS. All is needed is good construction practices. High performance buildings exchange better building shells for smaller less expensive mechanical equipment. Also, the better the shell is weatherized (insulation and air tightness) the lower the energy consumption and GHG potential of the building and lower the quantities of fuel used to heat and cool. The input fuel becomes less important. The lower the stress on electric grid and less electricity required to meet the loads. The less renewables and storage are needed for a 100% renewable electric grid.

The level of improvement in this proposal resembles the failed attempt to chart the Future of Natural Gas which flatly rejected by the public and state. This type of rulemaking is irresponsible and reckless. It slows achieving the commonwealth goals for 2050. It is time to enact rules that achieve the goals and implement the will of the public.

While I do not support making PHIUS the base code for high performance buildings I believe that splitting the difference between the proposed regulations will meet the Commonwealths goals of building high performance buildings with good passive survivability characteristics. Passive survivability means that the occupant can stay in the building for about 24 hours before experiencing dangerous extreme indoor conditions allowing emergency services time to react to power outages. The document overall has the outline of the requirements to build high performance buildings. The issue is many of the minimum requirements do not match current state of the art construction methodologies and material specification. It is within easy expectations that better buildings can be built. Listed below are a few examples I have identified of the that can be improved:

1. Electric car charging minimum sizes are defined in AMPs only. Without the voltage, number of phases, kW rating, or industry standard size rating in level, the installed chargers could end up smaller than expected. In one place the code lists a 40 AMP charger is required. A 40 AMP 12-volt DC charge will meet code but will take days to charge a vehicle.

2. The core requirement of building a high-performance building is a well-insulated, air and moisture tight shell. The code allows for Non-Load Bearing Glass Bearing curtain wall. Curtain wall construction is very difficult to air seal and have poor insulation ratings. The regulation minimum requirement for the insulation factor for the glazing is four time poorer than the minimum factor standard wall construction. Over my career the building type with the highest level of comfort issues have curtain wall construction. People near the exterior tend to be cold in the winter due to convection currents and hot in the summer due to solar heat gain. These complaints result in the building operators altering mechanical system operating parameters to address the problem resulting in excessive energy consumption. The 5% that complain control the building. Maintaining air tightness in a curtain wall construction is very challenging. So even if the building passes the end of construction air tightness requirements the deterioration will be quick. Glass curtain wall construction is very difficult to upgrade over time. For a project we looked at replacing the existing system double glazed system with a better triple glazed high performance glazing system, but the building structure would not support the improvement and the building must deal with a poor shell or replace the curtain wall with standard construction changing the aesthetics of the building.
3. PHIUS air infiltration rates are 0.06 cfm/sqft. at 50 pascals. The stretch code standard is 30 cfm/sqft at 75 pascals over 7.5 times leakier in many instances. While meeting the PHIUS standard is difficult and maybe extreme, splitting the difference with the proposed can easily be achieved with current construction practices. I would recommend changing the air tightness test to 0.15 cfm/sqft. at 50 pascals. The is would greatly improve the shell thermal performance and significantly reduce the potential for mold and mildew.
4. The minimum window spec is a U-value of 0.25 for building construction types. The market has many options at or below 0.20. They are readily available. Increase the size of the market will result in lower average cost.
5. The proposed HERs minimum ratings are not strict enough. Lower the minimum criteria by 5 points greatly reduce the incentive to installing fossil fuel heating and DHW systems. Actually, the smallest fossil fuel heating equipment will be significantly oversized for the residential unit. They will stress the electrical grid less if electrically heated.
6. Allowing all electric residential construction, a higher HERS rating compared to a fossil fuel building maybe a red herring. The poor performing shell that is the result of the higher HERS rating may result in larger mechanical equipment sizes resulting in the cost difference to disappear.
7. Renovations that are subject to these regulations need to be reviewed. I have witnessed in Scituate MA and number of ways owners have skirted renovating requirements to the existing stretch code. One common process is to build one addition less than 50% of the existing building size and upon completion making another addition of the same size. This could be easily discouraged with simple language requiring that additional additions within a five-year period subject the entire structure to the regulation. Another building gut rehabbed the existing structure and only had to fill the cavities with minimum insulation then built and addition about 90% of the size of the original structure so that they did not have bring the original structure up to full code. The idea that the code does not apply if the work is on less than 50% of the value of the building is very subjective. This threshold should be lowered to 25%.

Let's talk about Social Justice and medium income populations. The stronger this regulation the smaller the future utility bills. Since PHIUS has illustrated that they can building very high performing residences and multi-family building for the same project cost as standard construction the result would be $100's to $1,000's of reduced energy bills and increase in disposable income. These populations are stretched thin on making ends meet, the higher the performance the residences they live in the better their lives. The result will not be increased ownership or rental cost.

During the public meeting I attended on August 2, 2022, there was testimony from the Propane industry stating that building using propane should be exempt from some of the requirements like being electric heat, cooking, and DHW ready because they are environmentally friendly fuel. I want to remind the committee that Propane is a fossil fuel. I researched the emissions factors per MMBTU rating compared to natural gas.

- Propane – 62.87 kg CO2 per MMBTU 0.60 g N2O per MMBTU 3.0 g CH4 per MMBTU
- Natural Gas – 53.06 kg CO2 per MMBTU 0.10 g N2O per MMBTU 1.0 g CH4 per MMBTU
- # 2 fuel oil – 73.96 kg CO2 per MMBTU 0.60 g N2O per MMBTU 3.0 g CH4 per MMBTU

While the 100-year GWP of propane is 3 compared to 25 for natural gas (CH4) for leaking commodity the combustion emissions are greater. When burned the Propane it generates more CH4 and N2O than natural gas resulting in greater GHG generation. N2O 100-year GWP potential is 298. Propane is not the clean fuel advertised during the hearing. I would recommend that if propane is used for heating, DHW, or cooking the stretch code requirements be more stringent than the base code requirements because of the damage.

Source EPA Center for Corporate Climate Leadership - Emissions Factors for Greenhouse Gas Inventories Last Modified 26 March 2020. www.epa.gov/sites/default/files/2020-04/documents/ghg-emission-factors-hub.pdf

In summary I recommend that DOER review the proposed regulations and adjust all values for better performance before issuing. To achieve the regulations goals should error on the side of a better shell the core requirement of a high-performance building. The quality of the shell will deteriorate over time and the heating and cooling loads will increase slowly. The better starting point the longer the performance will meet expectations.