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Transmitted to:  
Massachusetts Department of  
Energy Resources  
(Via email)

The National Propane Gas Association asks that you consider the information contained herein to represent the position of the NPGA with respect to the document “Massachusetts (MA) 2023 Residential Stretch code and Specialized Opt-in code (IECC2021 with MA amendments) DOER Draft 6-24-2022” and therefore address residential building implications. However, many of the general comments may also pertain to commercial construction proposals in the document, “MA 2023 Commercial Stretch code and Specialized Opt-in code (IECC2021 with MA amendments) DOER Draft 6-24-2022.” Comments that are specific to either the “stretch code” or the “opt-in code” are identified as such. Specific modifications to the code and justifications are provided in Annexes A and B following the signature page.

The National Propane Gas Association (NPGA) is the national trade association of the propane industry with a membership of about 2,500 companies, and 38 state and regional associations that represent members in all 50 states. Membership in NPGA includes retail marketers of propane gas who deliver the fuel to the end user, propane producers, transporters and wholesalers, and manufacturers and distributors of equipment, containers, and appliances. Propane gas fuels millions of installations nationwide for home and commercial heating and cooking, in agriculture, industrial processing, and is a clean air alternative engine fuel for both over-the-road vehicles and industrial lift trucks.

## Overview

The Massachusetts Department of Energy Resources’ (DOER) proposed Stretch Building Energy Code and new Municipal Opt-In Specialized Stretch Energy Code would not achieve the Commonwealth’s carbon emission reduction goals and, instead, simply shift emissions from one sector (buildings) to another (electric power). This is because the proposal fails to account for the inherent inefficiencies and added emissions associated with utility-scale power generation. It also fails to accurately compare emissions from primary energy sources, such as propane, to secondary sources, like electricity.

The direct use of propane is a clean and efficient way to consume energy, especially for energy intensive applications (e.g., space heating, water heating). And stretch codes should not prioritize one type of clean energy over another. However, as currently designed, these codes would discriminate against mixed-fuel buildings by instituting higher efficiency standards than all-electric ones. DOER's desire to promote electrification through the building codes process is based on wishful thinking about the future carbon intensity of electricity in Massachusetts and across ISO New England. Despite making rosy assumptions about the future carbon friendliness of electrons, the Agency ignores the substantial reduction in carbon emissions that can be achieved through the utilization of renewable propane molecules, which are currently being produced and consumed around the country.

Propane is at work today reducing greenhouse gas (GHG) emissions from residential and commercial buildings, all while ensuring Bay States have a reliable and cost-effective energy source to power applications they love, including fireplaces and cooking ranges.

### **Unintended Consequences of Building Electrification**

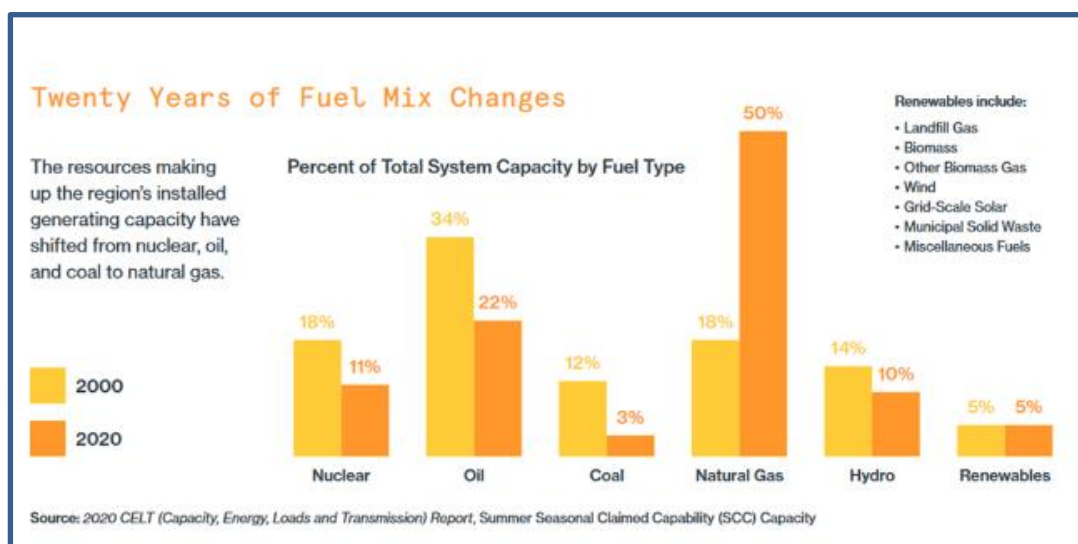
Both codes (the "stretch code" and "opt-in code") for residential construction would not achieve the Commonwealth of Massachusetts carbon reduction goals when full fuel cycle impacts are considered, including carbon emissions at the building, transmission of energy (electricity and fuel gas), and grid generation of electricity.

- a. The Commonwealth's contribution of carbon emissions from building energy consumption is the total of emissions generated from both its own energy generation infrastructure and imported energy from other states and Canada.
- b. While the concerns of NPGA rest with the role of propane in meeting building energy needs in the Commonwealth, implications of natural gas-fired grid power (within the Commonwealth and imported from outside the state) represent significant barriers to the Commonwealth's ability to deliver on total carbon emissions reductions that can impact global climate change. In this respect, Commonwealth and local jurisdictional restrictions on building energy options, premised on reducing carbon emissions from buildings alone, are logically flawed.
- c. In 2019, Massachusetts consumed 423.9 billion cubic feet (Bcf) of natural gas, of which 118,394 Bcf was consumed generating electricity in the Commonwealth.<sup>1</sup> This represents an extremely strong commitment to natural gas by the Commonwealth and the carbon emissions associated with consumption of natural gas for power generation over direct use in applications such as residential space heating.

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<sup>1</sup> 2019 EIA data for Massachusetts for in-state natural gas consumption.

- d. Natural gas electricity generation capacity rose from 18% of total capacity to 50% between 2000 and 2020, suggesting that the Commonwealth's commitment to gas-fired generation will continue to be significant out to 2030 and beyond.<sup>2</sup>



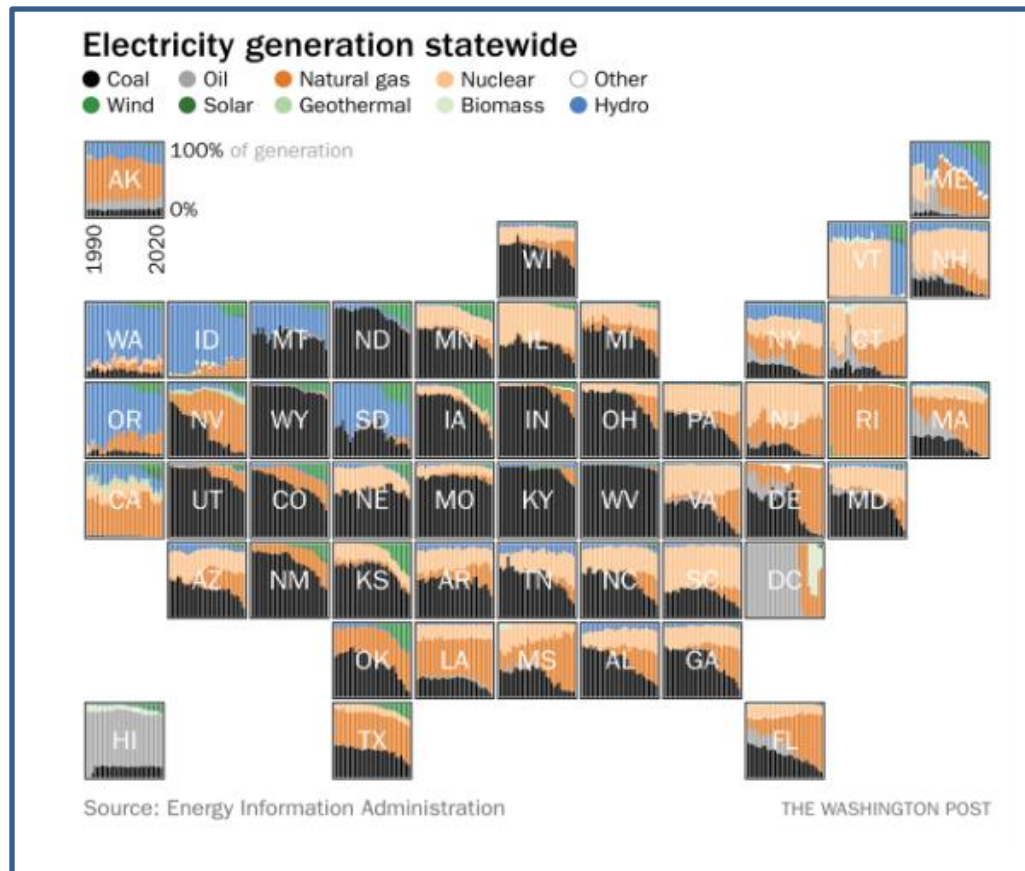
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It is not reasonable to expect that power generators serving Massachusetts will abandon this capacity or use it at suboptimal levels, hence preserving the role of gas-fired generation and related carbon emissions.

- e. Looking at Massachusetts' actual electric generation activity mix over time, adjacent states, and the Emissions & Generation Resource Integration Database (eGRID) subregion including Massachusetts (Northeast Power Coordinating Council – New England or NEWE) overall, U. S. Energy Information Administration (EIA) statistics present a visual

<sup>2</sup> 2021 ISO New England, "Regional Energy Outlook" for Massachusetts, 2000 to 2020 electric generation capacity.

representation of the Commonwealth's and regional commitment to natural gas-fired generation in terms of generation capacity utilization from 1990 to 2020 (note: the sources for this image are The Washington Post, July 30, 2022 And EIA as shown on the image):



- f. Implications of this commitment to natural gas-generated electricity serving space heating (i.e., for “electrified residential buildings) include energy consumption approaching three times the delivered energy available for space heating for gas-fired heating services from gas consumed at the residential property. A 2021 analysis published by American Gas Association<sup>3</sup> comparing national average residential heat pump heating to residential furnace heating fired by either natural gas or propane shows that, for a “typical” new home of 2,072 square feet of conditioned space and comparing a heat pump with a heating seasonal performance factor (HSPF) of 8.5, even an 80% annual fuel use efficiency (AFUE) outperforms the heat pump for space heating when full fuel cycle energy is used for comparison. For the analytical case, site energy consumption from the fuel-fired heating system consumed roughly double the energy of the heat pump (59.6 million Btus per year versus 29.7 million Btus per year), but the full fuel cycle consumption for the house for space heating, which was dominated by the space heating

<sup>3</sup> “A Comparison of Energy Use, Operating Costs, and Carbon Dioxide Emissions of Home Appliances, 2021 Update,” American Gas Association, Energy Markets, Analysis, and Standards, Energy Analysis, EA 2021-04, October 1, 2021.

load, was approximately 30% less than the consumption for the heat pump case (94.5 million Btus per year for natural gas specifically versus 134.1 million Btus per year for the heat pump case). Presumably DOER has information on Massachusetts homes and climate that would allow similar case comparisons since the REM/Rate™ tool that it uses generates a source energy report in rating building designs, but the DOER simulation cases do not appear to have been published.

- g. With the strong role of natural gas-fired generation serving the Commonwealth, carbon emissions associated with the Commonwealth's natural gas commitment for power generation will continue.
- h. The recent U. S. Supreme Court decision nullifying the federal Clean Power Program undermines many of the assumptions regarding a carbon-free power grid and, instead, is likely to lock in for the Commonwealth current natural gas-fired generation as a dominant option for the foreseeable future.
- i. Completely neglected from DOER consideration of greenhouse gas emissions at residential buildings is the likelihood of refrigerant leakage and consequent contributions to the global warming potential contributed by the codes. Conventional heat pump refrigerants have high global warming potentials (GWP) such as R-410a, which has a GWP of 2,088 (i.e., equivalent warming potential of 2,088 kilograms – kg - of carbon dioxide for each kg of leaked refrigerant). Industry is making great strides to introduce refrigerants with lower GWPs, but foreseeable industry practices and requirements such as those being introduced in California set the maximum GWP for heat pump and other application refrigerants at 750. Supreme Court action also nullified the EPA "SNAP 20" program, which would have introduced federal regulation of heat pump refrigerant GWPs. Estimates of annual leakage of refrigerants vary, but a 2017 U. K. study of heat pump and other systems places leakage at 6% per year.<sup>4</sup> At least one U. S. source uses 10% per year as a near term target for annual leakage.<sup>5</sup> Annual leakage from residential heat pump systems, typically representing approximately 1 kg of refrigerant at full charge multiplied by future GWPs that might range up to 750 and again multiplied by number of new residential heat pump systems installed as a result of the two codes creates a substantial potential global warming impact associated directly to implementation of the codes. NPGA is not predicting a specific greenhouse gas impact that adoption of the codes might add, in part due to uncertainty of residential construction in adopting jurisdiction, but that prediction and any discussion of better data on leakage and leakage impact mitigation needs to be addressed by DOER.
- j. It is noteworthy that the proposed amendments to the proposed "Base Energy Code deletes IECC 2021, Section R405 "in its entirety..." including the exception under R405.2 providing an alternative for energy use based upon source energy:

<sup>4</sup> <https://support.accuvio.com/support/solutions/articles/4000040366-annual-leakage-rate-for-the-refrigeration-air-con-hvac->

<sup>5</sup> <https://www.mybacharach.com/changes-to-refrigerant-leak-rate-requirements/>.

**“Exception:** The energy use based on source energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.”

Inclusion of the source energy exception serves as a proxy for direct calculation of the full fuel cycle energy consumption and, by extension with emission factors, carbon emissions associated with the building design. This performance option would directly serve the objectives of the Commonwealth. None of the building energy performance requirements in either the base energy code or the stretch code or opt-in code supports a direct association of building energy demand with carbon emissions attributable to the building design. Inclusion of the source energy exception, with updated site-to-source energy conversion factors applicable to Massachusetts, would address this deficiency and avoid tenuous and even erroneous associations of the code requirements with quantifiable estimates of carbon reduction impacts discussed in these comments. As discussed elsewhere in these comments, the REM/Rate™ software used by DOER in its building case analyses generates a source energy and emissions report as part of its rating output (Report 13). Simply reviewing that report, produced in association with the DOER case analyses, would illustrate the potential differences between the proposed requirements and the direct calculation of source energy and emissions produced by this integrated software, albeit on current conversions that are not necessarily suitable for Massachusetts with the exception of the current source energy conversion factor. NPGA strongly recommends that DOER include the R405.2 exception alternative in its base energy code and update the source energy conversions and emissions factors relevant to Massachusetts, the latter especially with respect to grid electricity serving Massachusetts.

## Clean Energy Molecules

Direct use of propane in buildings, which would essentially be handicapped under the proposed code provisions, would be significantly reduced as a consumer option for both meeting energy needs and reducing carbon emissions associated with the building sector.

- a. Conservatively, natural gas energy delivered to the Commonwealth had the equivalent of 4% or over 471 million gallons of commercial propane removed prior to entering Massachusetts.<sup>6</sup> This propane production capacity will undoubtedly be consumed elsewhere if not within the Commonwealth.

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<sup>6</sup> This calculation is based on 2019 EIA national data for total natural gas production liquids (NGPL), dry natural gas fraction from subtracted liquids extraction, and an estimated LPG fraction based upon a 39% proportion of heavy gas liquid (HGL). Total liquids extraction includes production and “straddle” extraction plant removal of C<sub>5</sub> and heavier fractions. Four percent (4%) is “conservative,” based upon low estimation of extraction and could be as high as 6%, but with use of national average data and conversion factors, higher removal percentages are difficult to justify. Data conversion to LP gallons based on standard conversion factors for MMCF of propane gas.



- b. In contrast to natural gas and gas-fired generation versus direct use, eliminating direct use of propane from residential construction would simply redirect carbon emissions from propane stripped from natural gas already used for electricity generation. That propane would be consumed in other jurisdictions, generate equivalent carbon emissions, and on net would not provide climate benefits to Commonwealth consumers.
- c. In fact, since delivered energy from electricity generation using natural gas requires over twice the fuel energy of direct use of propane, net carbon emissions for space heating will approximately double relative to energy delivered to consumers.<sup>7</sup>
- d. With respect to space heating in buildings, high efficiency, “cold climate” heat pumps contribute an approximately equal carbon footprint to high efficiency propane heating systems during the heating season despite the much higher heat pump rated efficiencies and when supplemental heating is required through use of electric resistance back up coils during severe cold spells.
- e. Beyond space heating carbon contributions, buildings meeting the Stretch Code requirements will not have propane-fired service water heating and cooking, which have important reduced carbon emissions opportunities when full fuel cycle emissions are taken into account.

## Impacts on New Construction

Focus of the codes on new construction as a means of achieving carbon emissions reduction goals disproportionately burdens new construction buyers and builders.

- a. In the end, direct use of gas fuels is likely to continue and in fact grow with continuing conversions of oil heat to gas fuels in existing housing.
- b. As a consequence, the dependence upon new construction reductions of fossil fuels generally in the Commonwealth’s relatively mature building stock is unlikely to contribute to meeting the declared objectives.
- c. Associated with this disproportionate burden, economically disadvantaged new home buyers and business owners and operators will bear the higher relative cost of the Commonwealth’s flawed efforts to meet carbon emissions goals.

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<sup>7</sup> Delivered energy comparisons are based upon GTI EPAT conversion factors for Massachusetts and its use of 2010 eGRID data, showing grid electricity conversion of 2.49 for energy delivered to consumers versus its national propane conversion factor of 1.15. Reductions in this grid electricity conversion factor to any measurable degree by 2030 is highly unlikely, and any change by that date would reset the trend in the conversion factor out to 2050.

- d. Federal information resources such as the U. S. Department of Energy’s “Energy Justice Dashboard”<sup>8</sup> provides insights on some of these disproportionate impacts for new home buyers, builders, and business owners and operators. While this and other resources are intended to help assess disproportionate environmental impacts, their focus on energy and associated costs are directly relevant to jurisdictions considering adopting the Stretch Code.

### **Inequitable Energy Efficiency Requirements**

Within the proposed code requirements, the inequitable imposition of minimum HERS rating index performance as a compliance option is unsupported.

- a. Dwellings meeting the definition of “mixed-fuel buildings” where combustion equipment is allowed in the building design have to meet a revised new construction HERS performance of 42 and for buildings undergoing major alterations, additions, or “changes in use” a minimum HERS performance of 52. These ratings changes from the current code of 52 and 65 (respectively) while also inequitably applied to buildings with combustion equipment, did not present significant barriers to deploying high efficiency propane end use options.
- b. By comparison, the new “all-electric, solar, and solar & all-electric” buildings HERS thresholds of 45 for new construction and 55 for major alterations, et. Al., impose severe disincentives for building designs with combustion equipment (i.e., at HERS thresholds of 42 and 52, respectively).
- c. This disparity is exacerbated by its imposition upon “large additions” and Level 3 alterations exceeding 1,000 square feet.
- d. The “mixed-fuel building” implicit prohibition of propane appliances imparted by the requirement for “HERS 0” or PHIUS ZERO” for homes larger than 4,000 square feet is discriminatory and disproportionately economically burdensome for large families and lower income extended families requiring larger dwellings to reduce housing costs.
- e. From a review of the technical background supporting the changes to the HERS minimums, it was found that the simulations of building energy consumption used to support the differentials, while involving a large number of building design “cases,” were based upon an artificially narrow set of propane-fired alternatives for space heating and not commercially-available high efficiency systems. The analysis does not cover these other types of gas-fired heating systems but instead uses a static and unrealistic comparison and should include have included the following systems and associated costs at a minimum:

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<sup>8</sup> <https://www.energy.gov/diversity/energy-justice-dashboard-beta>



- i. “Add-on” or hybrid heat pump equipment (using gas as the supplemental heat source). These systems have been in commercial production and residential installation for decades.
  - ii. Gas-fired heat pump water heating technology for hot water domestic boilers and other advanced technologies that will come into production in the near-term years ahead. An analysis of gas-fired heat pump water heating performance conducted for GTI has shown that source energy COPs and emissions for gas water heating designs range from 1.24 to 1.29 and with emission of 5.6 to 6.1 pounds of CO<sub>2</sub> equivalent (CO<sub>2</sub>e) per 100 gallons of hot water produced for a unit installed in California compared to electric heat pump water heater COP ranging from 0.92 to 1.16 and with CO<sub>2</sub>e emissions of 4.3 to 8.2 pounds per 100 gallons of hot water.<sup>9</sup> Comparisons to a modern “cold climate” air-source heat pump would be better basis for comparison (provided it is done on a source energy basis) and is an analysis that DOER should perform for Massachusetts climatic conditions.
- f. A further narrowing of the basis for supporting HERS minimum performance is evident with the recognition that home designs would tend toward the installation of forced air heating systems instead of the gas-fired hydronic heating systems used in the analytical comparison. Home designers would likely exploit associated installation cost advantages of heat distribution changes beyond those apparently assumed in support of the HERS analysis, from hydronic loops to forced air systems for fossil fuel heating buildings. As DOER staff have informally commented, builder cost savings from having to install both a hydronic heating system for gas heating and an air distribution system for air conditioning provides an installation cost penalty for gas boiler hydronic heating. The logical course of designers, then, would be to focus on forced air space conditioning systems (combustion as well as electric systems) where this redundancy in space conditioning systems would be avoided. DOER has not explained the reasoning behind its assumptions regarding hydronic heating systems being the predominant gas system in the Stretch Code.
- g. Cost analyses of these design requirements are opaque and lacking in efforts for development of consensus surrounding their findings. Jurisdictions considering adopting the Stretch Code should seek a clearer explanation of these costs, and the cost experience of jurisdictions that do adopt the Code should be analyzed and documented.
- h. To minimize negative consequences of the disparity in HERS minimum performance requirements, NPGA strongly recommends that the minimums be harmonized (i.e., made equal) for buildings with combustion equipment in their designs and “solar, all-electric, and solar & all-electric” building. Before differentials in HERS performance are re-proposed for the Stretch Code, full documentation of energy and emissions impacts should be developed based on data generated while the Code is applied.

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<sup>9</sup> Glanville, P. “Gas Heat Pump Water Heaters in California: Field and Laboratory Results,” Slide #5 and footnotes, GTI presentation, 2019 ACEEE Hot Water Forum Nashville, Tennessee, March 13th, 2019.

## Electric Heat Pumps

Practical implications of requiring heat pumps for space conditioning are not taken into account in the analysis supporting the Stretch Code. As pointed out by commentators on similar heat pump requirements proposals for the State of New York,<sup>10</sup> the feasibility of meeting heating needs by transitioning to heat pumps for 100% of citizens is infeasible from the standpoint of the appliance industry serving this required demand, training and qualifications of technicians to install these systems, and maintaining affordable consumer costs in the face of the induced market demand and marginal demand and supply pricing.

## Financial Burdens of Electrification

Requirements for multi-family buildings larger than 10,000 square feet to install wiring for domestic appliances and electric vehicle (EV) charging imposes additional costs that are likely to most directly affect economically-disadvantaged multi-family building tenants. These costs would be in the form of higher costs for multi-family unit renters for vehicle charging infrastructure serving systems that may never be installed and for vehicles that these consumers may never be able to afford to purchase.

## Solar PV Requirement

The requirement in the opt-in code for installation of solar panels in mixed fuel buildings and unit less than 4,000 square feet inappropriately penalizes homes using propane for any end use purpose, including for domestic cooking in an otherwise all electric home. This discriminatory requirement imposes excessive cost on building designs that use propane for any purpose and without any quantified consideration of offsetting carbon emissions. The all-electric building with a propane cooking appliance is a significant example since fuel requirements for domestic cooking are notably small and continuing to decline over time. In the AGA study cited elsewhere in these comments, domestic cooking accounts for less than 4% of “typical” house fuel consumption measured at the site and less than 3.5% compared to source energy consumed. Such trivial loads should not generate a requirement for solar panels.

## Conclusion and Summary

If the Commonwealth concludes that revisions to building energy codes are a necessary component of its overall GHG reduction strategy, then these codes should be energy and fuel agnostic. Stretch energy codes should not unfairly promote one energy source above another. Fuel sources should, first and foremost, be judged on their ability to reduce the carbon intensity

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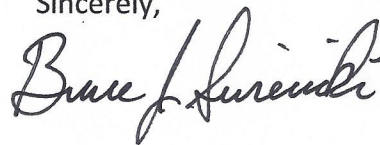
<sup>10</sup> Hanley, J, “Green Scheme: The Climate Action Council’s Climate Transition Cost Analysis,” Empire Center, November 2021, p. 3.

of energy today. And today, we know that propane produces fewer GHG emissions than an equivalent amount electricity from the grid in Massachusetts. As detailed above, it is critical that, when comparing the carbon footprints of propane and electricity, source energy metrics, based on a full fuel-cycle energy analysis is used. This is the only accurate and complete way to compare emissions from a primary and secondary energy source.

However, if DOER is going to make decisions based on the potential for any particular energy source to reduce future emissions built on assumptions regarding the carbon intensity of that energy, then that reasoning should be applied across the board. It is blatantly unfair to assume that the grid electron of tomorrow will be cleaner and less carbon intensive and not assume the same for the propane molecule. Renewable propane is here today, and the potential for blends of renewable propane to further reduce carbon emissions across the Bay State are immense.

The National Propane Gas Association strongly encourages Massachusetts DOER to consider these comments and the proposed modifications to the code in Annexes A and B and make the applicable code revisions before it proceeds further with developing and implementing new stretch energy codes.

Sincerely,

A handwritten signature in black ink, appearing to read "Bruce J. Furin". The signature is fluid and cursive, with a large initial "B" and "F".

## ANNEX A

### Proposed Changes to Residential Code Text

#### 225CMR Chapter 22 and Chapter 22 appendix RC (specialized opt-in code)

#### CHAPTER 1 [RE]

### SCOPE AND ADMINISTRATION

#### SECTION R103

#### CONSTRUCTION DOCUMENTS

##### *R103.2 Amend as follows:*

**R103.2 Information on construction documents.** Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data

and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Energy compliance path.
2. Insulation materials and their *R*-values.
3. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
4. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
5. Mechanical system design criteria.
6. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
7. Equipment and system controls.
8. Duct sealing, duct and pipe insulation and location.
9. Air sealing details.

##### 10. EV Ready Space locations per R404.2.

**Reason:** This provision is not an energy-saving feature for the building and will unjustifiably increase the cost of construction without a definite payback for the consumer. This feature should be implemented solely at the discretion of the building owner.

11. Solar-Ready Zone in accordance with Appendix RB, or Solar Zone Area when complying with Appendix RC for fossil-fuel heated homes.

#### CHAPTER 2 [RE] DEFINITIONS

#### R202 GENERAL DEFINITIONS

##### *R202 Add the following definitions:*

**ALL-ELECTRIC BUILDING.** A building with no on-site indoor combustion equipment for fossil fuel use or capacity including fossil fuel use in space heating, water heating, cooking, or drying appliances.

**Reason:** Left unchanged, this definition would preclude the installation and use of outdoor cooking gas appliances that oftentimes are used to provide cooking operations when the electric power is not available.

**CLEAN BIOMASS HEATING SYSTEM.** Wood-pellet fired central boilers and furnaces where the equipment has a thermal efficiency rating of ~~85~~80% (higher heating value) or greater; and a particulate matter emissions rating of no more than ~~0.15~~ 0.08 lb PM<sub>2.5</sub>/MMBtu ~~PM~~ heat output.

**RENEWABLE PROPANE.** An energy source for appliances comprised of propane made from renewable feedstock having a maximum carbon intensity rating of 50 (grams CO<sub>2</sub> equivalent per megajoule).

**RENEWABLE PROPANE EQUIPMENT.** Any *equipment* or *appliance* used for space heating, *service water heating*, cooking, clothes drying and/or lighting that uses renewable propane *as its energy source*.

**Reason:** The code should not discriminate against other fuels, especially since renewable propane does not emit any particulate matter and is at least equivalent to wood pellets in terms of CO<sub>2</sub>e production from combustion. (Not much information seems to be available for wood pellet products of combustion. Eric Adair of HPBA says “groundbreaking” research is being done that should be able to report on that.)

**R406.5 ERI-based compliance.** Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have an **HERS index** rating less than or equal to the appropriate value indicated in Table R406.5 when compared to the *HERS index reference design* for each dwelling unit prior to credit for onsite renewable electric generation.

**TABLE R406.5 MAXIMUM ENERGY RATING INDEX**

On-site <b>Clean</b> Renewable Energy Application	Maximum HERS Index score <sup>a, b</sup>		
	New construction until June 30, 2024	<u>New construction permits after July 1, 2024</u>	<del>renovations</del> <u>Major alterations, additions, or Change of use</u> <sup>c</sup>
<i>Mixed-Fuel Building</i>	<del>52</del> <sup>d</sup>	<del>42</del> <sup>e</sup>	<del>52</del> <sup>d</sup> <del>65</del>
Solar Electric Generation	55	42	55 <del>70</del>
<del>Clean Space Heating</del> <i>All-Electric Building</i>	55	45	55 <del>70</del>
Solar Electric & <del>Clean</del> Space Heating	58	<u>45</u>	<u>58</u> <del>75</del>

<sup>a</sup> Maximum HERS rating prior to onsite renewable electric generation in accordance with Section R406.5

<sup>b</sup> ~~Where on-site renewable energy is included for compliance using the ERI analysis of Section~~

**R406.4.** The building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

<sup>c</sup> Alterations, Additions or Change of use covered by Section R502.1.1 or R503.1.5 are subject to this maximum HERS rating.

<sup>d</sup> **Where either renewable propane equipment is installed or conventional propane combustion equipment is installed and the total CO<sub>2</sub>e emissions do not exceed those of baseline electric appliances as determined on a source energy basis, the maximum HERS score shall be 55.**

<sup>e</sup> **Where either renewable propane equipment is installed or conventional propane combustion equipment is installed and the total CO<sub>2</sub>e emissions do not exceed those of baseline electric appliances as determined on a source energy basis, the maximum HERS score shall be 45.**

**REASON:** There are locations where *renewable propane equipment* or conventional propane equipment can be used and provide the same or better carbon intensity performance that an all-electric building can, based on source energy considerations. As promulgated by the U.S. federal government, source energy accounting is the most effective means to determining the true impact of CO<sub>2</sub>e production by buildings.

## **APPENDIX RC – MASSACHUSETTS MUNICIPAL OPT-IN SPECIALIZED STRETCH CODE 2023**

### **RESIDENTIAL LOW-RISE BUILDING PROVISIONS**

*The provisions contained in this appendix together with referenced sections from the Stretch energy code constitute the Specialized opt-in code for residential low-rise buildings, and may be adopted by a city or town together with the Commercial Specialized code Appendix CC as their stretch energy code. When adopted by the local municipality, the provisions in this appendix are mandatory in combination with the IECC2021 with Massachusetts Stretch code amendments.*

#### **RC101.3 Definitions.**

**NET ZERO BUILDING.** A building which is consistent with achievement of MA 2050 net zero emissions, through a combination of highly energy efficient design together with being either a *Zero Energy Building*, or an *All-Electric Building*, or where fossil fuels are utilized, a building fully pre-wired for future electrification and that generates solar power on-site from the available *Potential Solar Zone Area*.

**ZERO ENERGY BUILDING.** A building which through a combination of highly energy efficiency design and onsite renewable energy generation is designed to result in net zero energy consumption over the course of a year as measured in MMBtus or KWh<sub>eq</sub>, on a **site source** energy basis, excluding energy use for charging vehicles.

**Reason:** Since 2009, the National Academies have endorsed the use of source energy (full fuel cycle) calculations over site energy calculations. From Chair James W. Dally's May 15,



2009 letter to Acting DOE Assistant Secretary Dr. John Mizroch, “The committee’s primary general recommendation is that DOE/EERE consider moving over time to the use of a full-fuel-cycle measure of energy consumption for assessment of national and environmental impacts.” And, “...measuring full-fuel-cycle energy consumption would provide a more complete picture of energy used, allowing comparison across many different appliances as well as an improved assessment of impacts such as effects on energy security and the environment.” Nothing more need be said.

*RC102 Revise Section as follows:*

## **SECTION RC102 ZERO ENERGY RESIDENTIAL BUILDINGS PATHWAY**

**RC102.1 General.** New *zero energy buildings* shall comply with Section RC102.2 and demonstrate a certified HERS rating of 0 or less and comply with Section R406, or complete Design Certification to the Phius ZERO standard and comply with Section R405.

**RC102.2 Energy Rating Index Zero Energy Score.** Compliance with this section requires that the final HERS rated design be shown to have a score less than or equal to the values in Table RC102.2 when compared to the Energy Rating Index (ERI) reference design determined in accordance with RESNET/ICC 301 for both of the following:

1. ERI value not including on-site power production (OPP) calculated in accordance with RESNET/ICC 301.
2. ERI value including on-site power production calculated in accordance with RESNET/ICC 301 with the OPP in Equation 4.1.2 of RESNET/ICC 301.

**TABLE RC102.2 MAXIMUM ENERGY RATING  
INDEX<sup>a</sup>**

<b><u>FUEL USAGE</u></b>	<b>ENERGY RATING INDEX NOT INCLUDING OPP</b>	<b>ENERGY RATING INDEX INCLUDING OPP</b>
<u>All Electric</u>	45 47	0
<u>Mixed-Fuel</u>	42 <sup>b</sup> 47	0

a. The building shall meet the requirements of Table R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or R402.1.3.

<sup>b</sup> Where either renewable propane equipment is installed or conventional propane combustion equipment is installed and the total CO<sub>2</sub>e emissions do not exceed those of baseline electric appliances as determined on a source energy basis, the maximum HERS score shall be 45.

**REASON:** There are locations where *renewable propane equipment* or conventional propane equipment can be used and provide the same or better carbon intensity performance that an all-electric building can, based on source energy considerations. As promulgated by the U.S.



federal government, source energy accounting is the most effective means to determining the true impact of CO<sub>2</sub>e production by buildings.

## **SECTION RC104 MIXED-FUEL PATHWAY**

**RC104.1 General.** This section establishes requirements for new *residential mixed-fuel buildings* with any space heating systems, water heating systems or appliances capable of using fossil fuels such as natural gas, heating oil or propane fuel. All buildings shall comply with either:

1. HERS certification: Sections RC104.2 through RC104.5 and RC105
2. Passivehouse pre-certification: Section R405 and Section RC104.3

**RC104.1.1 Biomass heating.** New *residential buildings* using *clean biomass heating systems* may comply with this section. Biomass heating that does not meet the performance standards of *clean biomass heating systems* shall not be permitted as a primary heating system.

**RC104.2 Energy Rating Index score.** Compliance with this section requires that the rated design be shown to have a HERS Index score less than or equal to the values in **Table RC103.2 RC104.2** when compared to the Energy Rating Index (ERI) reference design determined in accordance with RESNET/ICC 301 for both of the following:

1. ERI value not including on-site power production (OPP) calculated in accordance with RESNET/ICC 301.

**TABLE RC104.2 MAXIMUM ENERGY RATING INDEX<sup>a</sup>**

<b><u>FUEL USAGE</u></b>	<b><u>HERS RATING INDEX NOT INCLUDING OPP</u></b>
<u>Mixed-Fuel building</u>	<u>42<sup>b</sup></u>

a. The building shall meet the requirements of Table R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or R402.1.3.

**<sup>b</sup> Where either renewable propane equipment is installed or conventional propane combustion equipment is installed and the total CO<sub>2</sub>e emissions do not exceed those of baseline electric appliances as determined on a source energy basis, the maximum HERS score shall be 45.**

**REASON:** There are locations where *renewable propane equipment* or *conventional propane equipment* can be used and provide the same or better carbon intensity performance that an all-electric building can, based on source energy considerations. As promulgated by the U.S. federal government, source energy accounting is the most effective means to determining the true impact of CO<sub>2</sub>e production by buildings.

**RC104.3 Electric Readiness.** Any installed gas, fuel oil or propane furnaces, boilers, water heaters, dryers, or cooking equipment shall comply with the requirements of Sections RC104.3.1 through RC104.3.4. Capacity for the future electric circuits required in this section shall be included in the load calculations of the original installation of electric service to the building and each dwelling unit.

**RC104.3.1 Space Heating.** The building and each *dwelling unit* shall be provided with a designated exterior location(s) in accordance with the following:

1. Natural drainage for condensate from cooling equipment operation or a condensate drain located within 3 feet (914 mm), and
2. A dedicated branch circuit in compliance with IRC Section E3702.11 based on heat pump space heating equipment sized in accordance with R403.7 and terminating within 3 feet (914 mm) of the location with no obstructions. Both ends of the branch circuit shall be labeled "For Future Heat Pump Space Heater."

**Exception:** Where an electrical circuit in compliance with IRC Section E3702.11 exists for space cooling equipment based on heat pump space heating equipment sized in accordance with R403.7.

**RC104.3.2 Household Ranges and Cooking Appliances.** An individual branch circuit outlet with a minimum rating of 250 volts, 40 amperes shall be installed within three feet of each gas or propane range or permanently installed cooking appliance.

**RC104.3.3 Household Clothes Dryers and Water Heaters.** An individual branch circuit outlet with a minimum rating of 250 volts, 30 amperes shall be installed within three feet of each gas or propane household clothes dryer and water heater.

**RC104.3.4 Water Heating Space.** An indoor space that is at least 3 feet (914 mm) by 3 feet (914 mm) by 7 feet (2134 mm) high shall be available surrounding or within 3 feet (914 mm) of the installed water heater.

**Reason:** The provisions in RC104.3 are tantamount to forcing home builders and their customers into choosing an electric home and therefore eliminating a competitive option for society at large. The argument that such provisions are providing options to consumers is a non-starter because otherwise a similar requirement that a home be piped for gas would also be on the table.

The fact is that this provision is based on speculation that plentiful (affordable) electric energy that is reliably delivered through a resilient grid will be available in the future and although that may be the case, it is based on myriad "house of cards" assumptions that all have to fall into place for the speculation to become reality.

In the meantime, it is not fair to add speculative cost to the construction of a home, especially for those who may be least able to afford it. The additional electrical accommodations and space requirements may add a thousand dollars or more to the cost of a new home that will prevent some of the most disadvantaged groups in society from being able to afford it.

## **ANNEX B**

### **Proposed Changes to Commercial Code Text**

#### **CHAPTER**

#### **2**

*Add the following definitions:*

**ALL-ELECTRIC BUILDING.** A building with no **on-site indoor** combustion equipment for fossil fuel use or capacity including fossil fuel use in space heating, water heating, cooking, or drying appliances.

**Reason:** Left unchanged, this definition would preclude the installation and use of outdoor cooking gas appliances that oftentimes are used to provide cooking operations when the electric power is not available.

**AUTOMATIC LOAD MANAGEMENT SYSTEMS (ALMS).** A control system that allows multiple connected electric vehicle supply equipment (EVSE) to share a circuit or panel and automatically manage power at each charger, reducing the total connected electrical capacity of all EVSE.

**CLASS 3 EXHAUST.** Exhaust meeting the definition of Class 3 air in ASHRAE/ASHRAE Standard 62.1-

2019, including air with significant contaminant concentration, significant sensory-irritation intensity, or offensive odor. The Class 3 Exhaust system must be capable of reducing exhaust and makeup airflow rates to 50% of the zone design values or the minimum required to maintain pressurization relationship requirements.

**RENEWABLE PROPANE.** An energy source for appliances comprised of propane made from renewable feedstock having a maximum carbon intensity rating of 50 (grams CO<sub>2</sub> equivalent per megajoule).

**RENEWABLE PROPANE EQUIPMENT.** Any equipment or appliance used for space heating, service water heating, cooking, clothes drying and/or lighting that uses renewable propane as its energy source.

**Reason:** The code should not discriminate against other fuels, especially since renewable propane does not emit any particulate matter and is at least equivalent to wood pellets in terms of CO<sub>2</sub>e production from combustion. (Not much information seems to be available for wood pellet products of combustion. Eric Adair of HPBA says “groundbreaking” research is being done that should be able to report on that.)

*Replace Section C406.2.3 with the following:*

**C406.2.3. Renewable space heating.** All space heating shall be provided with cold-climate air source heat pumps having rated coefficient of performance (COP) of at least 1.75 at 5 degrees Fahrenheit source air, or ground source heat pumps.

**Exception:** Where either renewable propane equipment is installed or conventional propane combustion equipment is installed and the total CO<sub>2</sub>e emissions do not exceed those of heat pumps as determined on a source energy basis.

**REASON:** There are locations where *renewable propane equipment* or conventional propane equipment can be used and provide the same or better carbon intensity performance that an all-electric building can, based on source energy considerations. As promulgated by the U.S. federal government, source energy accounting is the most effective means to determining the true impact of CO<sub>2</sub>e production by buildings.

**C407.2 Relative Performance.** This option requires compliance with Section C407.2.1 and C407.2.2

**Exception:** Where either renewable propane equipment is installed or conventional propane combustion equipment is installed and the total CO<sub>2</sub>e emissions do not exceed those of specified electric appliances as determined on a source energy basis.

**REASON:** There are locations where *renewable propane equipment* or conventional propane equipment can be used and provide the same or better carbon intensity performance that an all-electric building can, based on source energy considerations. As promulgated by the U.S. federal government, source energy accounting is the most effective means to determining the true impact of CO<sub>2</sub>e production by buildings.

**TABLE C407.4 MAXIMUM ENERGY RATING INDEX**  
Maximum HERS Index score<sup>a</sup>

Building Energy Sources	New construction permits until June 30, 2024	New construction permits after July 1, 2024	Major alterations, additions, or Change of use <sup>b</sup>
Mixed-fuel building	52 <sup>c</sup>	42 <sup>d</sup>	52 <sup>c</sup>
Solar Electric Generation	55	42	55
All-Electric building	55	45	55
Solar Electric & All-Electric building	58	45	58

<sup>a</sup> Maximum HERS rating prior to onsite renewable electric generation in accordance with Section C407.4

<sup>b</sup> Alterations, Additions or Change of use covered by Section R503.1.5 are subject to this maximum HERS rating.

<sup>c</sup> Where either renewable propane equipment is installed or conventional propane combustion equipment is installed and the total CO<sub>2</sub>e emissions do not exceed those of baseline electric appliances as determined on a source energy basis, the maximum HERS score shall be 55.

<sup>d</sup> Where either renewable propane equipment is installed or conventional propane combustion equipment is installed and the total CO<sub>2</sub>e emissions do not exceed those of baseline electric appliances as determined on a source energy basis, the maximum HERS score shall be 45.

**REASON:** There are locations where *renewable propane equipment* or conventional propane equipment can be used and provide the same or better carbon intensity performance that an all-electric building can, based on source energy considerations. As promulgated by the U.S. federal government, source energy accounting is the most effective means to determining the true impact of CO<sub>2e</sub> production by buildings.

## SECTION CC102 DEFINITIONS

**NET ZERO EMISSIONS BUILDING.** A building which is consistent with achievement of MA 2050 net zero emissions, through a combination of highly energy efficient design together with being either a *Zero Energy Building*, or an *All-Electric Building*. *Mixed Fuel buildings*, may also meet this standard where the building *is fully pre-wired for future electrification and generates solar power on-site from the available Potential Solar Zone Area.*

**Reason:** These provisions are tantamount to forcing builders and their customers into choosing an electric building and therefore eliminating a competitive option for society at large. The argument that such provisions are providing options to consumers is a non-starter because otherwise a similar requirement that a building be piped for gas would also be on the table. The fact is that this provision is based on speculation that plentiful (affordable) electric energy that is reliably delivered through a resilient grid will be available in the future and although that may be the case, it is based on myriad “house of cards” assumptions that all have to fall into place for the speculation to become reality.

In the meantime, it is not fair to add speculative cost to the construction of a building. The additional electrical accommodations and space requirements may add a thousand dollars or more to the cost of a new building.

**ZERO ENERGY BUILDING.** A building which through a combination of highly energy efficiency design and onsite or community-based renewable energy generation is designed to result in net zero energy consumption over the course of a year as measured in MMBtus or KWh<sub>eq</sub>, on a *site source* energy basis, excluding energy use for charging vehicles.

**Reason:** Since 2009, the National Academies have endorsed the use of source energy (full fuel cycle) calculations over site energy calculations. From Chair James W. Dally’s May 15, 2009 letter to Acting DOE Assistant Secretary Dr. John Mizroch, “The committee’s primary general recommendation is that DOE/EERE consider moving over time to the use of a full-fuel-cycle measure of energy consumption for assessment of national and environmental impacts.” And, “...measuring full-fuel-cycle energy consumption would provide a more complete picture of energy used, allowing comparison across many different appliances as well as an improved assessment of impacts such as effects on energy security and the environment.” Nothing more need be said.

*Add new Section CC106 as follows:*

## SECTION CC106 WIRING FOR FUTURE ELECTRIFICATION

**CC106.1 Additional electric infrastructure.** All *combustion equipment* and end uses shall be installed in accordance with this section. Capacity for the future electric circuits required in this section shall be included in the load calculations of the original installation of electric service to the building, and each *dwelling unit* for R-use buildings or portions thereof.

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**CC106.1.1 Electric infrastructure for dwelling and sleeping units.** *Combustion equipment* and end uses serving individual *dwelling units* or *sleeping units* shall comply with Section RC104.4.

**CC106.1.2 Combustion water heating equipment.** Gas fired or oil fired water heaters with a capacity less than 300,000 Btu/h (88 kW) shall be installed in accordance with the following:

1. A dedicated 208/240 volt branch circuit with a minimum capacity of 30 amps shall terminate within 3 feet (914 mm) from the water heater and be accessible to the water heater with no obstructions. Both ends of the branch circuit shall be labeled with the words "For Future Heat Pump Water Heater" and be electrically isolated.
2. A condensate drain that is no more than 2 inches (51 mm) higher than the base of the installed water heater and allows natural draining without pump assistance shall be installed within 3 feet (914 mm) of the water heater.
3. The water heater shall be installed in a space with minimum dimensions of 3 feet (914 mm) by 3 feet (914 mm) by 7 feet (2134 mm) high, and
4. The water heater shall be installed in a space with a minimum volume of 700 cubic feet (20,000 L) or the equivalent of one 16-inch (406 mm) by 24-inch (610 mm) grill to a heated space and one 8-inch (203 mm) duct of no more than 10 feet (3048 mm) in length for cool exhaust air.

**CC106.1.3 Cooking ranges, ovens and cooktops.** An individual branch circuit outlet with a minimum rating of 250 volts, 40 amperes shall be installed within three feet of each gas or propane range or any permanently installed *combustion equipment* oven or cooktop.

**Exception:** Commercial kitchens for cafeteria, restaurant or commercial catering business use

**CC106.1.4 Clothes Dryers.** An individual branch circuit outlet with a minimum rating of 250 volts, 30 amperes shall be installed within three feet of each gas or propane clothes dryer.

**Exception:** commercial drying equipment used for manufacturing and process loads

**CC106.1.5 Other combustion equipment.** *Combustion equipment* not covered by Sections CC106.1.1 and CC106.1.4 shall be provided with conduit that is continuous between a junction box located within 3 feet (914 mm) of the *appliance or equipment* and an electrical panel. The junction box, conduit and bus bar in the electrical panel shall be rated and sized to accommodate a branch circuit with sufficient capacity for an equivalent electric appliance, equipment or end use with an equivalent equipment capacity. The electrical junction box and electrical panel shall have labels stating, "For future electric

~~equipment”~~

**Reason:** The provisions in CC106 are tantamount to forcing builders and their customers into choosing an electric building and therefore eliminating a competitive option for society at large. The argument that such provisions are providing options to consumers is a non-starter because otherwise a similar requirement that a building be piped for gas would also be on the table. The fact is that this provision is based on speculation that plentiful (affordable) electric energy that is reliably delivered through a resilient grid will be available in the future and although that may be the case, it is based on myriad “house of cards” assumptions that all have to fall into place for the speculation to become reality. In the meantime, it is not fair to add speculative cost to the construction of a building. The additional electrical accommodations and space requirements may add a thousand dollars or more to the cost of a new building.