The Research Bureau

ENERGIZED? NO, SPECIALIZED

Decoding the New Specialized Stretch Code

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INTRODUCTION

ON JULY 1, 2024, both an updated Stretch Code and the Municipal Opt-In Specialized Stretch Code will go into effect in Worcester. While Worcester was *already a stretch code community*, the City Council voted to adopt the specialized stretch code in September 2023. So, what is the Municipal Opt-In Specialized Stretch Code? Referred to hereafter as the "Specialized" code, it is an optional update to the already-existing "Stretch Code" that **aims to further the electrification of *new* residential and commercial buildings** built in Massachusetts. Massachusetts has a series of regularly updated building regulations that set minimum standards for building design and construction concerned with energy efficiency and use. New construction in communities is by default built in accordance with the "base code," but municipal governing bodies can adopt the stretch code, or, further, the specialized code.

The intent of the specialized code is to create the next generation of energy efficient buildings. It goes slightly beyond the regulations found in the stretch code and much further than the base code stipulated in "An Act Relative to Green Communities" (2008 Mass. Acts Chapter 169). The specialized code was borne out of the MA Climate Act of 2021, officially known as "An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy" (2021 Mass. Acts Chapter 8), which set a goal for Massachusetts' economy to be net-zero energy by 2050. The specialized code does not dramatically overhaul the stretch code as it exists; rather, it adds a few additional requirements depending on the type and size of building being constructed. Alterations and renovations to existing buildings will continue to be governed by the existing stretch code.

The specialized code goes beyond the stretch code by requiring that ***new* construction that uses fossil fuels be pre-wired for electrification**, as well as a certain amount of solar installation depending on the size of the building, if solar is feasible.

EXPLAINING THE CODES

Massachusetts allows communities to build new residential and commercial buildings in accordance with one of three energy-related building codes: the "base" code, the stretch code, and now the specialized code. Both the stretch code and the specialized code are "opt-in" plans, and the specialized code itself builds on the stretch code. The base code is used by 50 communities, the stretch code has been adopted by 272 communities, and the specialized code has been adopted by 29 communities, including Worcester, since becoming available for adoption earlier in 2023. Each of these sets energy efficiency standards for new construction. Each level of code builds on the requirements of the previous. When the base code is applicable, construction generally follows International Energy Conservation Code 2021 (IECC 2021) standards (updated every few years). According to the Massachusetts Department of Energy Resources, the base code follows a "prescriptive" model where builders have to check off a list of certain energy efficiency installations, like specific kinds of windows or insulation. The stretch code includes IECC 2021 and certain stretch code amendment standards. The stretch code, unlike the base code, uses a "performance" based model (rather than prescriptive) to measure energy efficiency, using the "Home Energy Rating System" (HERS) or Passive House in residential units and allowing for "Thermal Energy Demand Intensity" (TEDI) or Passive House in certain commercial buildings over 20,000 square feet. The specialized code expands the stretch code for new construction. The specialized code uses the performance model utilized by the stretch code, and in most cases includes "Passive House" standards as an alternative to using HERS. See the next page for an explanation of HERS, Passive House, and TEDI.

Both the stretch and specialized codes require that new residential and commercial construction in Massachusetts adhere to certain energy efficiency standards, and both allow for some freedom to developers in how they choose to achieve the desired level of energy efficiency. Neither code eliminates the use of fossil fuels in most new construction, though different standards apply to buildings that continue to use them for heating or cooling. Indeed, buildings that use fossil fuels have to reach a higher (and sometimes a substantially higher) HERS standard than those that use electric HVAC systems from the start.

WHAT DOES THE SPECIALIZED CODE REQUIRE, ABOVE AND BEYOND THE STRETCH CODE?

The stretch code itself raises building efficiency standards as it is updated over time (as it is required to do). For example, on January 1, 2023 the stretch code required that new one and two family residential construction meet HERS 52 (if using fossil fuels) or HERS 58 (if building an all-electric home with on-site solar). An updated stretch code, that will take effect on July 1, 2024, will require HERS 42 and HERS 45. Because the specialized code ultimately goes beyond those standards, adopting it means putting the City on a *[continued on page 4]* faster pathway towards higher energy efficiency

Specialized Code Adoptees, as of 11/28/2023				
Specialized Code Municipalities	Code Start	Population 2020	Total Size in Sq.	Population Density per Sq. Mile
Acton	1/1/2024	24,021	20.295	1183.59
Amherst	7/1/2024	39,263	27.75	1414.88
Aquinnah	1/1/2024	439	5.78	75.95
Arlington	1/1/2024	46,308	5.49	8434.97
Bedford	7/1/2024	14,383	13.84	1039.23
Belmont	1/1/2025	27,295	4.715	5788.97
Boston	1/1/2024	675,647	50.16	13469.84
Brookline	7/1/2023	63,191	6.82	9265.54
Cambridge	7/1/2023	118,403	7.11	16653.02
Carlisle	7/1/2024	5,237	15.52	337.44
Chelmsford	7/1/2024	36,392	23.08	1576.78
Concord	1/1/2024	18,491	25.83	715.87
Lexington	1/1/2024	34,454	16.64	2070.55
Lincoln	1/1/2024	7,014	14.98	468.22
Maynard	1/1/2024	10,746	5.37	2001.12
Medford	7/1/2024	59,659	8.448	7061.91
Needham	7/1/2024	32,091	12.7	2526.85
Newton	1/1/2024	88,923	18.15	4899.34
Northampton	1/1/2024	29,571	35.75	827.16
Norwood	7/1/2024	31,611	10.501	3010.28
Sherborn	1/1/2024	4,401	16.16	272.34
Somerville	7/1/2023	81,045	4.13	19623.49
Stow	1/1/2024	7,174	17.995	398.67
Truro	1/1/2024	2,454	22	111.55
Wakefield	7/1/2024	27,090	7.994	3388.79
Watertown	7/1/2023	35,329	4.13	8554.24
Wellesley	1/1/2024	29,550	10.55	2800.95
Wellfleet	1/1/2024	3,566	21.01	169.73
Worcester	7/1/2024	206,518	38.441	5372.34

Source: Massachusetts Department of Energy Resources Stretch Code Communities Map; MassGIS; 2020 Decennial Census. See the map at the end of the report for a sense of how these communities are geographically located in Massachusetts.

UNDERSTANDING HERS, PASSIVE HOUSE, AND TEDI

The **Home Energy Rating System**, or "HERS" is an indexed scale that was developed by the Residential Energy Services Network (RESNET). It measures the energy efficiency of homes on a scale, using a model home from 2006 as the base (and scored at 100). Homes that are more energy efficient have scores closer to zero; and every point above or below 100 means that the home is that many percentage points less or more efficient than the model home (i.e., a score of 50, which was the average home rating in Massachusetts in 2022, is 50% more efficient than the model home from 2006; 150 would be 50% less efficient). In 2022, 10,189 homes in Massachusetts were rated using this index, out of 337,962 nationally, ranking 9th in the number of homes rated (RESNET 2023). In terms of single or two family homes, Massachusetts ranked highest with 82% of new construction receiving a HERS rating (Meres 2023). The reason for this high percentage, of course, is that the majority of communities in Massachusetts are stretch code communities, and the stretch code requires a HERS rating on new construction.

"Passive House" is an alternative standard and rating system for all kinds of buildings, focused on maximizing energy efficiency through both exterior construction and the interior use of efficient space heating and cooling systems as well as building "envelope" standards (the envelope is the part of the building that separates the exterior wall from the interior wall). There are two standards of passive house, including Passive House Institute (PHI) and Passive House Institute US (PHIUS). Both the Stretch and specialized codes provide the option of using either PHI or PHIUS instead of HERS depending on the size and use of the building in question.

Thermal Energy Demand Intensity, or "TEDI," is an energy efficiency standard used in Massachusetts and a few other places worldwide. It is basically a measure of how much energy is required to heat spaces and outside air brought in through ventilation in a building. TEDI, like passive house, is focused on overall building design.

standards—fulfilling both Massachusetts' goal of net-zero energy in 2050 and the Green Worcester Plan goals of renewable energy use and net-zero and climate resilient buildings. Some of these Green Worcester Plan goals include an aim "towards interim goals of 30% of units heated by renewables by 2030 and 100% of units heated by renewables by 2045" and to provide "incentives for energy efficient construction beyond the minimum" in City TIF projects (Green 2021, 71). Importantly, even if Worcester had not adopted the specialized code, it would have already been subject to the higher standards set in the stretch code as of July 1, 2024. The largest addition that the specialized code imposes on new construction is requiring pre-wiring for electrification and solar panel installation for mixed-fuel buildings. Multi-Family homes over 12,000 square feet will also be required to meet passive house standards.

It is important to remember that the specialized and stretch codes apply to all types of buildings, both residential and commercial. Again, the specialized code really provides for a faster pathway towards a "net-zero" Massachusetts through the creation of more energy efficient buildings in all sectors now. One thing to consider is that buildings last for decades. Indeed, as data from the American Community Survey shows, nearly 40% of occupied housing units in Worcester were built before 1939; the median year in which all of Worcester's housing structures was built is 1953, more than ten years older

Stretch Code Residential Requirements		
If Following HERS Path		
Type of On-Site Energy Use	*1/1/2023 - 7/1/2024*	*7/1/2024 onwards*
Fossil Fuel	52	42
Solar	55	
All-Electric	55	45
Solar and All-Electric	58	
If Following Passive House Path		
New Construction	Phius+ 2018, PHI	Phius CORE 2021, Phius ZERO 2021, PHI
Other Requirements		
HERS		Heat or Energy Recovery Ventilation
All New Homes		1 EV Space; 20% spaces in multifamily

Stretch Code Commercial Requirements	
Building Type	Pathway Options
Offices, Multi-Family, Schools >20,000 sf	TEDI Modeling; Passive House
Labs/Office/High Ventilation Buildings >20,000 sf	10% Better than ASHRAE Appendix G; TEDI; Passive House
Commercial Space (except multifamily) up to 20,000 sf	Prescriptive Pathway or TEDI Modeling
Multi-Family Sized Larger than Normal Residential Requirements	HERS, Passive House, or TEDI

Source: DOER Summary of 2023 Stretch Energy Code Update

Specialized Code Requirements for Residential Structures, by Unit Size					
Building Size	Fuel Type	Minimum Efficiency	Electrification	Min. EV Wiring	Renewable Generation
Dwelling Units Up to 4,000 sf	All Electric	HERS 45 or Phius CORE or PHI	Full	1 parking space	Optional
Dwelling Units Up to 4,000 sf	Mixed-Fuel	HERS 42 or Phius CORE or PHI	Pre-wiring	1 parking space	Solar PV (except shaded sites)
Dwelling Units > 4,000 sf	All Electric	HERS 45 or Phius CORE or PHI	Full	1 parking space	Optional
Dwelling Units > 4,000 sf	Mixed-Fuel	HERS 0 or Phius ZERO	Pre-wiring	1 parking space	Solar PV or other renewables
Multi-Family >12,000 sf	All Electric	Phius CORE or PHI	Full	20% of Spaces	Optional
Multi-Family >12,000 sf	Mixed-Fuel	Phius CORE or PHI	Pre-wiring	20% of Spaces	Optional

Source: MA Department of Energy Resources Stretch Code FAQ

than Massachusetts' median of 1964. (Data about commercial building stock age is not available from the Census). It is a simple fact that building energy efficient buildings now—or at the very least, buildings that can be easily electrified in the future—is more effective than trying to retrofit buildings that are not energy efficient.

COSTS

One aspect of this discussion that has not yet been touched on is the cost of implementation of the specialized code. Specific costs are hard to pin down, as they depend on a wide variety of factors that may differ based on location, the economy, and even the experience of the construction company in building to these standards. Many of the costs associated with the specialized code are really associated with the stretch code itself, which makes up the bulk of building standards. Some have argued that while the specialized standards might be more expensive up front, the wide variety of tax incentives and other programs available to developers (and not to mention cost savings for owners from higher energy efficiency over time) would tend to make these standards cheaper. Others have argued that these same programs are difficult to access, and that developers may pass along higher costs to buyers—ultimately slowing down cost savings from higher energy efficiency. Still, as stated earlier, building efficient structures from the start is ultimately cheaper than retrofitting them later.

The stretch code itself will increase its standards as of July 2024, and while the specialized code does add some more requirements to those already in the stretch code, most of the costs associated with these plans are really associated with the stretch code itself. There have been several models that have studied the impact on the potential costs of the stretch and specialized code.

The Massachusetts Department of Energy Resources has previously published several models of the costs of the updated stretch code, and through a combination of tax incentives and other programs, predicts that the updated stretch code will, in most cases, save both developers and

MA DOER Residential Cost Analysis for Stretch Code		
	Builder (Construction Costs)	Buyer (Annual Costs)
Large Single Family (Electric)	-$20,062	-$548
Large Single Family (Gas)	$3,184	-$302
Small Single Family (Electric)	-$28,597	-$1,053
Small Single Family (Gas)	$7,907	$496
Townhouse (Electric)	-$11,492	$316
Townhouse (Gas)	$61	-$11
6-Unit Multifamily (Electric)	-$15,690	-$683
6-Unit Multifamily (Gas)	$2,277	-$14
4-story Multifamily (Electric)	-$16,326	-$738
4-story Multifamily (Gas)	-$568	-$75

Source: Massachusetts Department of Energy Resources. Notes: Large Single Family = 4,000 sf.; Small Single Family and Townhouse = 2,100 sf.; 6-unit building is 1,400 sf per unit; 4-story is 1,200 sf per unit . Model used Worcester as the location of new construction. Model compares predicted stretch code price to the base code, and assumes HERS 52 (base) to HERS 42 (stretch). Includes Incentives.

MA DOER Commercial Cost Analysis for Stretch Code				
	Electric		Gas	
	Cost to Build	Build and Operate	Cost to Build	Build and Operate
Primary School (TEDI)	2.80%	-1.90%	1.10%	-1.40%
Secondary School (TEDI)	0.40%	-2.50%	0%	-2.40%
Small Office (TEDI)	4.50%	-0.20%	3.10%	-0.70%
Large Office (TEDI)	-4.20%	-8.30%	-4.70%	-9.60%
Office/Lab (MA ASHRAE)	-0.80%	-8.10%	-1.10%	-6.40%

Source: Massachusetts Department of Energy Resources. Notes: In the new stretch code for 2024, offices, residential buildings, and schools (all over 20,000 sf) are required to use TEDI. Labs and hospitals can choose 10% better than ASHRAE or use TEDI. Commercial buildings under 20,000 sf can use prescriptive pathway or TEDI. Multifamily buildings not covered by residential code can use HERS or Passive House.

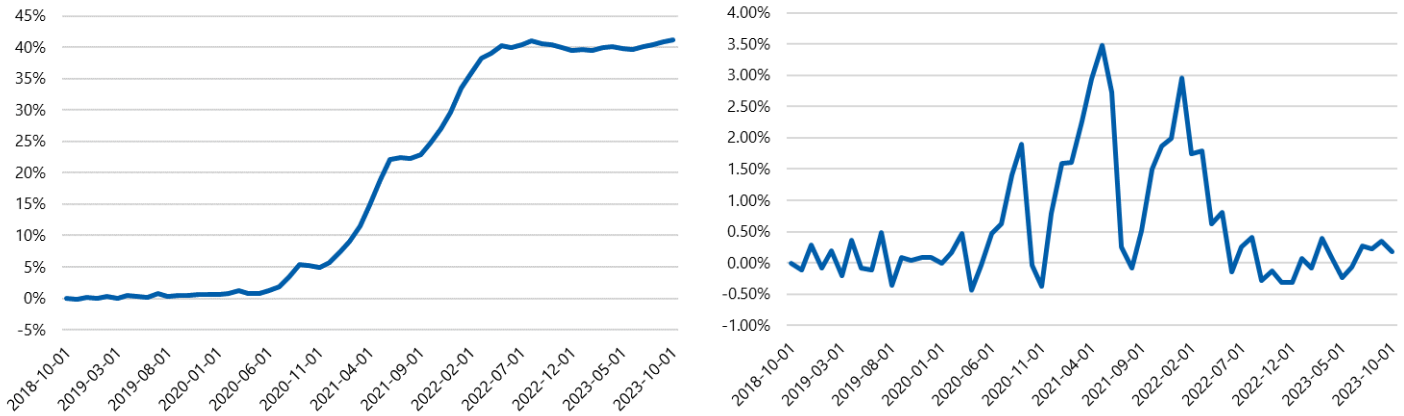
home buyers money over time. In terms of commercial buildings, those same DOER models show that the stretch code will increase up-front building costs on some structures but will, on an annual basis, reduce the combined costs of building and operating them (and DOER conducted this analysis without any MassSave or other reimbursements or incentives, which would likely serve to lower costs as well). The DOER found that all-electric buildings, across the board, are cheaper to build than new construction that uses fossil fuels.

Another study, sponsored by the Home Builders and Remodelers Association of Massachusetts (HBRA MA) and conducted by a group of researchers from Wentworth Institute of Technology and the Massachusetts Institute of Technology, found that the specialized code (not, consequentially, accounting for incentives that DOER did above) would raise the cost of construction of new low-rise residential buildings by 1.8 to 3.8% ($10,000 to $23,000) and multifamily by 2.4%. The authors are clear to note that these are initial estimates, and that experience building more energy efficient structures, as well as advancements in efficiency technologies, could bring these prices down over time. The authors also note that there are other ways that municipalities and the state could help to lower these costs, such as zoning reform (including easing height requirements or lowering minimum lot sizes for new housing construction) or increased incentives for building.

Some of these have already been recommended in Worcester; for example, Worcester Now | Next's draft plan emphasizes in Goal 3 the plan to "update Worcester's base zoning to encourage development that aligns with the Growth Framework," including updating land use and density, and updating dimensional requirements of new construction.

Still, the price of new construction may be hard to predict. For example, it is worth keeping in mind that since 2020, the prices of construction materials has increased. One measure of these prices comes from the Bureau of Labor Statistics intermediate demand producer price index for materials and components for construction. This price index (BLS ID612) measures what's known as "intermediate demand," or the inputs of processed and semi-processed goods that are then used in construction. Ultimately, these indices show trends in costs for construction over time. "Materials" covers partially finished products like lumber or concrete pipe that are fully processed during construction. "Components" covers completely finished products like sinks or oil tanks that are also integral to construction. Nationally, this index shows that materials and components together have increased in price 41.11% since October 2018. Largely, this has coincided with the pandemic years: between October 2018 and March 2020, prices increased 1.28%, while in the same number of months, between March 2020 and August 2021, prices increased 20.76% (see below for the graphs of change since October 2018 and month-to-month). While the wild fluctuations in price have slowed down since the beginning of 2022, the question of how to incentivize construction while accounting for the prices of materials is a worthwhile one for the City to consider.

Change in Producer Price Index, Intermediate Demand by Commodity Type—Materials and Components for Construction (Seasonally Adjusted). Left: Percent change compared to October 2018. Right: Percent change from month to month



Source: US Bureau of Labor Statistics; Retrieved from FRED, Federal Reserve Bank of St. Louis

CONCLUSION

Since at least 2008, Massachusetts has set design and construction regulations related to energy efficiency and energy use in new construction and renovation. These regulations—known as the base code, stretch code, and now the specialized code—are updated regularly as Massachusetts aims at becoming a net-zero energy economy by 2050. Municipalities in Massachusetts must at a minimum follow the base code, but they can opt-in to stretch code standards, or, further, specialized code standards that require pre-wiring for electrification in new construction. The majority of Massachusetts' communities, 272 of 351, are *at least* stretch code communities, and another 29 have become specialized code communities, including Worcester, since the beginning of 2023. By opting-in, these communities are further obligated to follow any subsequent updates to these building energy standards.

Ultimately, the energy efficiency standards set by the specialized and stretch codes will be crucial to meeting both Worcester's and Massachusetts' goals of climate resiliency by mid-century. Many, if not all, of the structures built today will continue to exist for decades to come, and setting them up for electrification now (even if, in some cases, fossil fuels continue to be used within them) will allow for an easier switch over when necessary. Indeed, the largest addition that the specialized code will add onto the already existing stretch code is required pre-wiring for electrification and solar panel installation if new construction continues to use fossil fuels. Construction with deep energy efficiency and electrification in mind now will be more cost effective than trying to retrofit existing buildings later on. While new construction will likely be more expensive up front, there should be cost savings over time for owners, and there are still tax incentives for developers to blunt the cost of new construction.

Going forward, the City of Worcester should make every effort to inform developers and the public about this code and what it will mean for costs, savings, and Worcester's "Green Worcester Plan."

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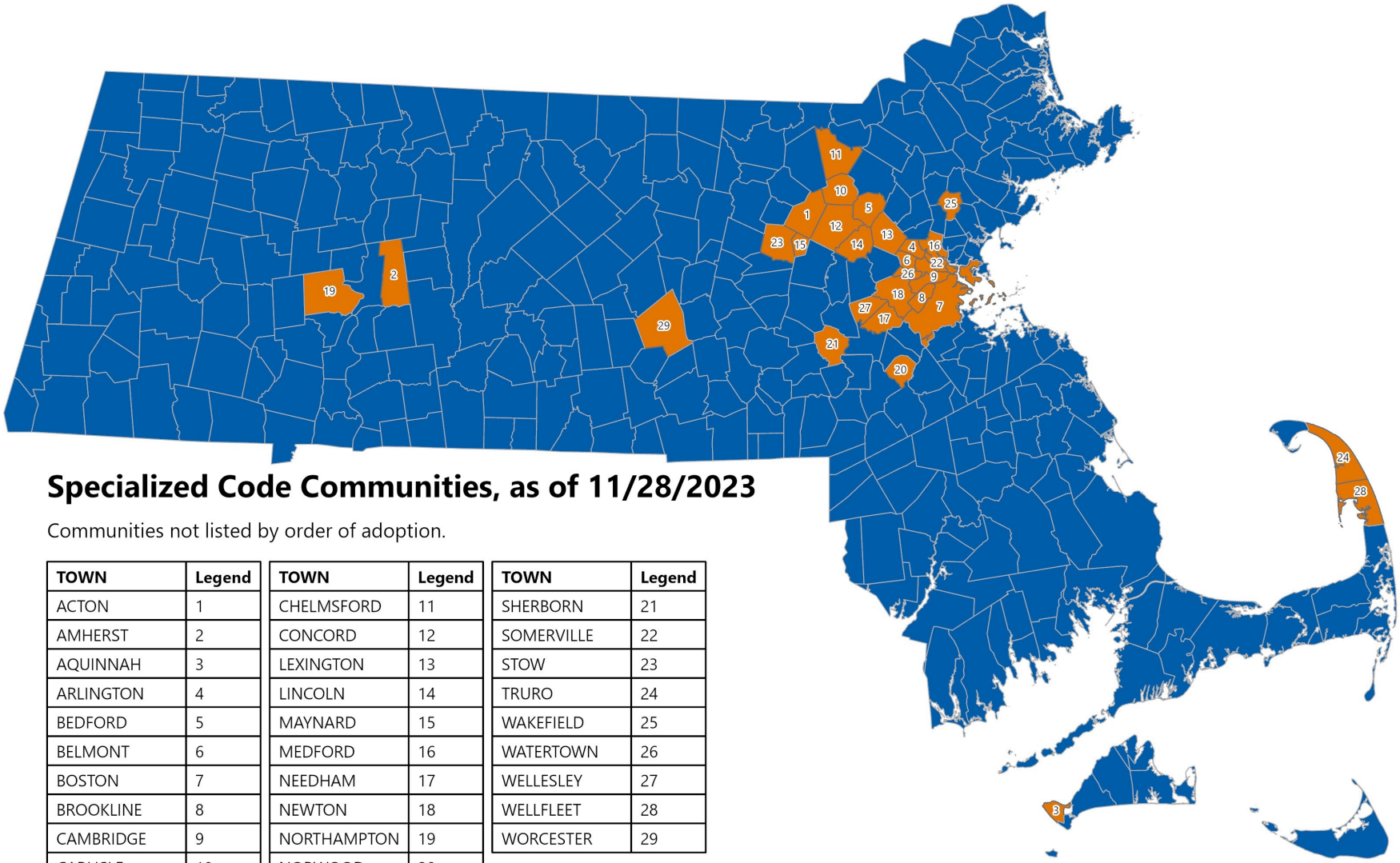

Specialized Code Communities, as of 11/28/2023

Communities not listed by order of adoption.

TOWN	Legend
ACTON	1
AMHERST	2
AQUINNAH	3
ARLINGTON	4
BEDFORD	5
BELMONT	6
BOSTON	7
BROOKLINE	8
CAMBRIDGE	9
CARLISLE	10

TOWN	Legend
CHELMSFORD	11
CONCORD	12
LEXINGTON	13
LINCOLN	14
MAYNARD	15
MEDFORD	16
NEEDHAM	17
NEWTON	18
NORTHAMPTON	19
NORWOOD	20

TOWN	Legend
SHERBORN	21
SOMERVILLE	22
STOW	23
TRURO	24
WAKEFIELD	25
WATERTOWN	26
WELLESLEY	27
WELLFLEET	28
WORCESTER	29

Not a Specialized Code Community

Specialized Code Community

Source: Massachusetts Department of Energy Resources Stretch Code Communities Map; MassGIS; 2020 Decennial Census

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