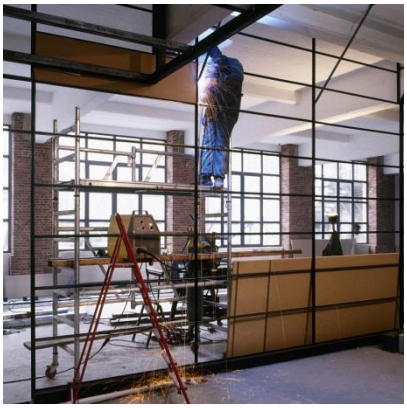

Construction Codes in the Northeast: Myths and Realities of Energy Code Adoption and the Economic Effects

July 2015

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Acknowledgements

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About NEEP

Northeast Energy Efficiency Partnerships (NEEP) is a non-profit founded in 1996 based in Lexington, Massachusetts. NEEP supports the expansion and implementation of policies and programs to accelerate energy efficiency in the Northeast and Mid-Atlantic region. NEEP works in four key areas: speeding the adoption of high-efficiency products, reducing building energy use, advancing knowledge and best practices and generally increasing the visibility of the benefits of efficiency.

Our vision is that the region will fully embrace energy efficiency as a cornerstone of sustainable energy policy to help achieve a cleaner environment and a more reliable and affordable energy system. NEEP is available to assist state energy offices, political candidates, legislators, regulators or administration officials in any of these areas. NEEP is one of six Regional Energy Efficiency Organizations (REEOs), which, through funded partnerships with the U.S. Department of Energy, are available to serve as resources for state and local energy officials, advocates and others, providing technical assistance to support efficiency policy development and adoption, along with strategic program design. NEEP also works with utilities, third-party program administrators, public officials, various advocacy groups, businesses and foundations.

NEEP offers assistance in the following jurisdictions: Connecticut, Washington D.C., Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

Disclaimer: NEEP verified the data used for this white paper to the best of our ability. This paper reflects the opinion and judgments of the NEEP staff and does not necessarily reflect those of NEEP Board members, NEEP Sponsors, or project participants and funders.

Executive Summary

Buildings are among the largest users of energy in the United States, accounting for approximately 41 percent of all energy consumption, 72 percent of electricity usage, and over one-third of greenhouse gas emissions. Because this represents such a significant portion of our energy use, policies have been put into place that govern the way and extent to which buildings use energy. Building energy codes act as the "floor" or minimum level of efficiency at which new buildings or renovations can be constructed.

Proponents of building energy codes sometimes point to them as a cost effective way to achieve large scale energy savings while ensuring consumer protection. The energy efficiency of a building is not very visible to most buyers so codes are a way of ensuring consistency in construction and design practices so consumers don't get surprised with massive energy bills.

The Myth:

Opponents of energy codes will often raise concerns over perceived complexities and upfront costs associated with code compliance and whether these impacts are enough to relocate construction projects to areas that don't require code compliance or have less stringent enforcement.

This report examines commercial and residential construction data from the Northeast and Mid-Atlantic regions to see if more rigorous code implementations have led to any noticeable impacts on investments in construction projects. This white paper lays out the data at the regional and state level and summarizes the findings of our analysis. We also provide projections of potential energy cost and carbon emissions savings potentials if all NEEP states were to implement the newest energy codes.

The Realities:

- **Total regional construction projects are increasing -** After falling significantly since the recession low point in 2008, total commercial and residential construction project numbers are on the rise and are projected to keep rising.
- **Renovation projects are growing faster than new construction –** Commercial building renovations have more than doubled over the last ten years (increasing by 258% since 2005), while new building construction has dipped significantly (decreasing by 26%).
- **Commercial projects have increased since energy code updates -** All NEEP states have undergone a commercial code update since 2008, and all show higher numbers of construction projects since the recession low in that year.
- **Residential projects have increased since energy code updates –** All NEEP states have also undergone residential code updates since 2008, and all show higher number of construction projects since that market bottomed out in 2011.
- **Significant cost and emissions savings opportunities exist –** If all NEEP states were to adopt the newest 2015 IECC energy codes, the residents and business owners of these states could save over $260 million over the next four years. The carbon savings during this same time period could reach over 1.5 million metric tons or the equivalent of taking 316,618 cars off the road for a year.

- **Public building projects represent a big opportunity for energy savings -** The share of public building construction projects[1] since 2005 represents 44 percent of the total construction activity. The top three overall construction project types in the region were Government Offices, Pre and Elementary Schools, and Junior and Senior High Schools.

[1] Public Building Numbers Include: Courthouses, Elementary & Pre-Schools, Governmental Offices, Jr. & Sr. High Schools, Libraries, Museums, Military Buildings, Police & Fire Buildings.

Introduction

Over half of the building stock in the United States was built before 1980. In the Northeast and Mid-Atlantic, the number is nearly 75 percent[2]. This represents 16 million housing units and 500,000 commercial buildings. Construction investments are expected to rise steadily over the coming years as the economic recovery continues. As this construction activity picks up and the region moves to update these aging buildings, building energy codes will be vital in ensuring a minimum level of energy efficiency.

When states or adopting entities are considering moving to a more stringent energy code, there can be concerns over the economic impact of complying with these higher standards for builders, contractors, and practitioners, and, ultimately, the people who live or work in these buildings. Opponents of increasing the energy efficiency of building codes often argue that building projects will be moved to states that don't have stringent energy codes, diverting economic activity away from states that adopt the most recent versions. To test this theory, NEEP analyzed construction data from states throughout the Northeast and Mid-Atlantic region to see if there is a correlation between the implementation of more energy efficient building energy codes and any significant changes in construction starts for commercial and residential buildings. Additionally, we created savings estimates using regional construction projections to compare the energy use and carbon emissions of buildings under current code in those jurisdictions to those which would be built to the 2015 International Energy Conservation Code (IECC), the most recent national model energy code.

Why Conduct This Analysis?

This white paper has three primary goals:

- Identify trends in building construction for the Northeast and Mid-Atlantic regions for the purposes of providing a baseline in analyzing the impact of energy codes in the region while providing data to maximize the effectiveness of energy code compliance trainings.
- Examine the economic effects of building code implementation on residential and commercial building project starts,
- Estimate the cost and carbon savings potential if the NEEP region states were to implement the latest energy codes.

We hope this paper serves to inform a number of different stakeholders, including state and local code offices and other policymakers. The specific location, building type, and project type (new construction vs. renovation) analyses included in this report aim to provide granular data on the construction that has taken place in the region to help identify trends. This data could be used to more effectively target energy code trainings by matching them to areas which would maximize their impact. Code officials and other policymakers considering the adoption of new energy codes can use the baseline construction information, as well as the potential savings projections, to educate stakeholders and avoid any misconceptions about code adoption in their jurisdictions.

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[2] U.S. Energy Information Administration. 2012 CBECS Data, Table B8. "Year Constructed, Floorspace" http://www.eia.gov/consumption/commercial/data/2012/#b3 and 2009 RECS Data, Table HC2.3. "By Year of Construction" http://www.eia.gov/consumption/residential/data/2009/#undefined

Methodology

Commercial construction data on new construction and renovations used for this analysis was purchased from CMD Group, Inc., formerly Reed Construction Data, a provider of business information for the North American construction industry. CMD Group construction data includes information taken from construction permitting including the project type (new/renovation), location by state and county, building type[3], square footage, and cost. In order to provide some macroeconomic context on the housing market, we included the U.S. Real Gross Domestic Product (GDP) in some of the graphs along with the permitting numbers. The Real GDP is an inflation adjusted representation of the total value of economic output of the national economy. This metric is related to construction activity because the overall health of the economy has historically played a large part in the amount of public and private investment made in construction projects.

The majority of the residential new construction data was compiled by CMD Group, Inc. and taken from publically available census data. The United States Census website was used to cross check CMD data and for states that weren't included in CMD's data set. Information on residential renovation construction projects is currently very limited because of widely varying reporting practices between municipalities. For this reason, only new construction data was included in the residential analysis.

To make the projections for dollar savings and cost savings if states adopted the 2015 IECC energy codes, we used Oxford Economics projections. Oxford Economics provides economic forecasting and modeling for different industries all over the world to inform policy and business decisions. Their construction forecasting was included in CMD's data for the region from 2015 through 2018. These estimates were combined with models created by the Pacific Northwest National Lab that provide average energy use and energy cost intensities of buildings in each state under different energy codes[4]. We compared the current code in each state with the 2015 IECC. For states that have already implemented the 2015 IECC (Vermont and Maryland as of the publication of this paper), we compared it to the code in place before the update to estimate their savings over the next four years.

U.S. Environmental Protection Agency (EPA) and Energy Information Administration (EIA) assumptions were used for the carbon savings projections provided in this paper. The projected site energy savings of the 2015 IECC energy codes were multiplied by average emissions factors[5] from the three Independent System Operators (ISOs) in NEEP's region, as well as emissions coefficients for heating fuels based on an average for the region[6] for residential and a national average for commercial[7].

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[3] The commercial building data includes buildings of the following types: Amusement, College, University, Courthouses, Jr. and Sr. High Schools, Elementary and Pre-Schools, Governmental Offices, Hospitals, Clinics, Hotels, Motels, Labs, Library, Museums, Manufacturing, Miscellaneous Medical, Military, Nursing Homes, Assisted Living, Offices, Parking Garages, Police, Fire, Prisons, Religious, Miscellaneous Retail, Shopping, Special, Vocational, Convention Center, Transportation Terminals, and Warehouses.

[4] U.S. Department of Energy. "State Analyses". http://www.energycodes.gov/development/commercial/cost_effectiveness and http://www.energycodes.gov/development/residential

[5] U.S. EPA. 2010 GHG Annual Emissions Rates. http://www.epa.gov/cleanenergy/documents/egridzips/eGRID_9th_edition_V1-0_year_2010_GHG_Rates.pdf

[6] For Residential, assumed 56% of energy savings would be from heating fuels and 44% from electricity. For heating fuels we assumed a regional average of 10% Propane, 30% Oil, 50% Gas, and 10% Electric. These assumptions are from regional averages from the northeast and mid-atlantic. U.S. EIA. "State Fact Sheets" http://www.eia.gov/consumption/residential/reports/2009/state_briefs/

[7] Commercial Assumptions: U.S. Department of Energy. "Building Energy Data Book". Graph 3.1.5 http://buildingsdatabook.eren.doe.gov/docs/xls_pdf/3.1.5.pdf

Background on Energy Codes in the Northeast and Mid-Atlantic Regions

In NEEP's Region, states currently employ building energy codes based on the last three generations of the national model codes and standards. Specifically, these are:

- ASHRAE Standard 90.1-2007 and 2009 IECC;
- ASHRAE Standard 90.1-2010 and 2012 IECC; and
- ASHRAE Standard 90.1-2013 and 2015 IECC.

Comparison of Energy Savings: A significant push to increase the energy efficiency of these model codes and standards over the past decade has resulted in there being substantial changes in code requirements and, in turn, energy savings potential among these three code cycles. The chart below shows the average reductions in site energy usage between the different code updates.

Code	Percent Site Energy Reduction Over Previous Version of Code		
Commercial: ASHRAE Standard 90.1	2004 to 2007: 5%[8]	2007 to 2010: 18%[9]	2010 to 2013: 8%[10]
Residential: IECC	2006 to 2009: 14%[11]	2009 to 2012: 21%[12]	2012 to 2015: 1%[13]

Cost Effectiveness: In order to ensure the initial costs of implementing these new codes is recouped in a reasonable amount of time the U.S. Department of Energy conducts cost effectiveness tests on each code update. These tests provide lifecycle cost net savings, cash flow analyses, and simple payback estimates. Once this analysis is completed, the analysis is released so state and local governments are better informed about the impacts of implementing these codes.

[8] US Government Publishing Office. "Building Energy Standards Program: Determination Regarding Energy Efficiency Improvements in the Energy Standard for Buildings, Except LowRise Residential Buildings, ANSI/ ASHRAE/IESNA Standard 90.1–2007" http://www.gpo.gov/fdsys/pkg/FR-2011-07-20/pdf/2011-18251.pdf

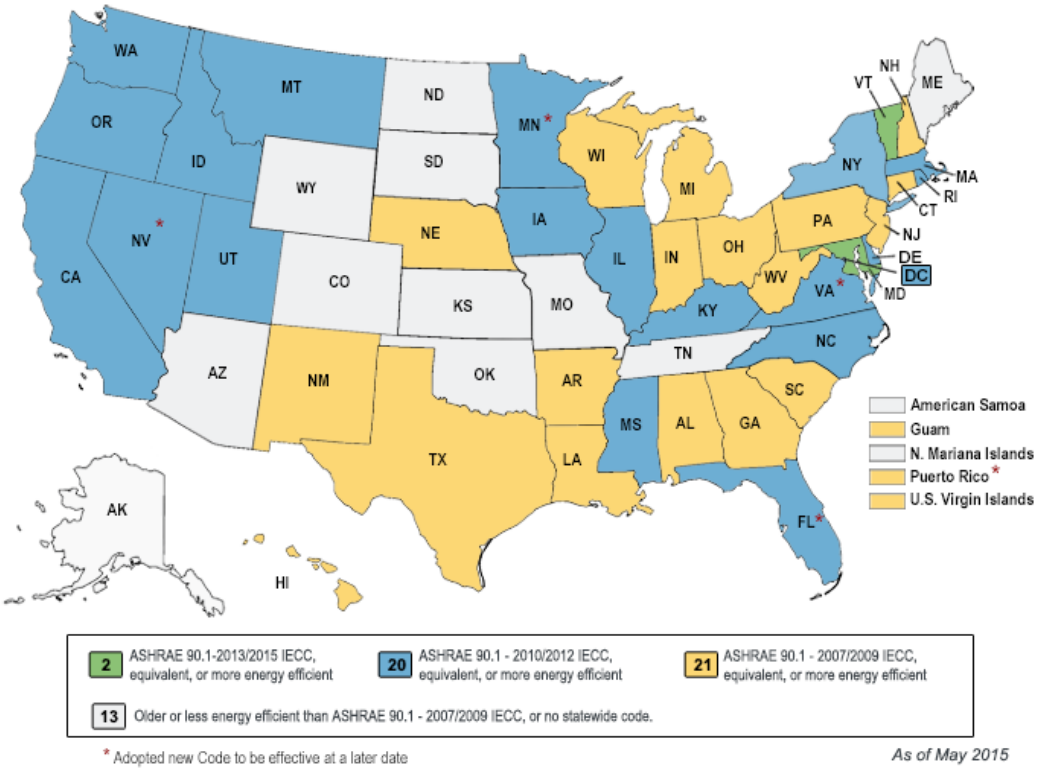
[9] U.S. Government Publishing Office. "Building Energy Standards Program: Final Determination Regarding Energy Efficiency Improvements in the Energy Standard for Buildings, Except LowRise Residential Buildings, ANSI/ ASHRAE/IESNA Standard 90.1–2010" http://www.gpo.gov/fdsys/pkg/FR-2011-10-19/pdf/2011-27057.pdf

[10] Regulations.gov. "2014-09-26 Determination Regarding Energy Efficiency Improvements in ANSI/ASHRAE/IES Standard 90.1–2013: Energy Standard for Buildings, Except Low-Rise Residential Buildings; Notice of Determination." http://www.regulations.gov/#!documentDetail;D=EERE-2014-BT-DET-0009-0006

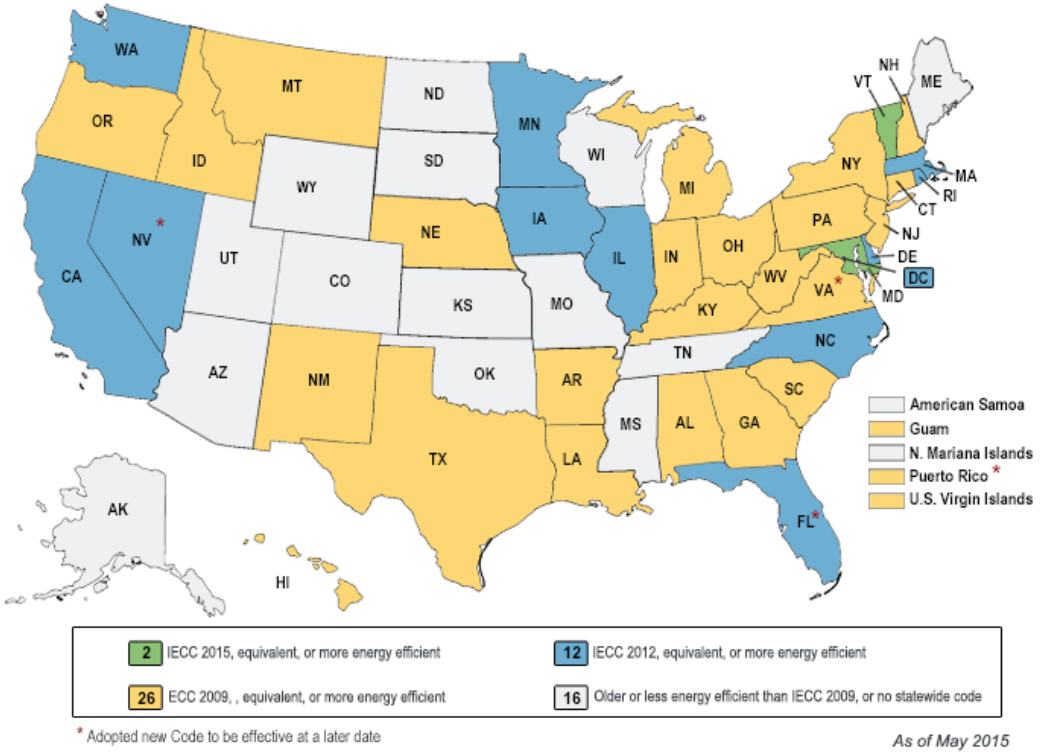
[11] US Government Publishing Office. "Updating State Residential Building Energy Efficiency Codes" http://www.gpo.gov/fdsys/pkg/FR-2011-07-19/pdf/2011-18080.pdf

[12] U.S. DOE. https://www.energycodes.gov/sites/default/files/documents/NationalResidentialCostEffectiveness.pdf

[13] Regulations.gov. "2014-09-26 Preliminary Determination Regarding Energy Efficiency Improvements in the 2015 International Energy Conservation Code; Notice of Preliminary Determination" http://www.regulations.gov/#!documentDetail;D=EERE-2014-BT-DET-0030-0001



State	Current Regional Commercial Energy Code Adoptions (as of June 2015)
CT	2009 IECC with reference to ASHRAE Standard 90.1 2007. Effective: 10/07/2011
DC	2012 IECC with minor amendments. Effective 3/28/2014
DE	ASHRAE Standard 90.1-2010. Effective: 05/11/2014
MA	2012 IECC. Effective 07/01/2014
MD	2015 IECC. Effective 01/01/2015
ME	ASHRAE Standard 90.1-2007. Effective 12/01/2010 (optional for towns with fewer than 4,000 residents)
NH	2009 IECC. Effective 04/01/2010
NJ	ASHRAE Standard 90.1-2007 with Amendments. Effective 09/07/2010
NY	2012 IECC / ASHRAE Standard 90.1-2010 with NY amendments. Effective 01/01/2015
PA	2009 IECC. Effective 12/31/2009
RI	2012 IECC. Effective 10/01/2013
VT	2015 IECC with VT amendments. Effective 03/01/2015

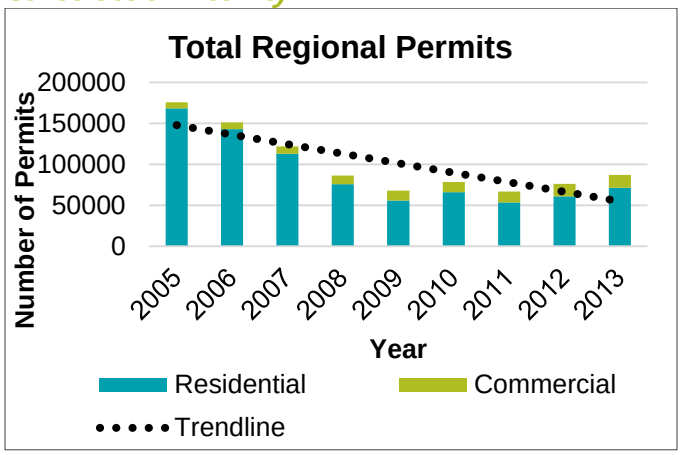


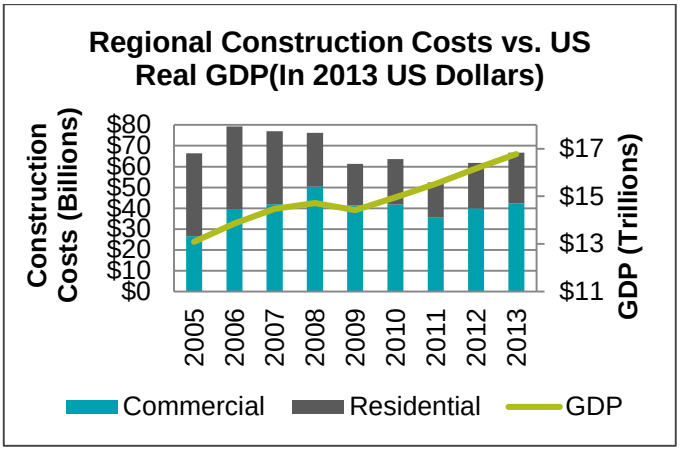
State	Current Regional Residential Energy Code Adoptions (as of June 2015)
CT	2009 IECC. Effective 10/07/2011
DC	2012 IECC. Effective 05/11/2014
DE	2012 IECC. Effective 03/28/2014
MA	2012 IECC. Effective 07/01/2014
MD	2015 IECC. Effective 01/01/2015
ME	2009 IECC. Effective 12/01/2010 (Optional for towns with fewer than 4,000 residents)
NH	2009 IECC. Effective 04/01/2010
NJ	2009 IECC. Effective 09/07/2010
NY	2009 IECC with amendments. Effective 12/28/2010
PA	2009 IECC. Effective 12/31/2009
RI	2012 IECC. Effective 07/01/2013
VT	2015 IECC with VT amendments. Effective 03/01/2015

Construction Trends in the Region

The following graphs provide a visual representation of the construction activity in the NEEP region. They are organized by the number of permits, the dollar value of projects, and the project type.

Construction Activity





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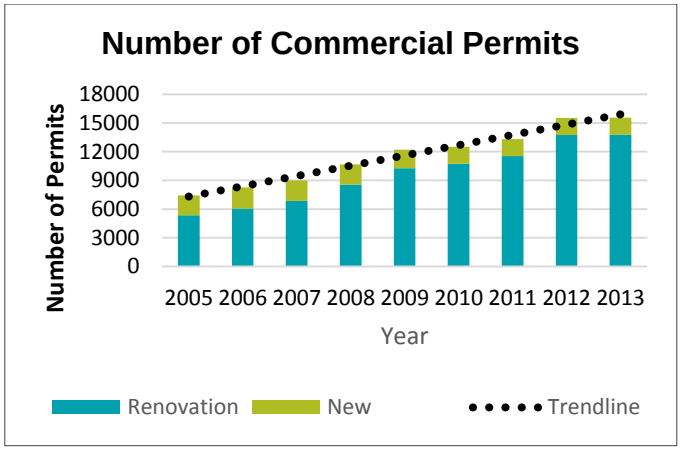

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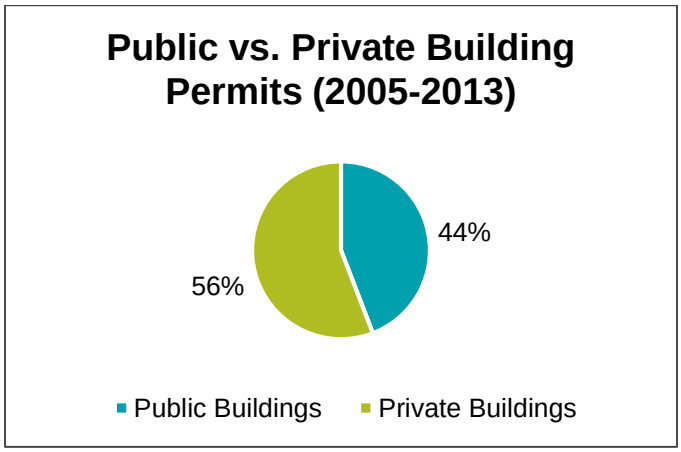

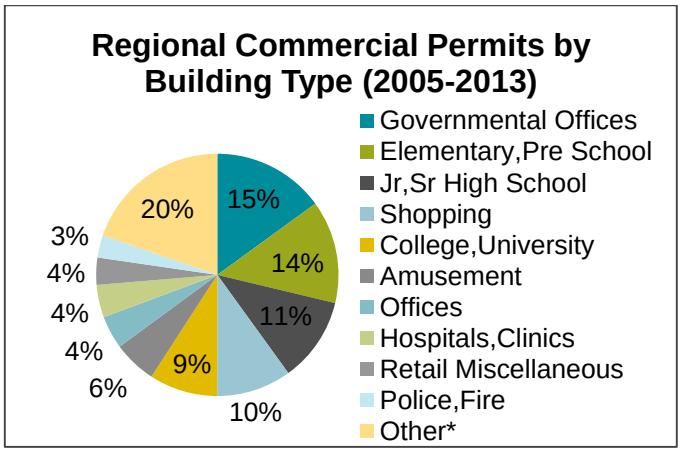

*Other includes the following building types: Library, Museum, Warehouses, Transportation Terminals, Prisons, Military, Parking Garages, Nursing Homes, Assisted Living, Special Vocational, Medical misc., Religious, Hotels, Motels, Courthouse, Industrial Labs, Labs, School Labs, Sport, Convention Center, Manufacturing.

Commercial State Analysis

CONNECTICUT

Current Code: 2009 IECC with reference to ASHRAE 90.1 2007
Effective Date: 10/07/2011
Total Commercial Projects (2005-2013): 7,292
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $10,958,295.24
Potential Carbon Savings 2015-2018 with Code Update: 55,513 tons
Average Cost per Project: $2,806,742.39

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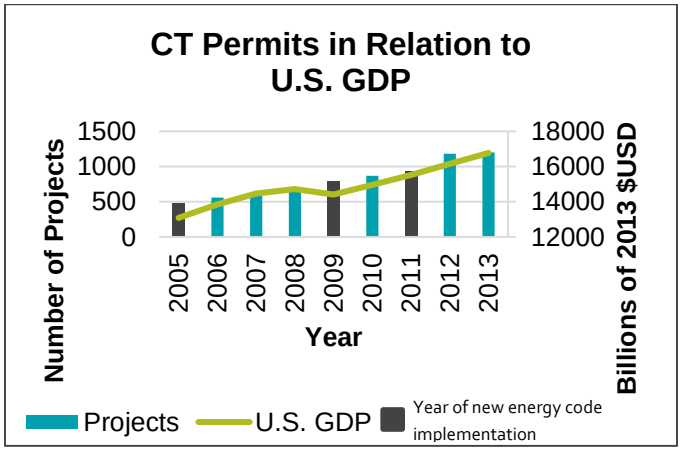

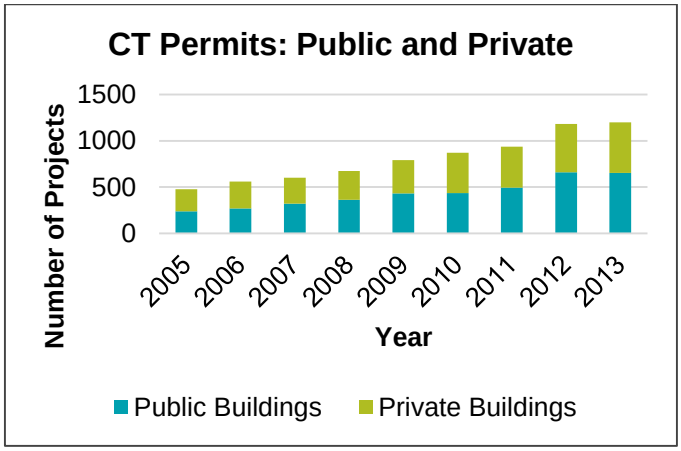

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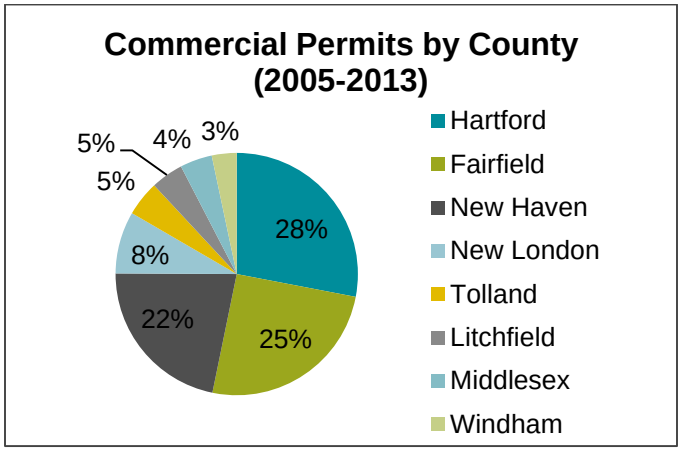

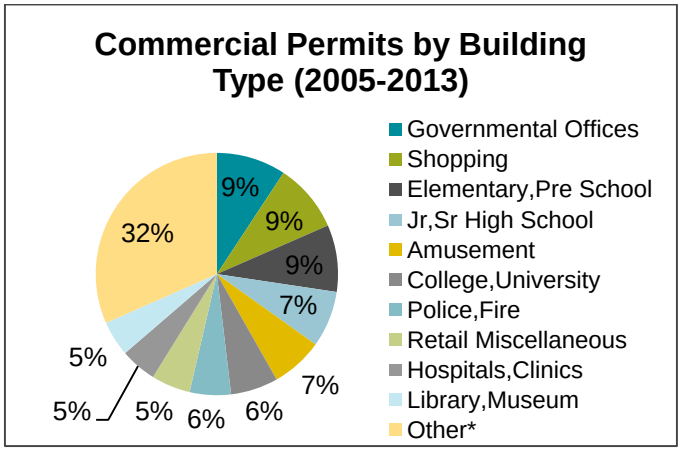

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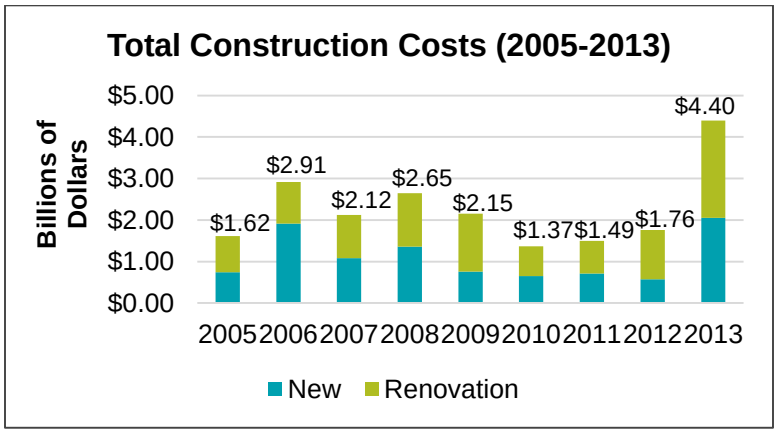
Construction Costs



DISTRICT OF COLUMBIA

Current Code: 2012 IECC with minor amendments
Effective Date: Effective 3/28/2014
Total Commercial Projects (2005-2013): 1,676
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $1,726,709.02
Potential Carbon Savings 2015-2018 with Code Update: 9,559 tons
Average Cost per Project: $9,685,286.64

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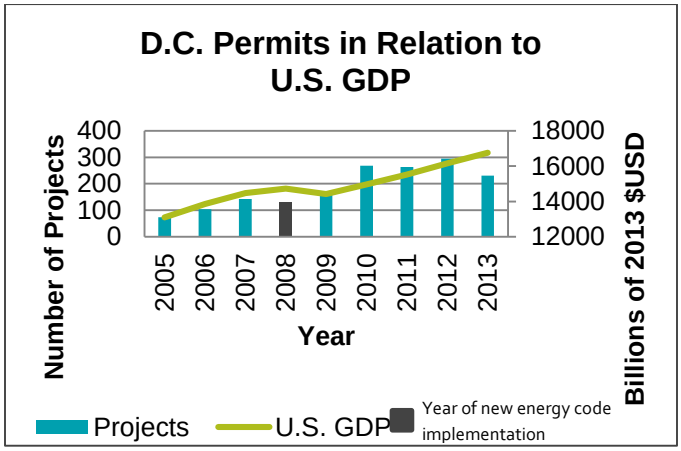
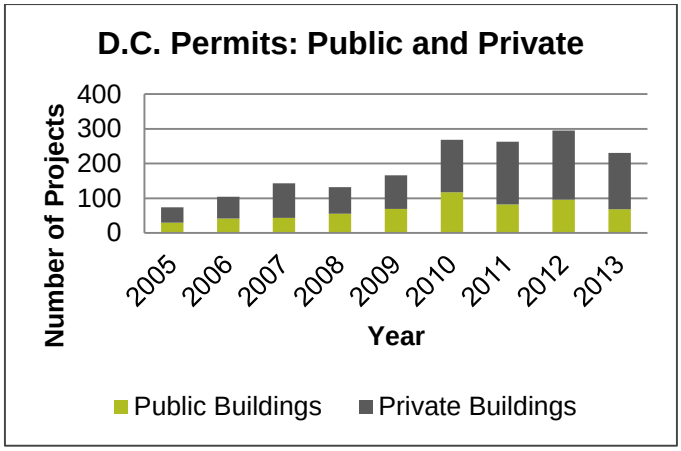
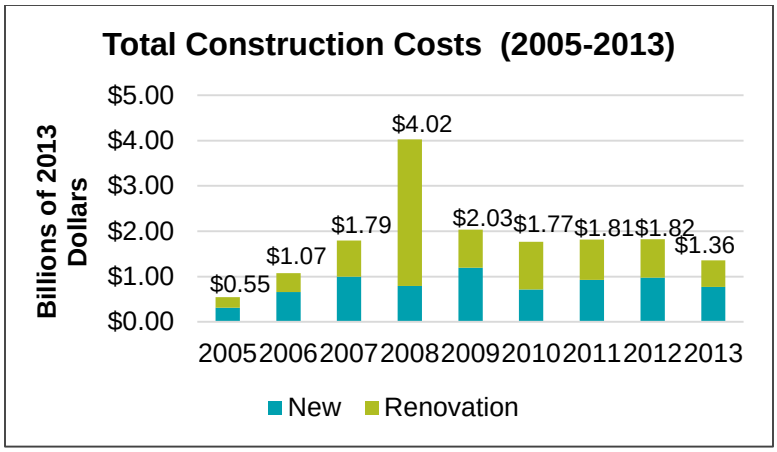




Construction Costs



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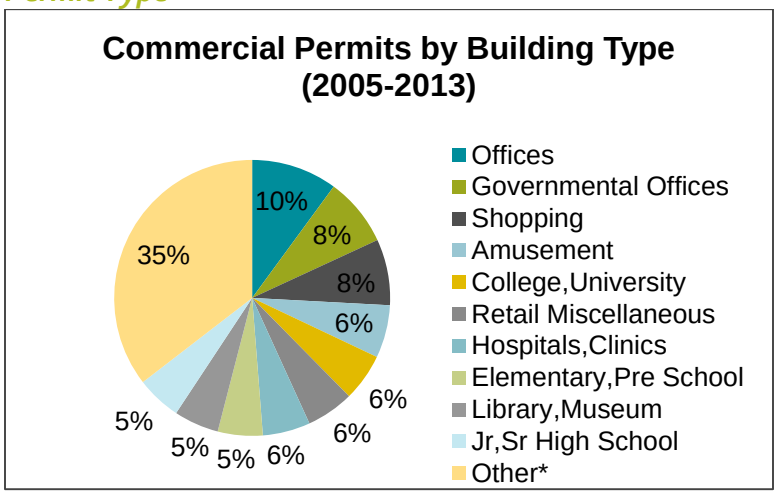

ii

DELAWARE

Current Code: ASHRAE 90.1-2010
Effective Date: 05/11/2014
Total Commercial Projects (2005-2013): 1,517
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $836,940.41
Potential Carbon Savings 2015-2018 with Code Update: 1,718 tons
Average Cost per Project: $3,203,788.95

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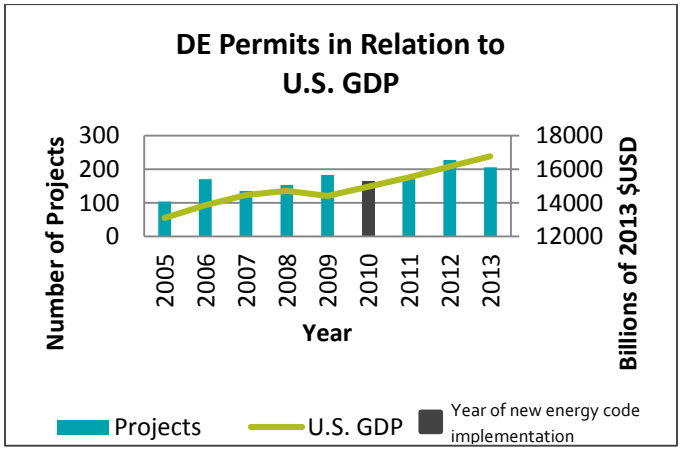

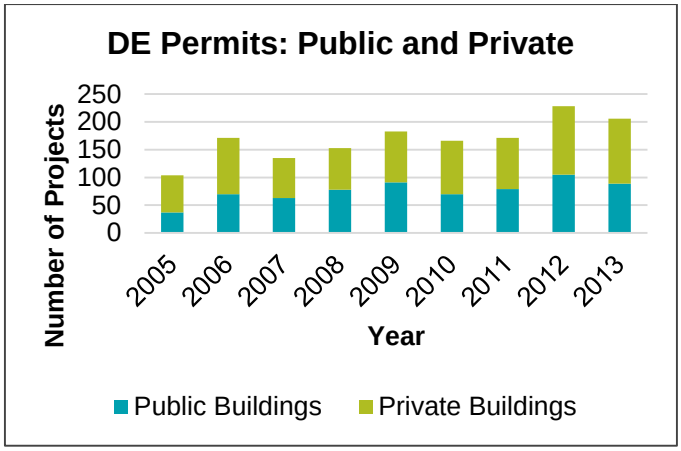

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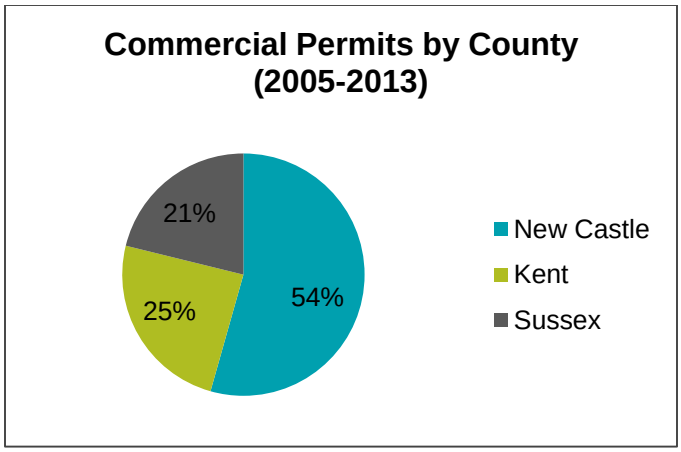
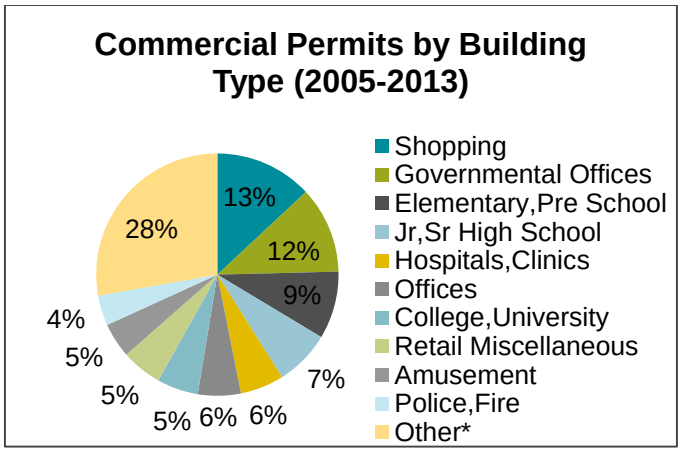
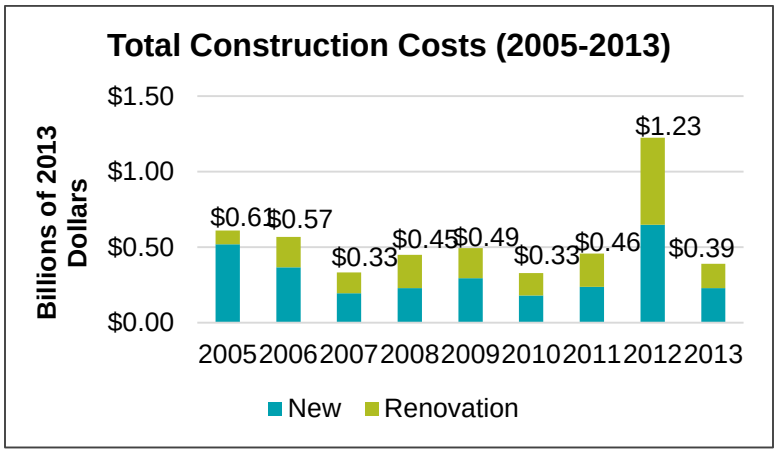




[iii]

Construction Costs



MASSACHUSETTS

Current Code: 2012 IECC
Effective Date: 07/01/2014
Total Commercial Projects (2005-2013): 14,992
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $9,656,482.85
Potential Carbon Savings 2015-2018 with Code Update: 48,947 tons
Average Cost per Project: $3,015,001.68

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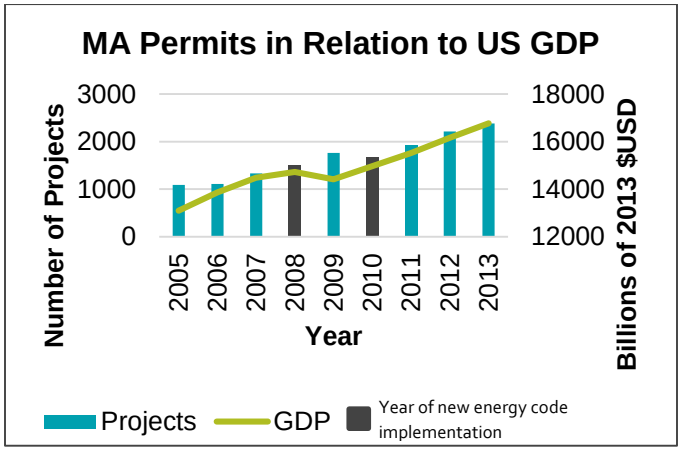

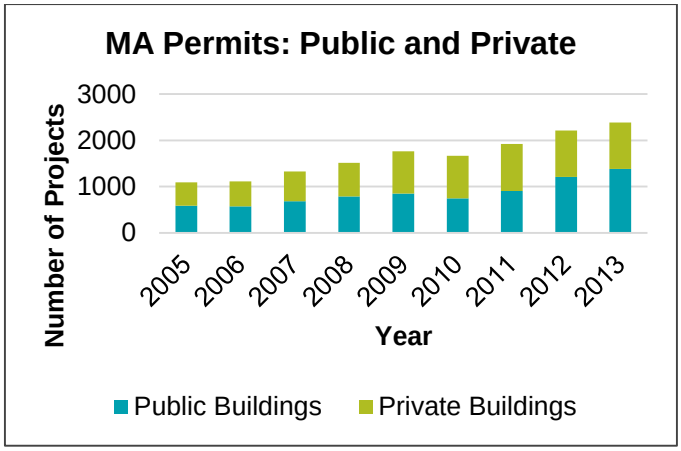

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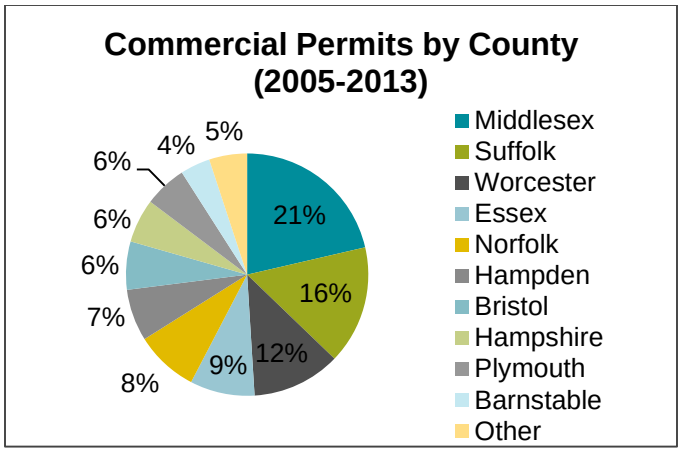
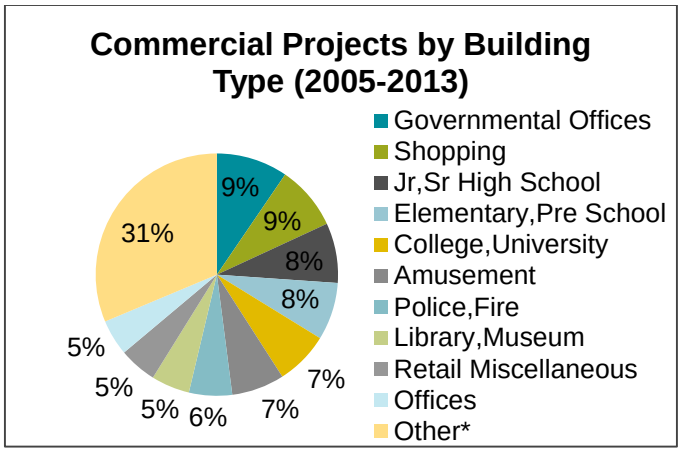
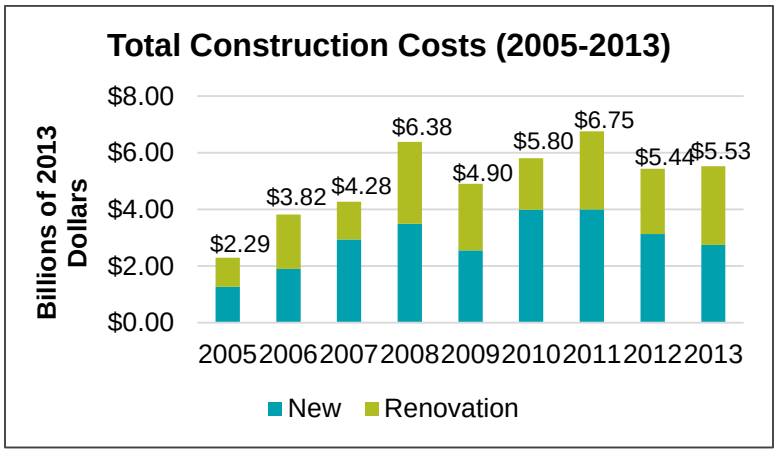




iv

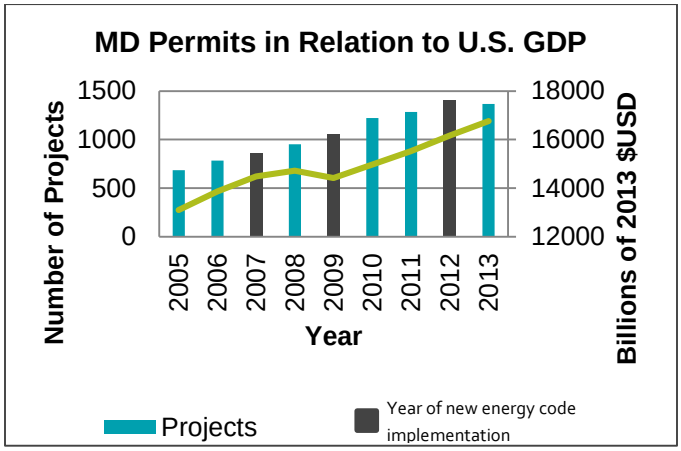
Construction Costs

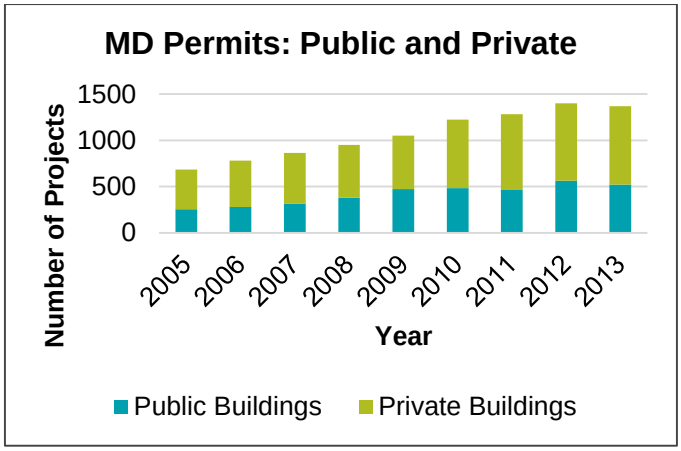


MARYLAND

Current Code: 2015 IECC
Effective Date: 01/01/2015
Total Commercial Projects (2005-2013): 9,610
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $12,412,062.64
Potential Carbon Savings 2015-2018 with Code Update: 64,678 tons
Average Cost per Project: $4,520,622.19

Permit Numbers





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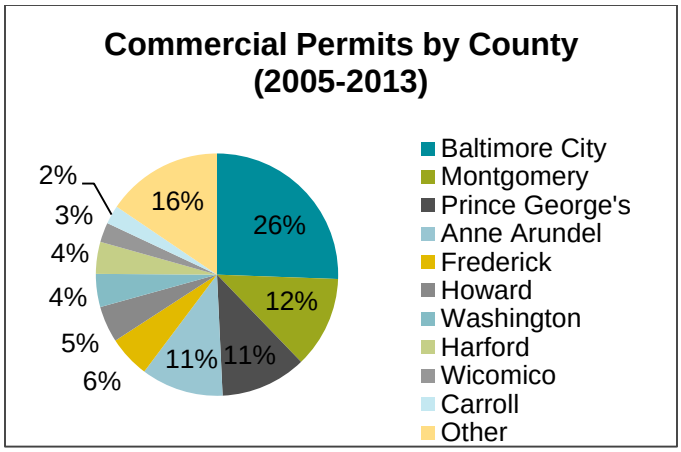
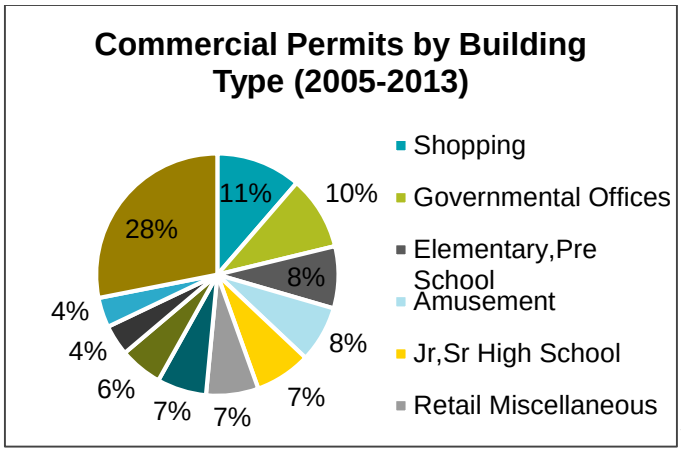
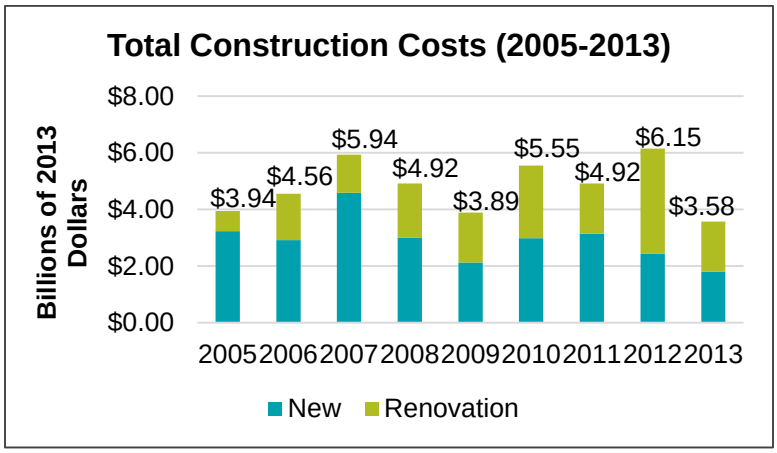




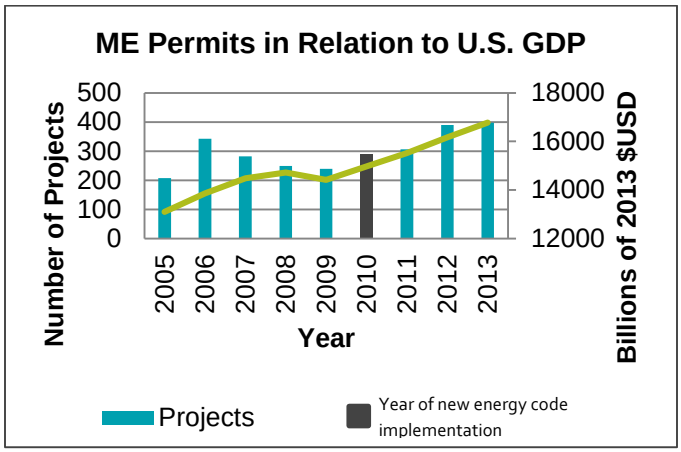
Construction Costs

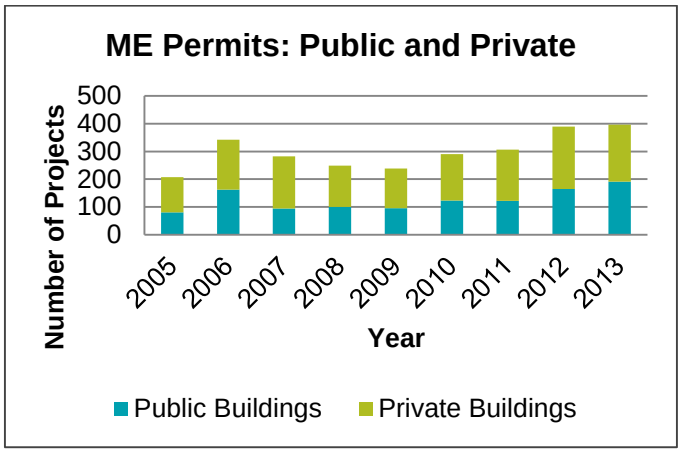


MAINE

Current Code: ASHRAE Standard 90.1-2007 (As of September, 2011 this code is optional for towns with fewer than 4,000 residents)
Effective Date: 12/01/2010
Total Commercial Projects (2005-2013): 2,703
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $9,032,318.92
Potential Carbon Savings 2015-2018 with Code Update: 49,518 tons
Average Cost per Project: $2,260,113.52

Permit Numbers





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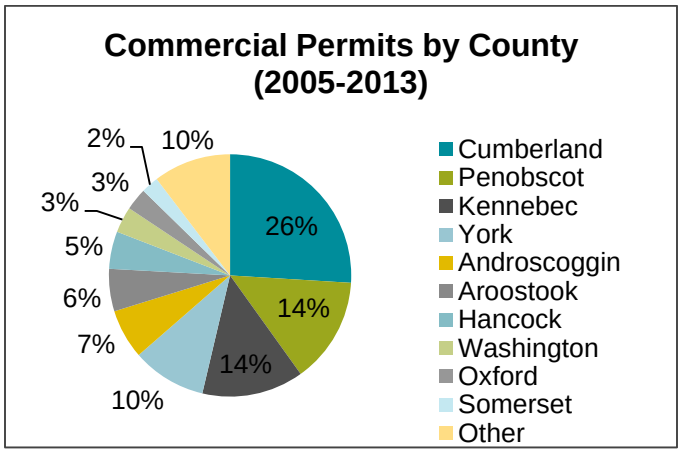
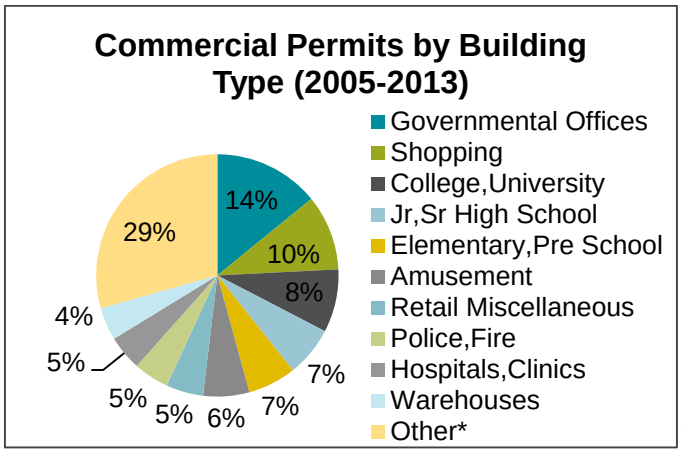




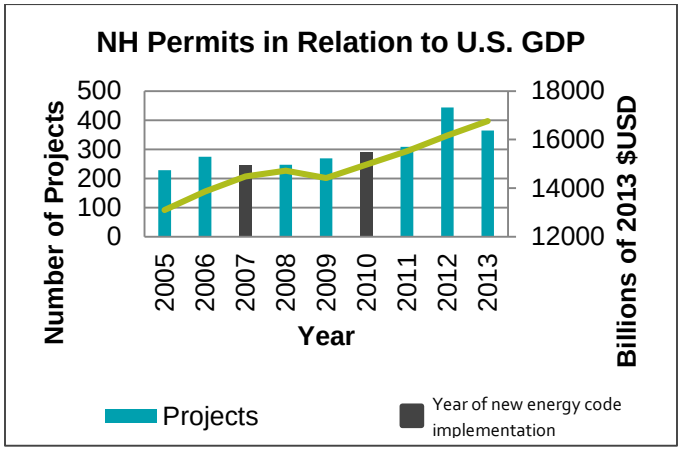
vi

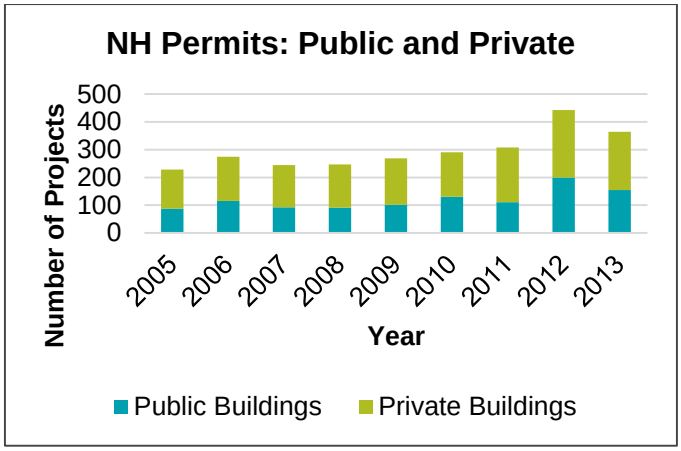
Construction Costs

NEW HAMPSHIRE

Current Code: 2009 IECC
Effective Date: 04/01/2010
Total Commercial Projects (2005-2013): 2,669
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $5,867,527.64
Potential Carbon Savings 2015-2018 with Code Update: 25,492 tons
Average Cost per Project: $2,691,273.55

Permit Numbers





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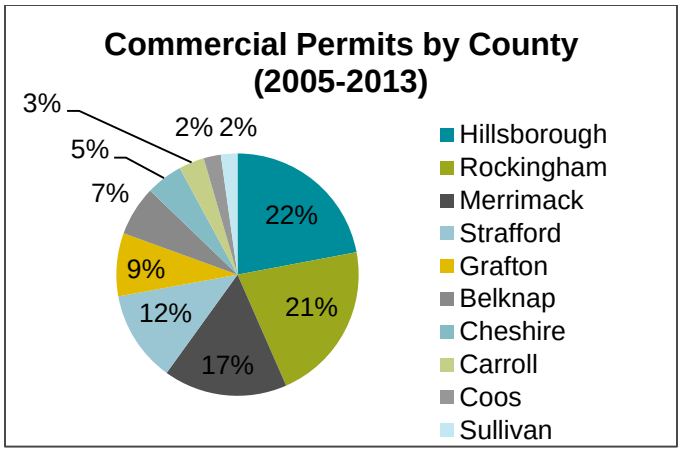
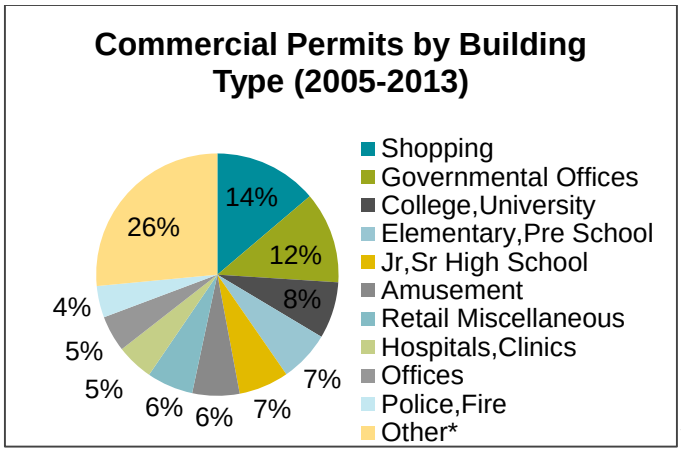
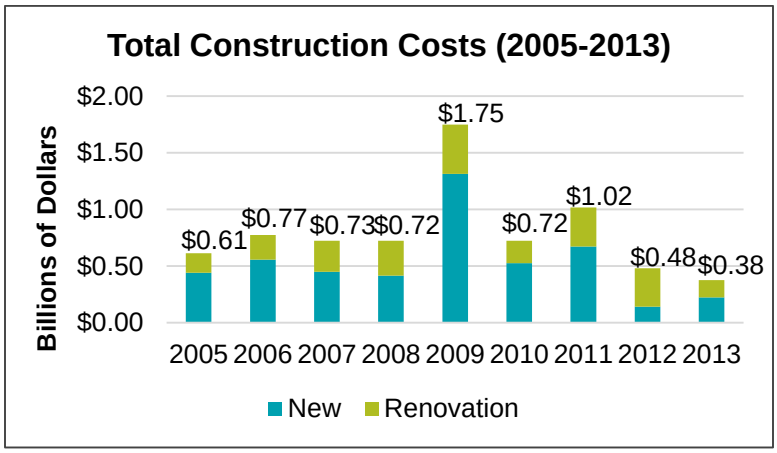




[vii]

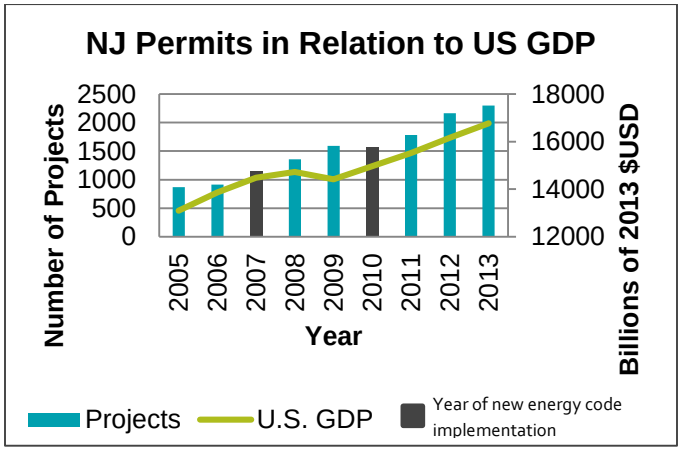
Construction Costs

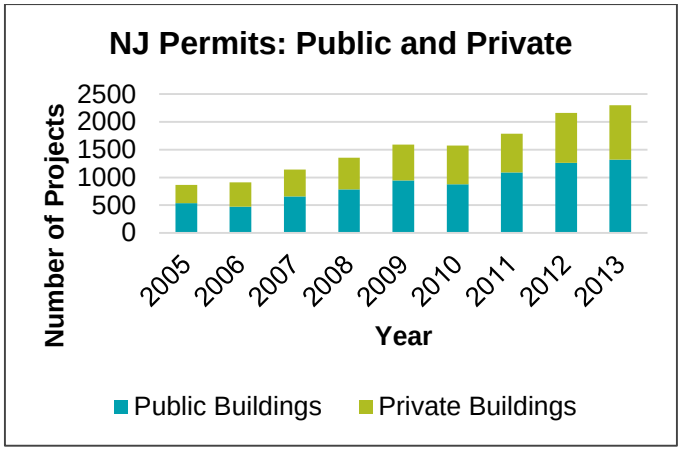


NEW JERSEY

Current Code: ASHRAE Standard 90.1-2007 with Amendments
Effective Date: 09/07/2010
Total Commercial Projects (2005-2013): 13,691
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $20,207,919.70
Potential Carbon Savings 2015-2018 with Code Update: 94,433 tons
Average Cost per Project: $2,867,920.53

Permit Numbers





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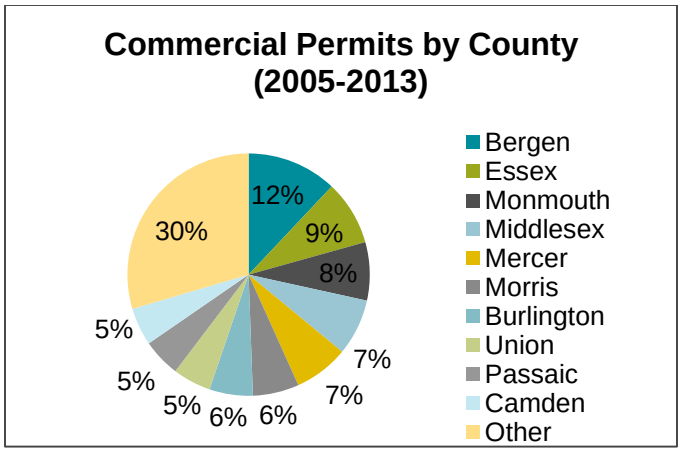
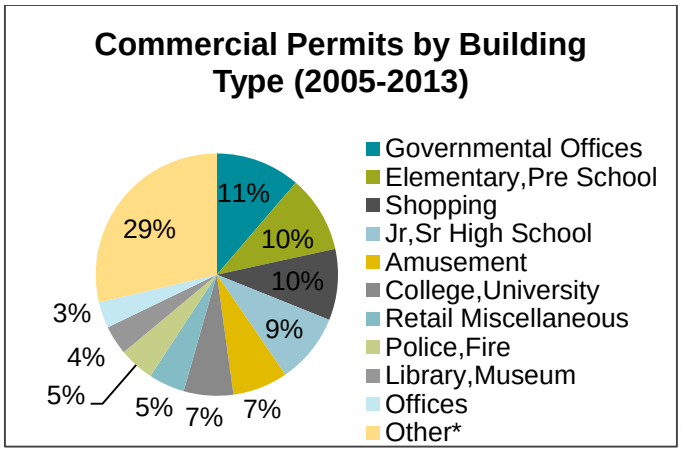
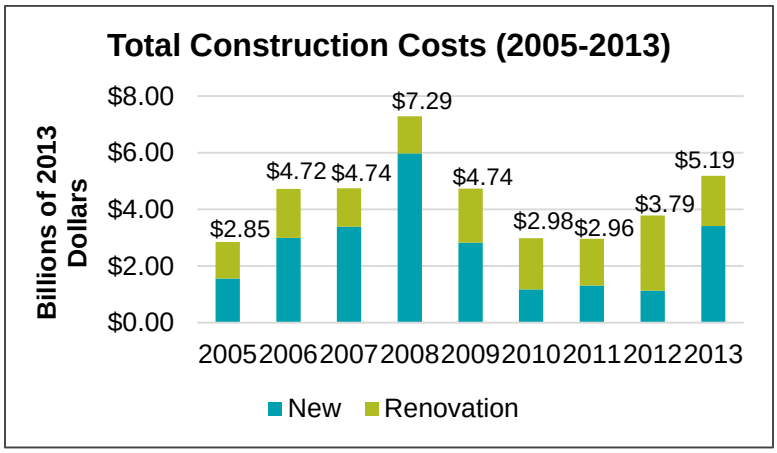




[viii]

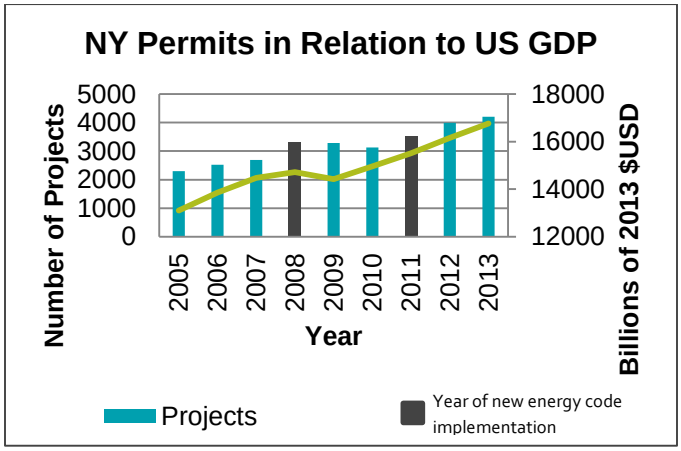
Construction Costs

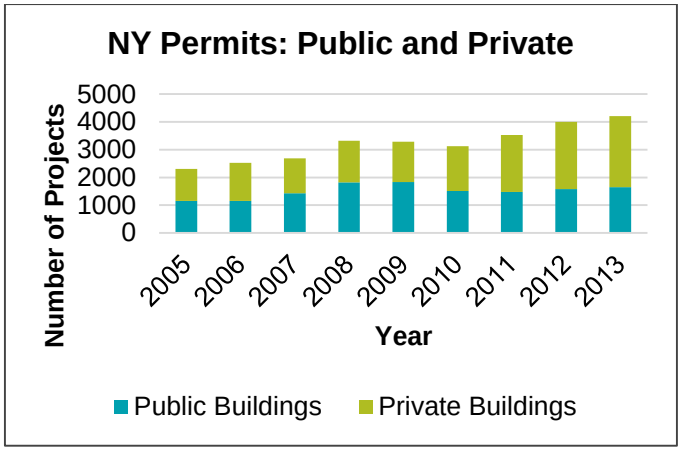


NEW YORK

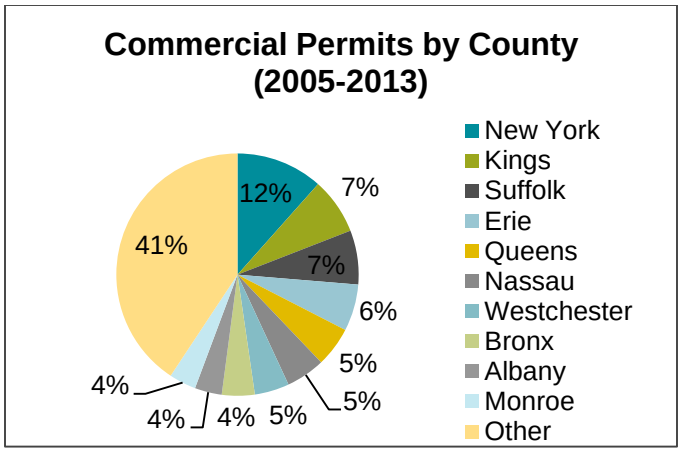
Current Code: 2012 IECC / ASHRAE 90.1-2010 with NY amendments
Effective Date: 01/01/2015
Total Commercial Projects (2005-2013): 28,971
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $17,008,127.52
Potential Carbon Savings 2015-2018 with Code Update: 82,876 tons
Average Cost per Project: $3,840,781.97

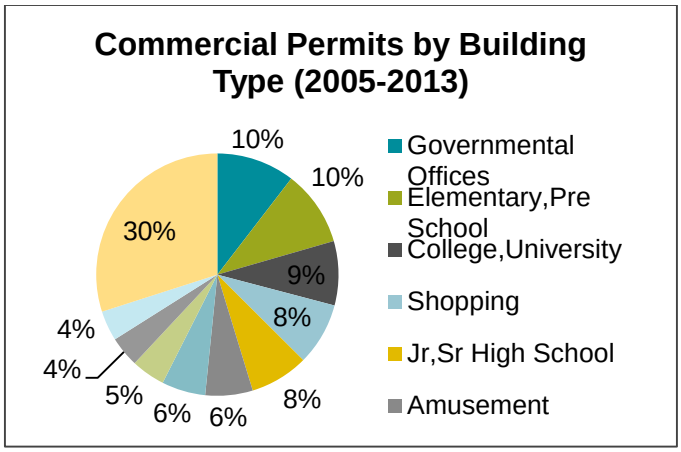
Permit Numbers



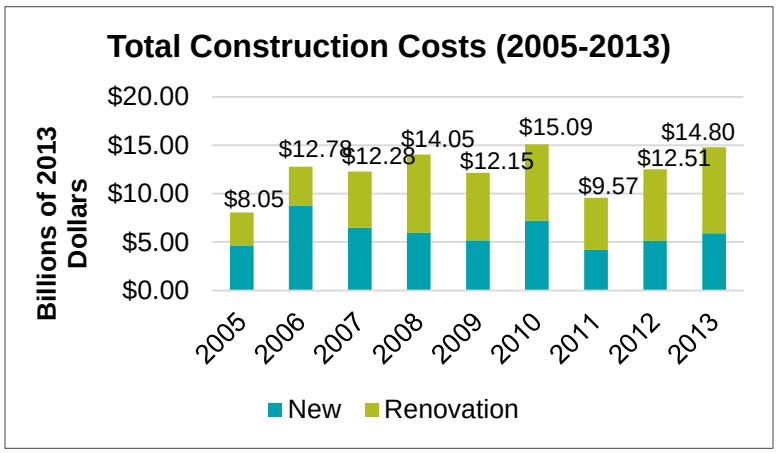


Permit Breakdown





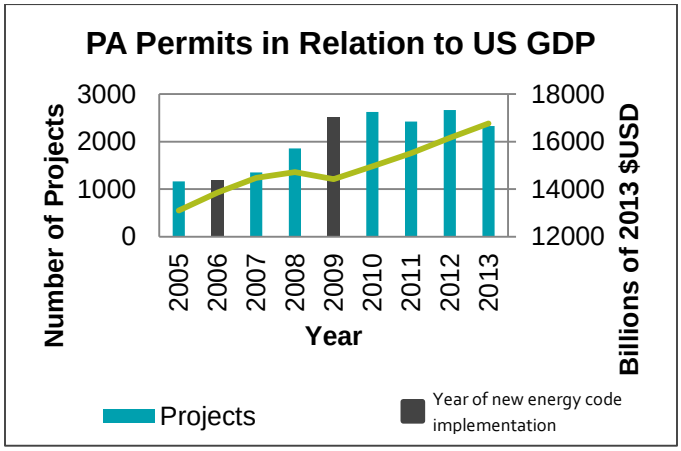
Construction Costs

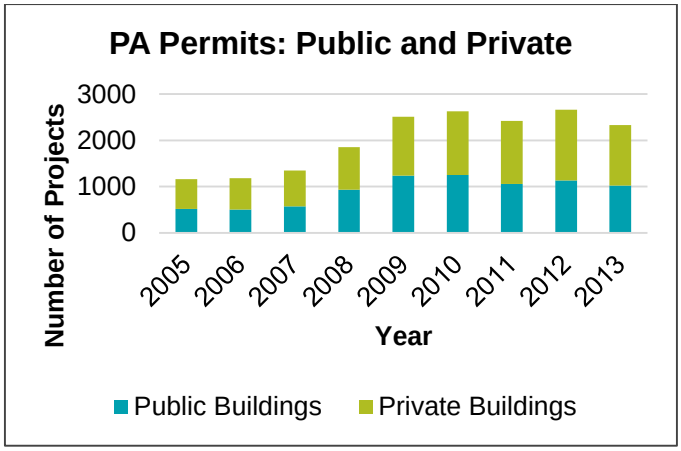


PENNSYLVANIA

Current Code: 2009 IECC
Effective Date: 12/31/2009
Total Commercial Projects (2005-2013): 18,112
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $47,852,562.52
Potential Carbon Savings 2015-2018 with Code Update: 200,772 tons
Average Cost per Project: $2,980,588.87

Permit Numbers





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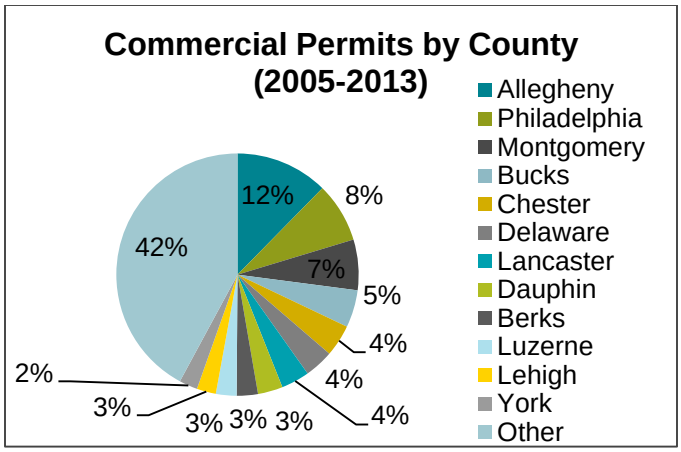
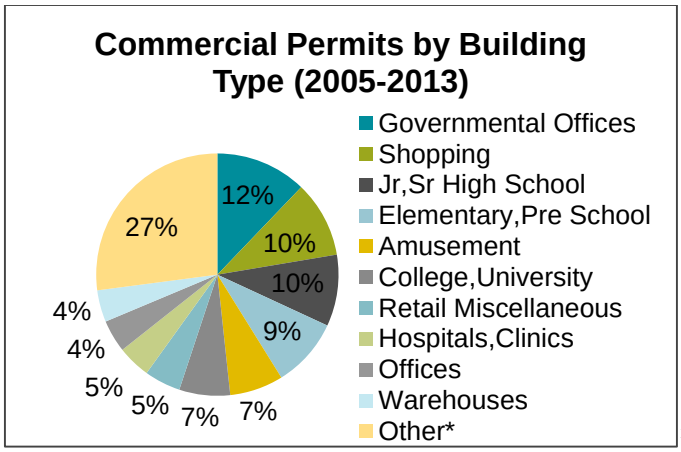
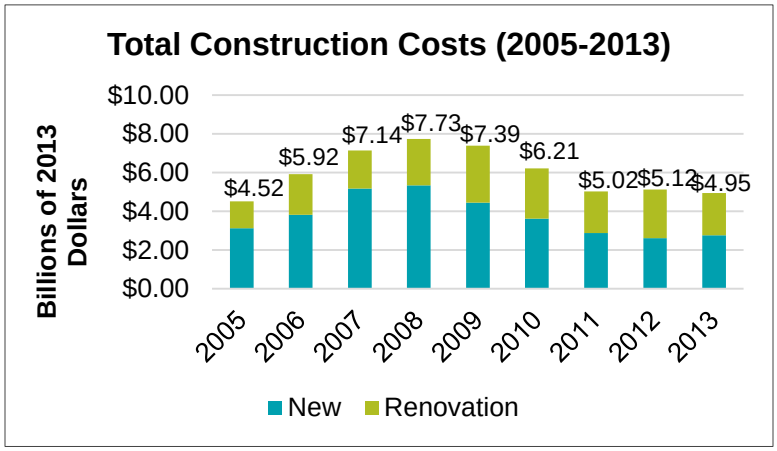




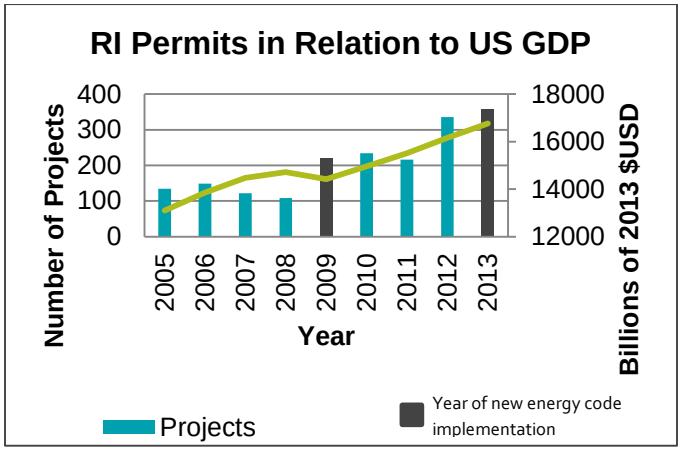
Construction Costs

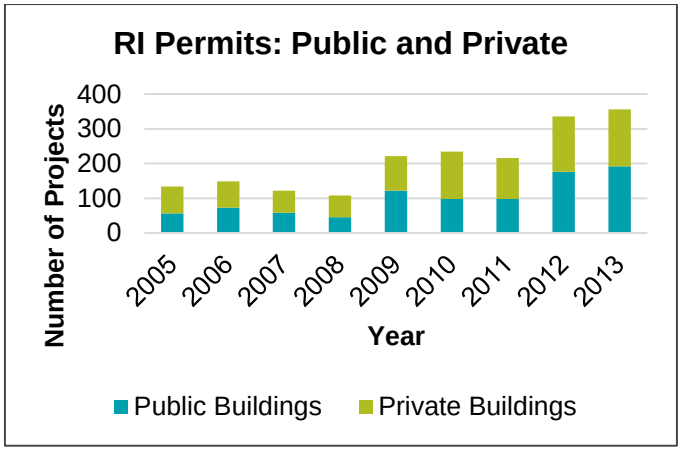


RHODE ISLAND

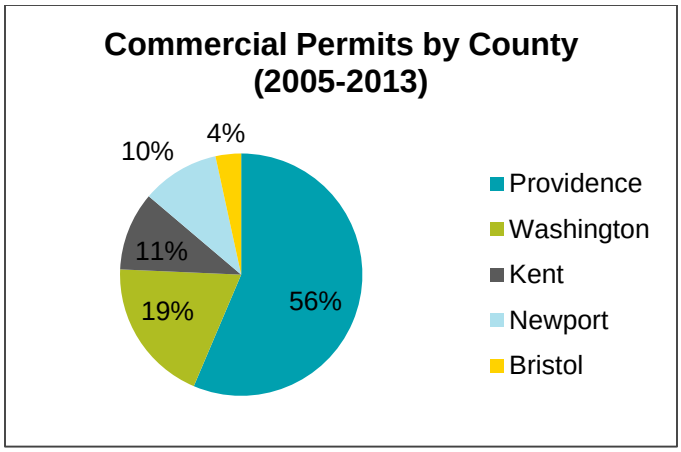
Current Code: 2012 IECC
Effective Date: 10/01/2013
Total Commercial Projects (2005-2013): 1,876
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $2,017,368.19
Potential Carbon Savings 2015-2018 with Code Update: 9,793 tons
Average Cost per Project: $2,363,183.86

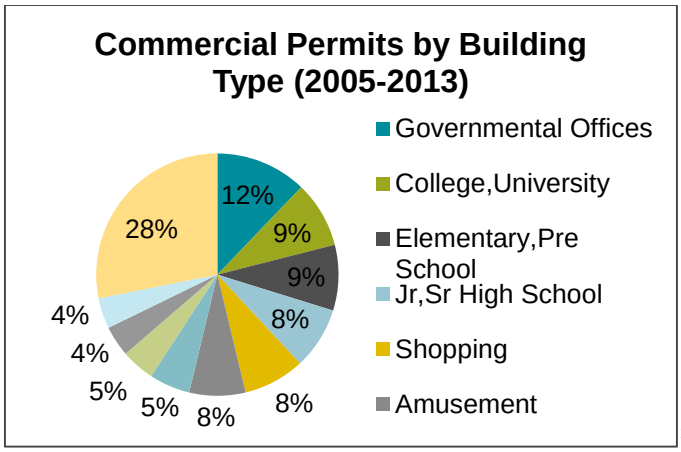
Permit Numbers





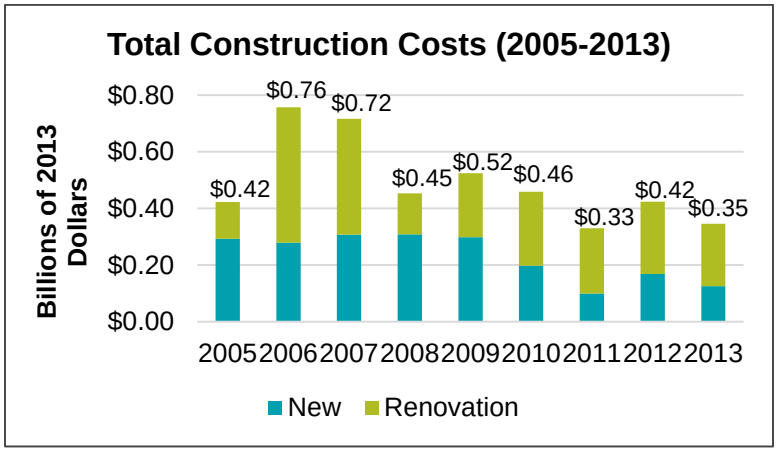
Permit Breakdown





xi

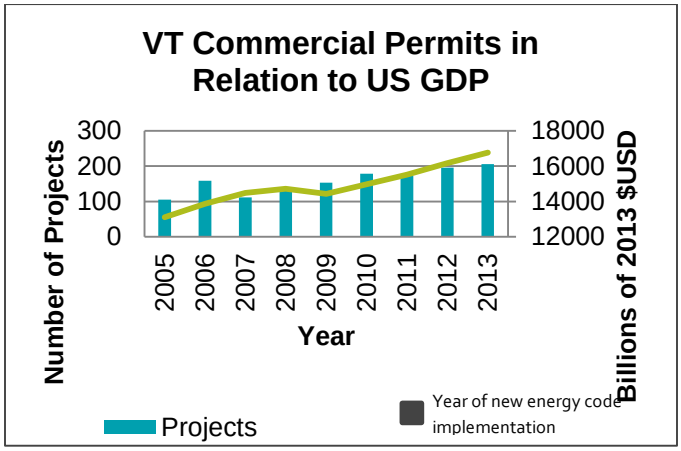
Construction Costs

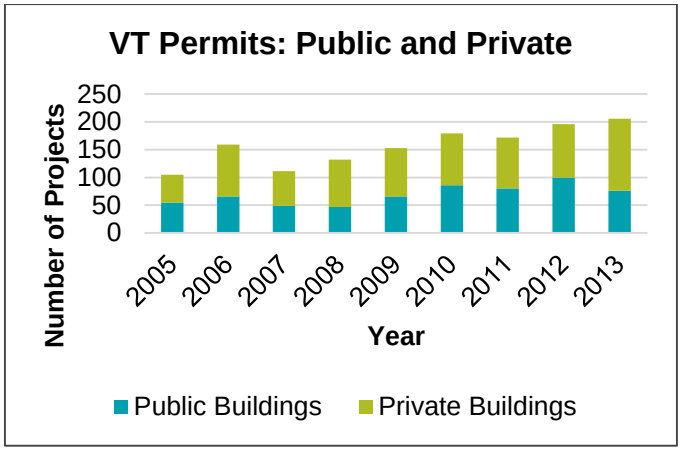


VERMONT

Current Code: 2015 IECC with VT amendments
Effective Date: 03/01/2015
Total Commercial Projects (2005-2013): 1,413
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $5,054,756.70
Potential Carbon Savings 2015-2018 with Code Update: 28,676 tons
Average Cost per Project: $1,754,346.31

Permit Numbers





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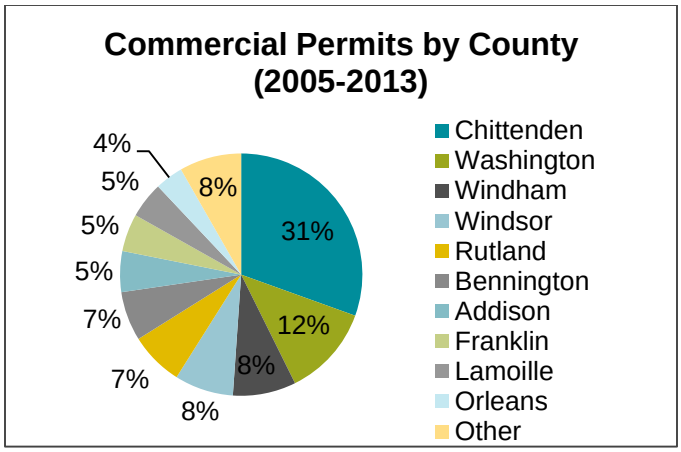
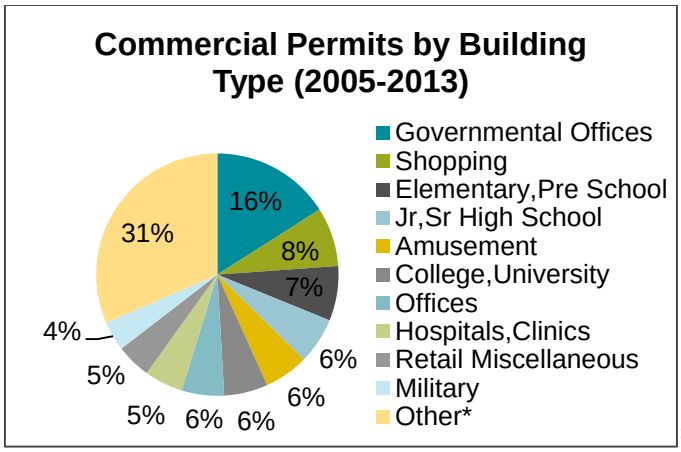
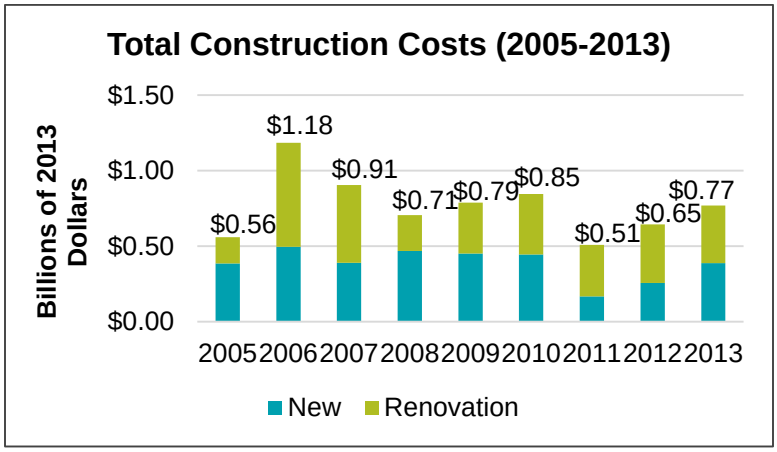




xii

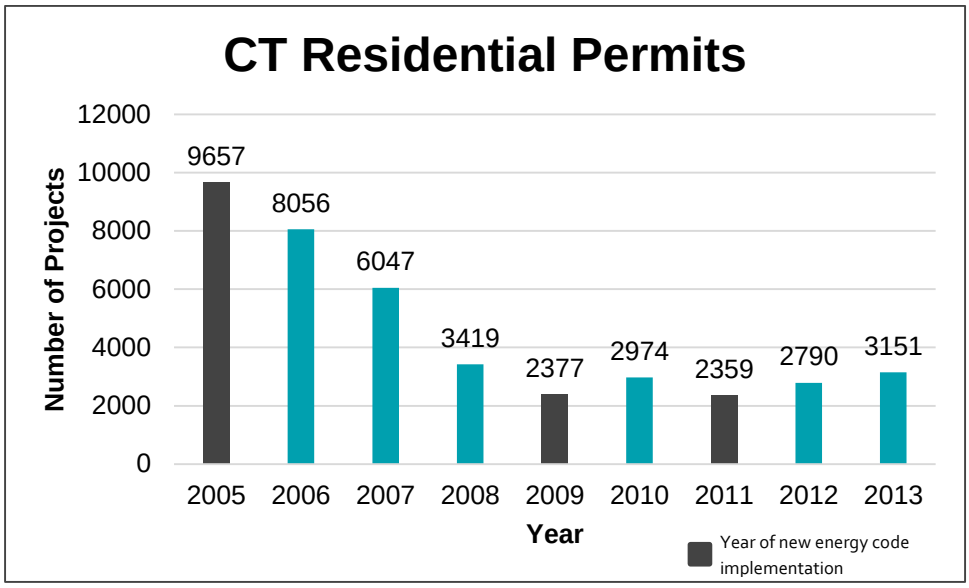
Construction Costs

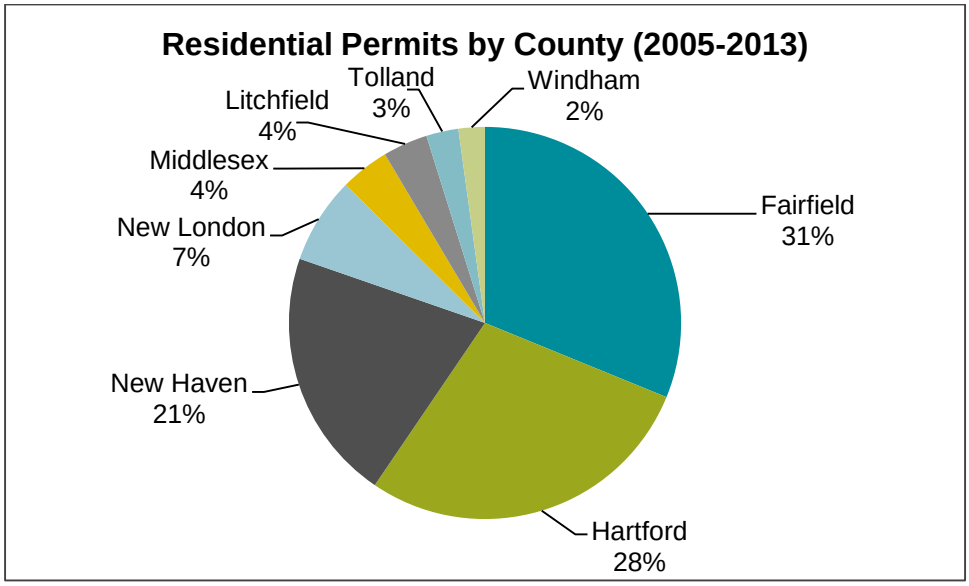


Residential State Analysis

CONNECTICUT

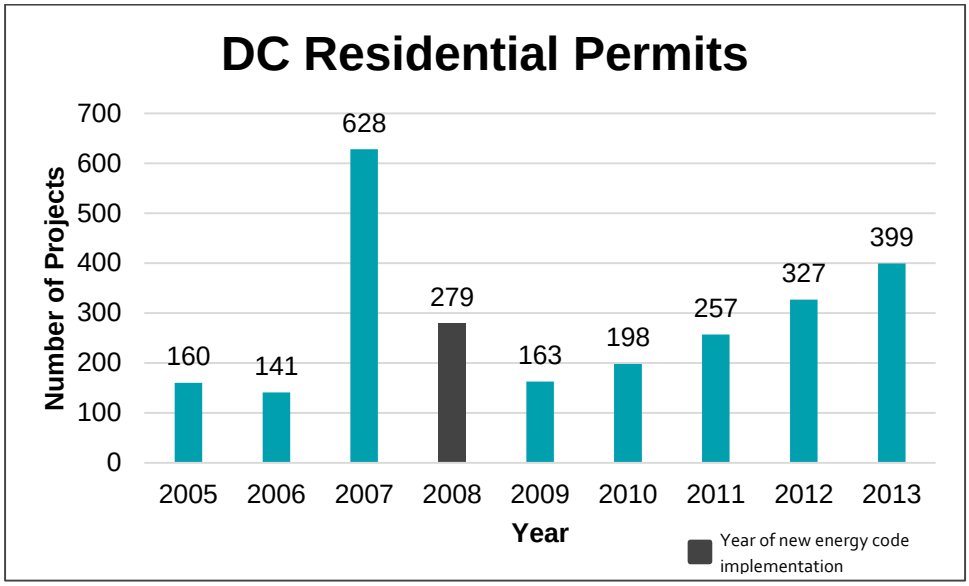
Current Code: 2009 IECC
Effective Date: 10/07/2011
Total New Residential Projects: 40,830
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $7,400,615
Potential Carbon Savings 2015-2018 with Code Update: 41,761 tons
Average Cost per Project: $331,479.77





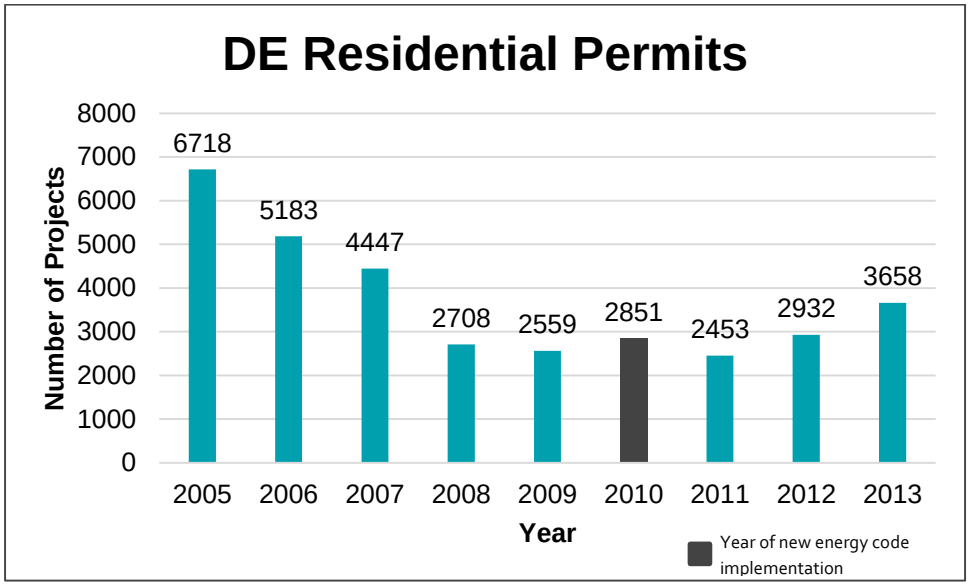
DISTRICT OF COLUMBIA

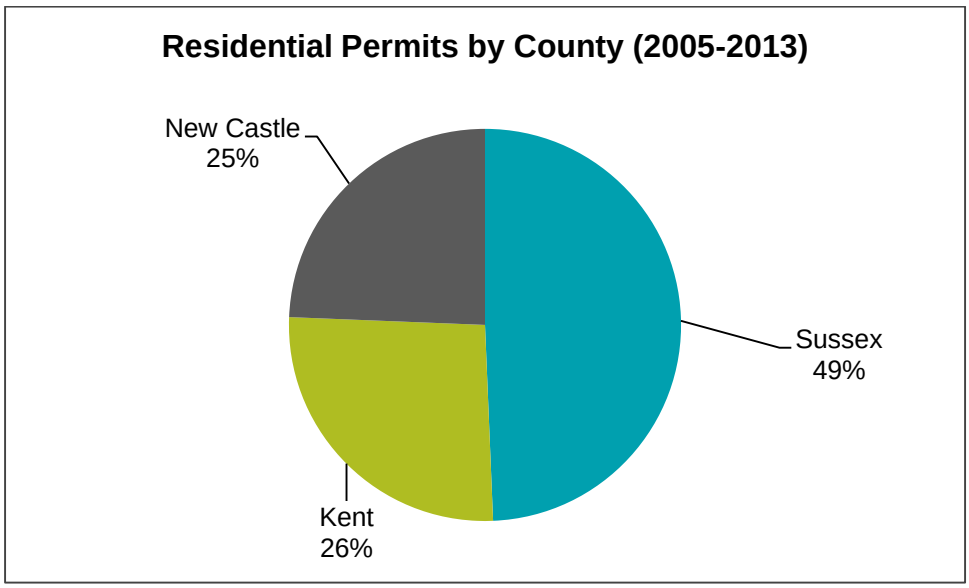
Current Code: 2012 IECC
Effective Date: 05/11/2014
Total New Residential Projects: 2,552
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $10,166
Potential Carbon Savings 2015-2018 with Code Update: 151 tons
Average Cost per Project: $115,341.06



DELAWARE

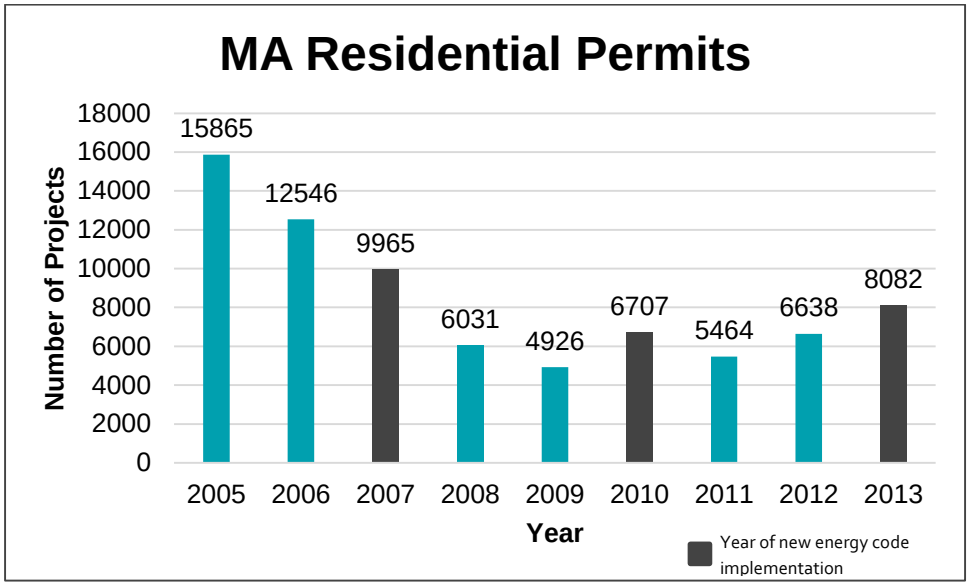
Current Code: 2012 IECC
Effective Date: 03/28/2014
Total New Residential Projects: 34,480
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $191,220
Potential Carbon Savings 2015-2018 with Code Update: 1,144 tons
Average Cost per Project: $303,043.25

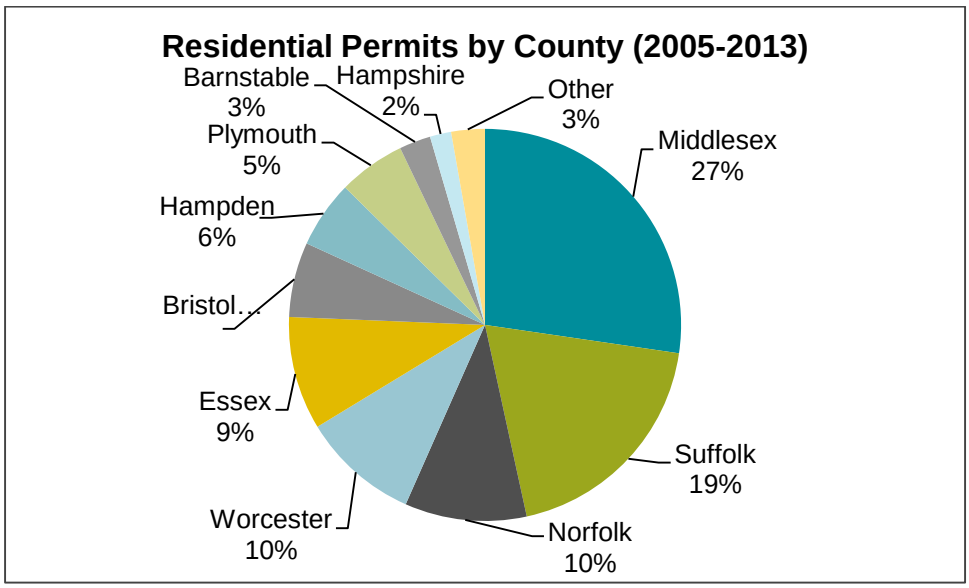




MASSACHUSETTS

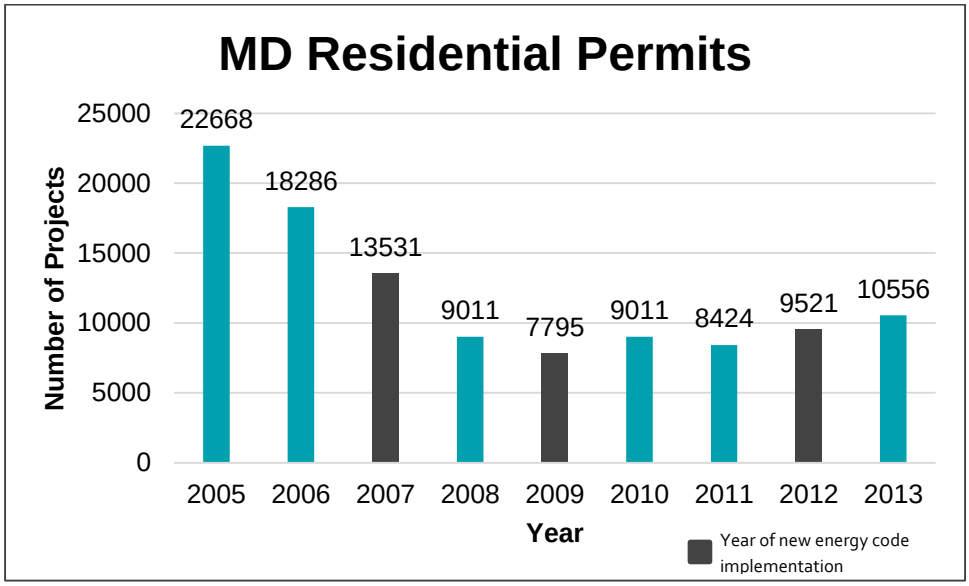
Current Code: 2012 IECC
Effective Date: 07/01/2014
Total New Residential Projects: 150,304
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $334,218
Potential Carbon Savings 2015-2018 with Code Update: 3,247 tons
Average Cost per Project: $390,500.13

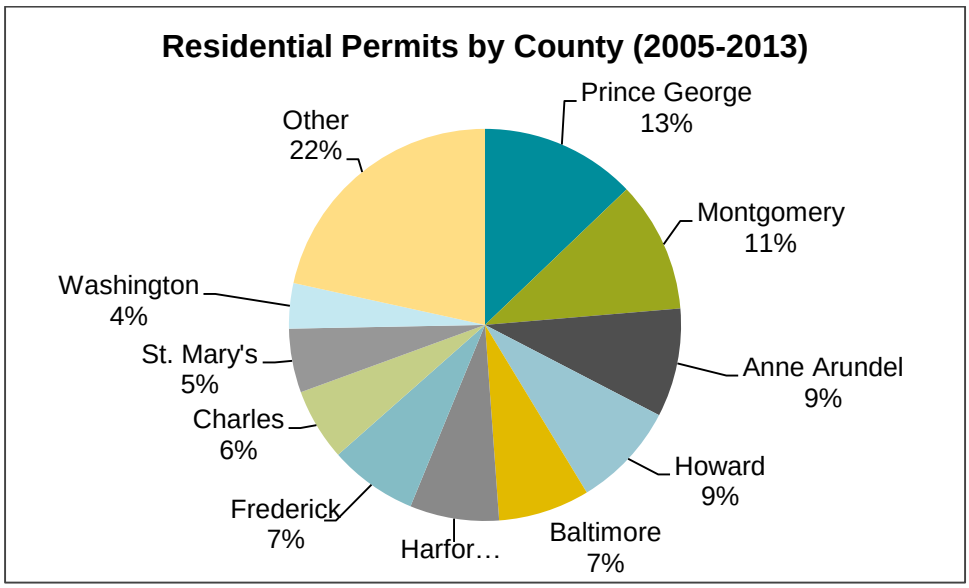




MARYLAND

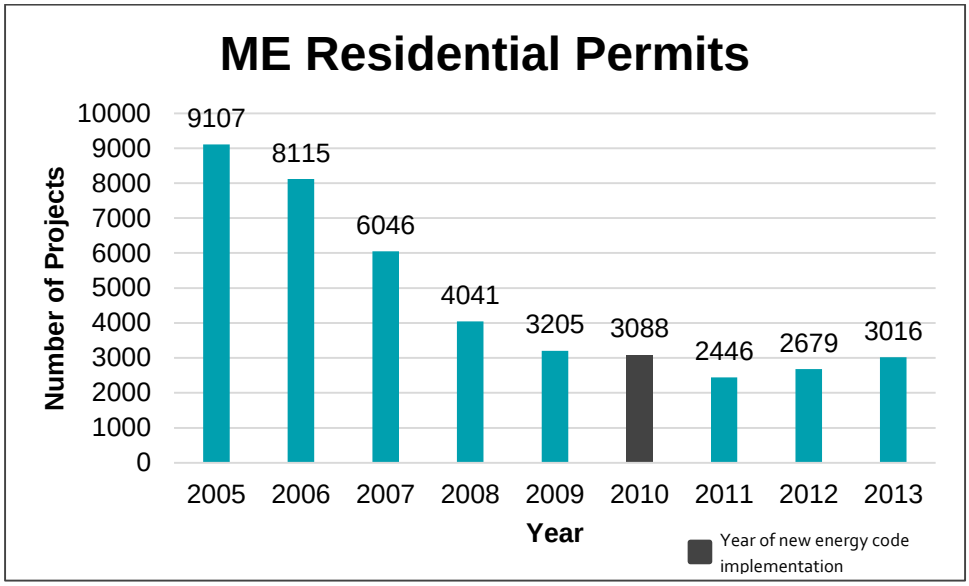
Current Code: 2015 IECC
Effective Date: 01/01/2015
Total New Residential Projects: 187,261
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $514,900
Potential Carbon Savings 2015-2018 with Code Update: 4,596 tons
Average Cost per Project: $354,413.74

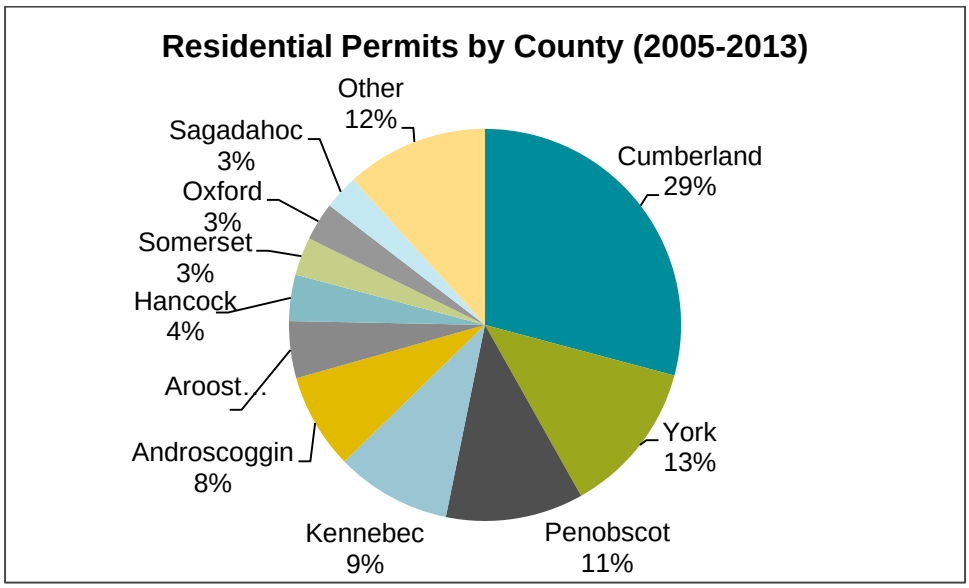




MAINE

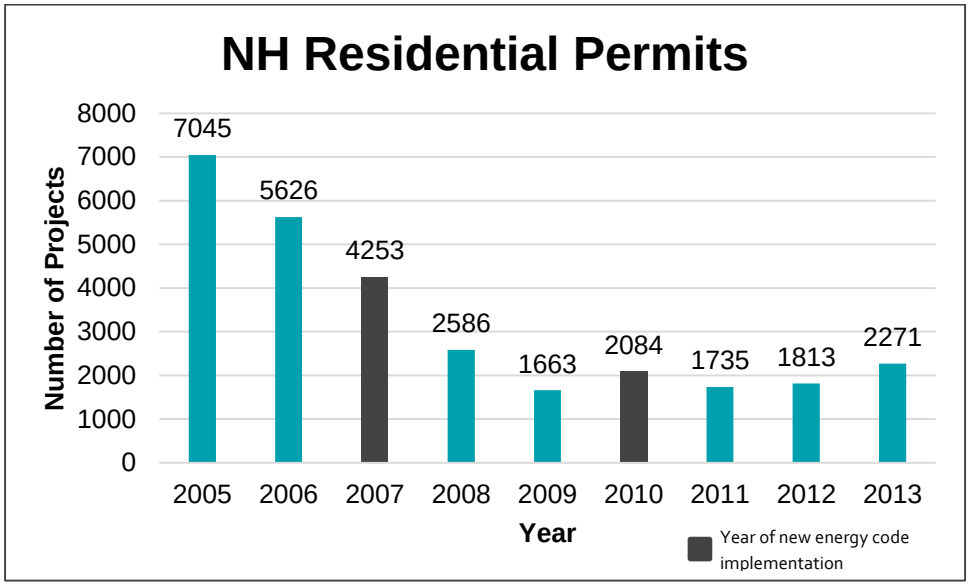
Current Code: 2009 IECC (Optional for towns with fewer than 4,000 residents)
Effective Date: 12/01/2010
Total New Residential Projects: 46,624
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $13,704,920
Potential Carbon Savings 2015-2018 with Code Update: 48,711 tons
Average Cost per Project: $212,412.14

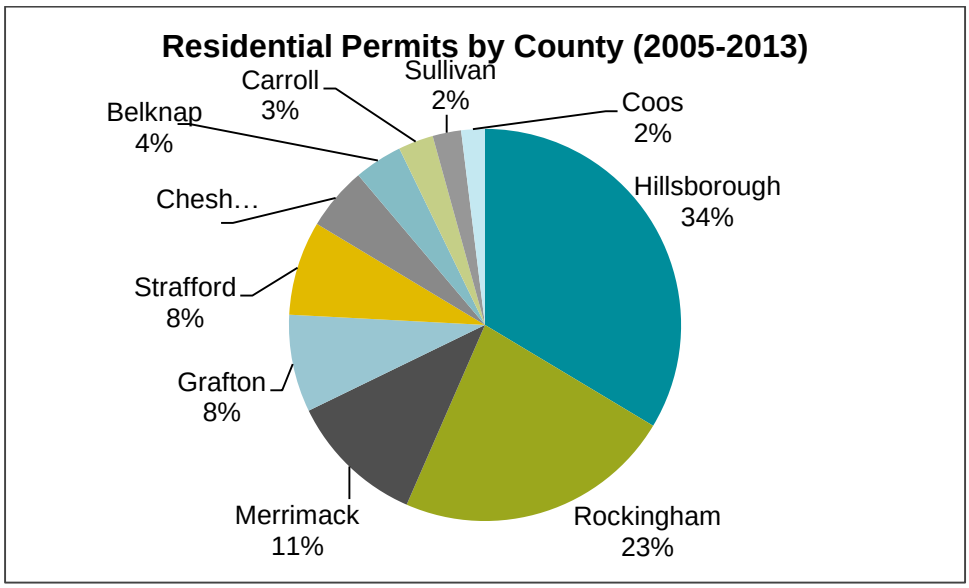




NEW HAMPSHIRE

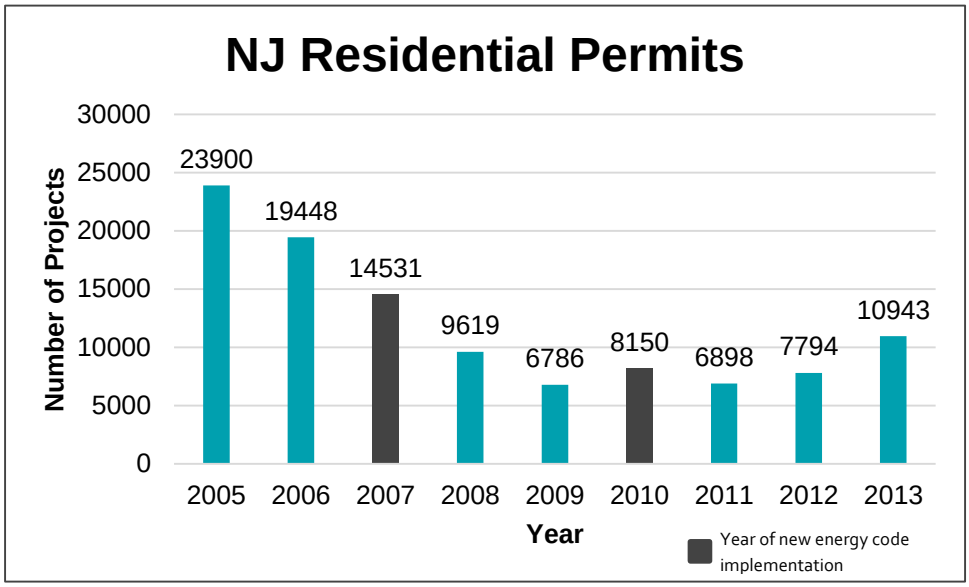
Current Code: 2009 IECC
Effective Date: 04/01/2010
Total New Residential Projects: 29,076
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $5,838,372
Potential Carbon Savings 2015-2018 with Code Update: 34,168 tons
Average Cost per Project: $296,226.29

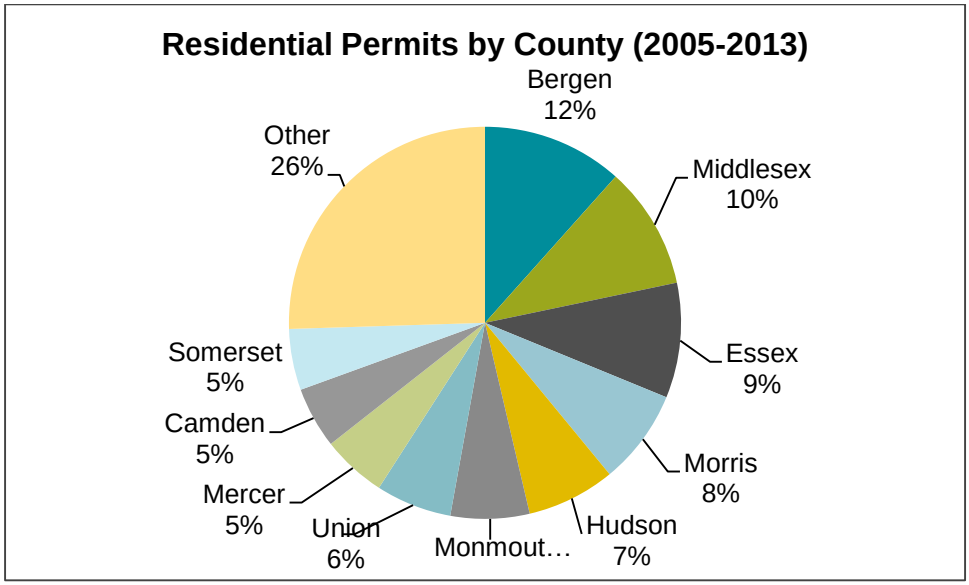




NEW JERSEY

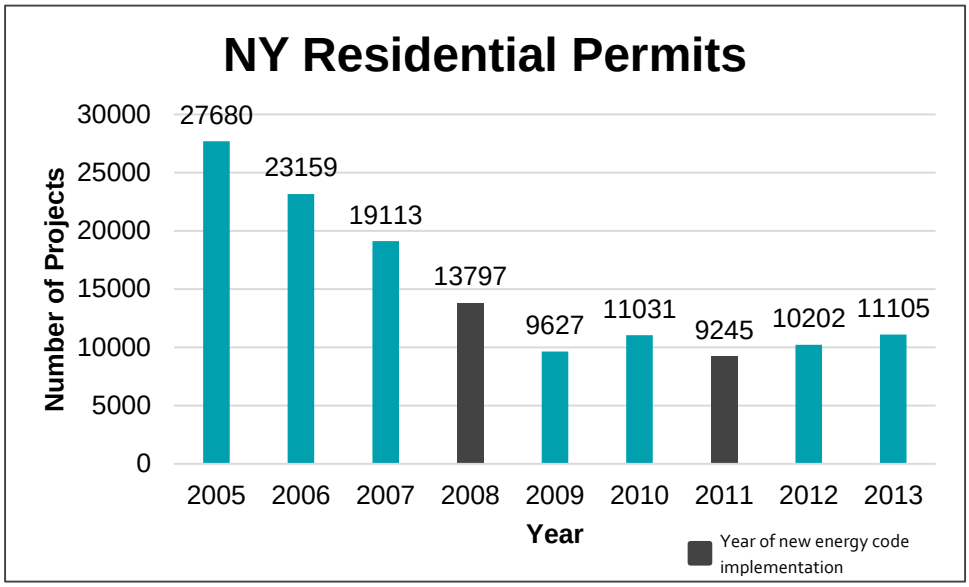
Current Code: 2009 IECC
Effective Date: 09/07/2010
Total New Residential Projects: 135,624
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $21,833,041
Potential Carbon Savings 2015-2018 with Code Update: 95,426 tons
Average Cost per Project: $318,504.36

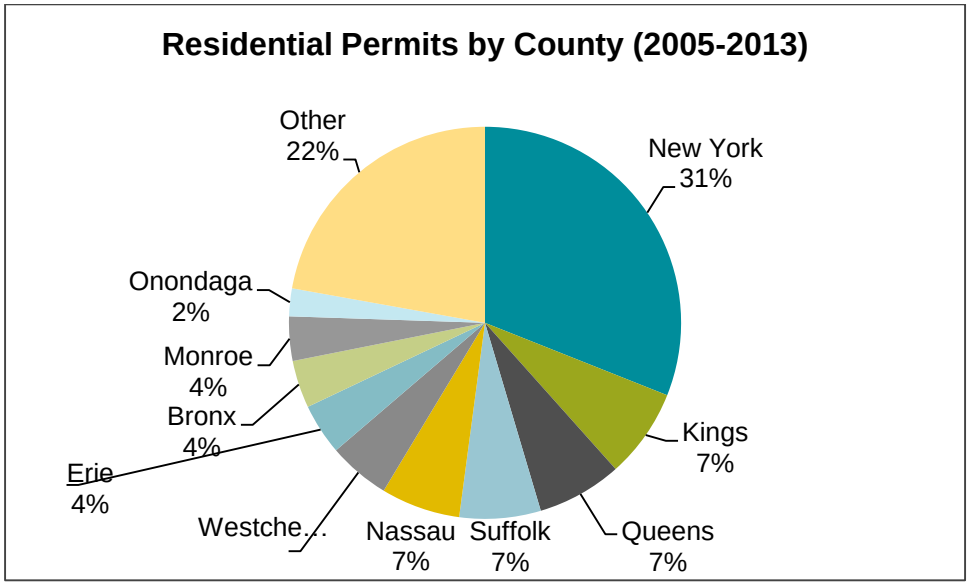




NEW YORK

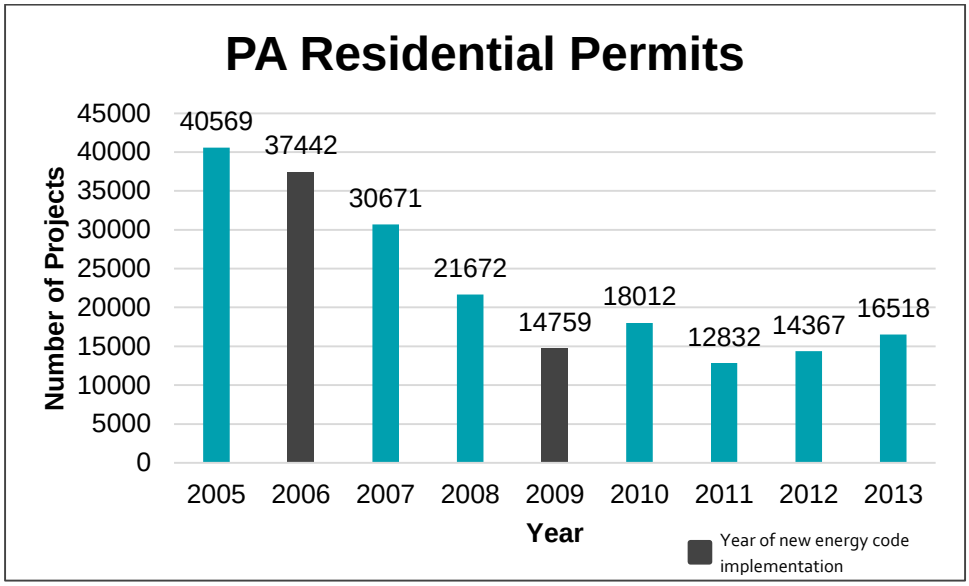
Current Code: 2009 IECC with amendments
Effective Date: 12/28/2010
Total New Residential Projects: 164,892
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $19,569,492
Potential Carbon Savings 2015-2018 with Code Update: 304,024 tons
Average Cost per Project: $501,709.28

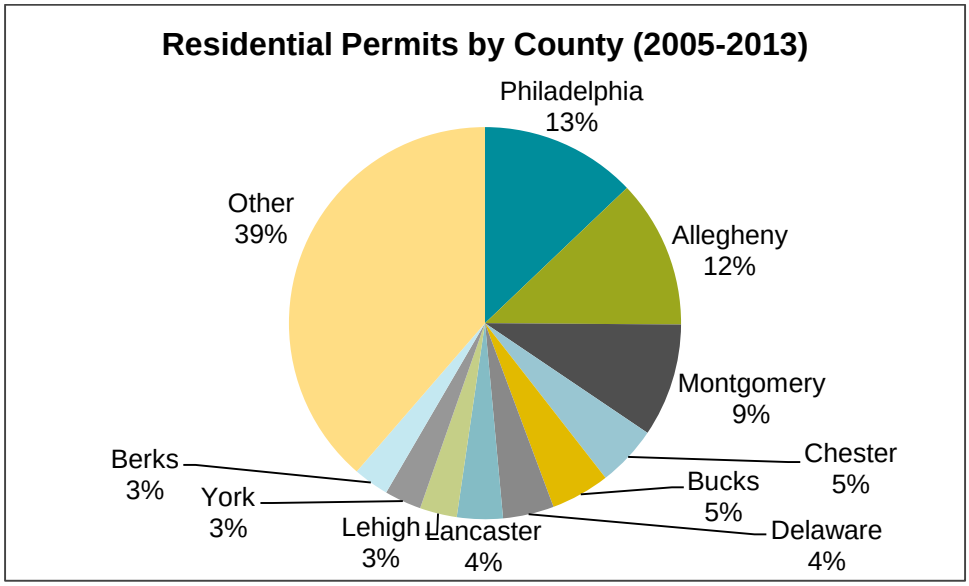




PENNSYLVANIA

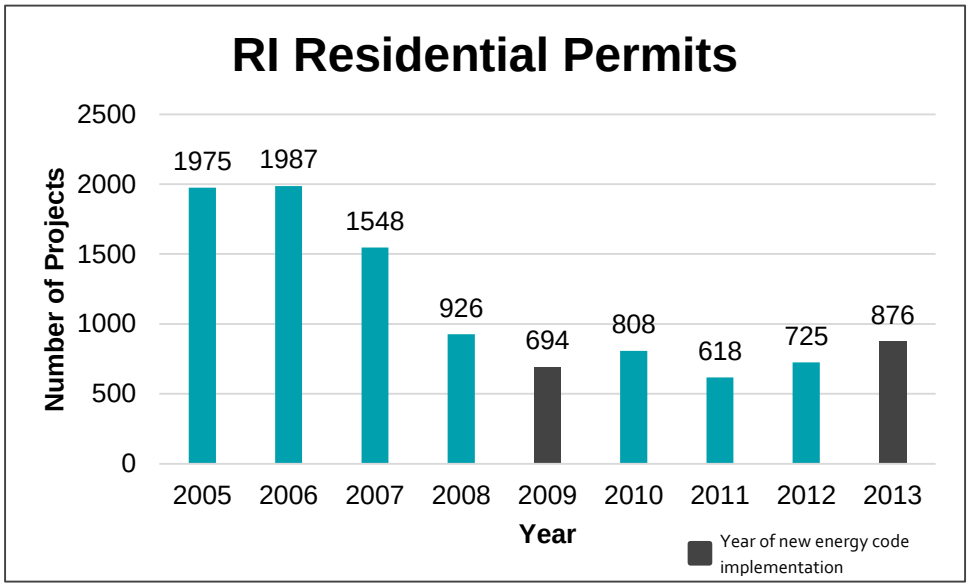
Current Code: 2009 IECC
Effective Date: 12/31/2009
Total New Residential Projects: 286,788
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $42,166,317
Potential Carbon Savings 2015-2018 with Code Update: 273,392 tons
Average Cost per Project: $290,875.45

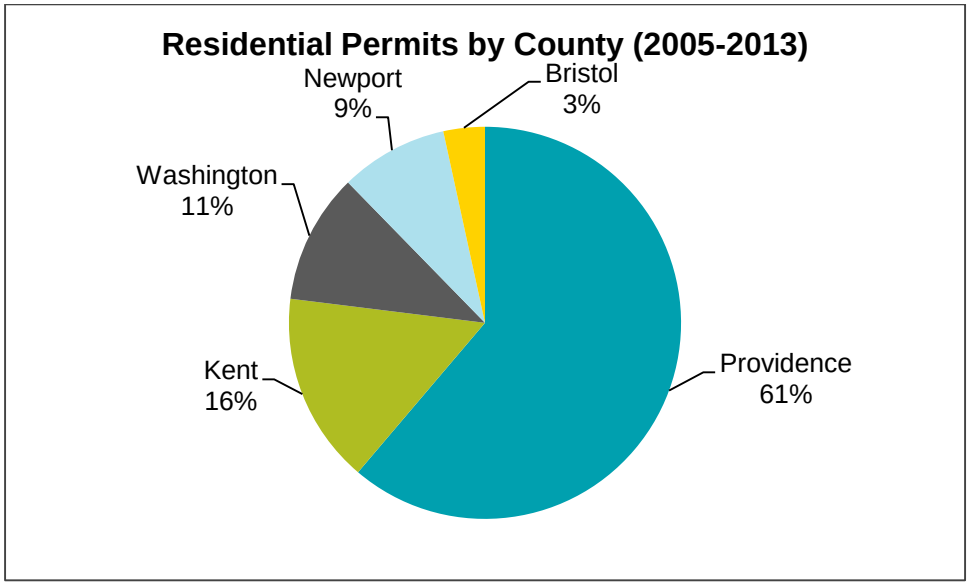




RHODE ISLAND

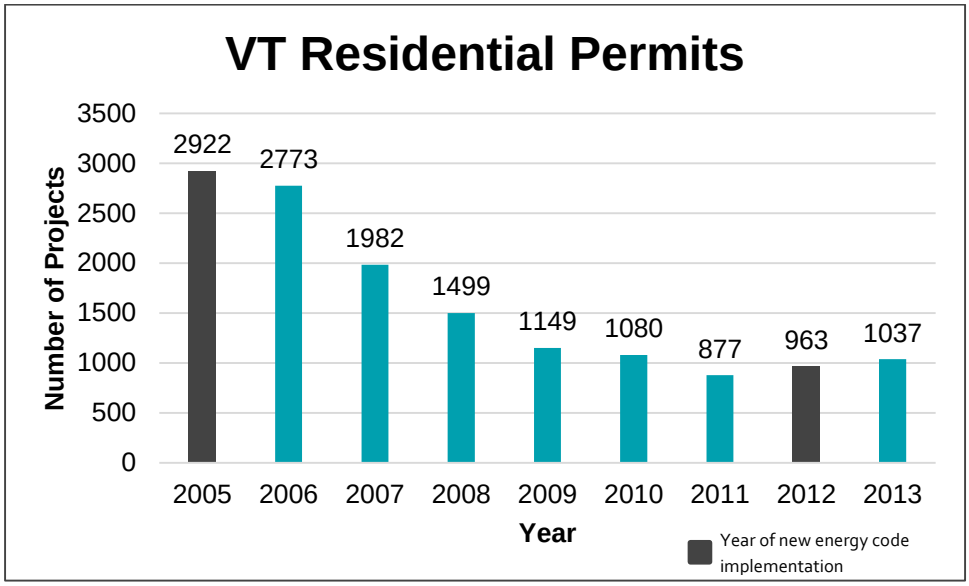
Current Code: 2012 IECC
Effective Date: 07/01/2013
Total New Residential Projects: 10,157
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $2,422,730
Potential Carbon Savings 2015-2018 with Code Update: 9,847 tons
Average Cost per Project: $277,667.59

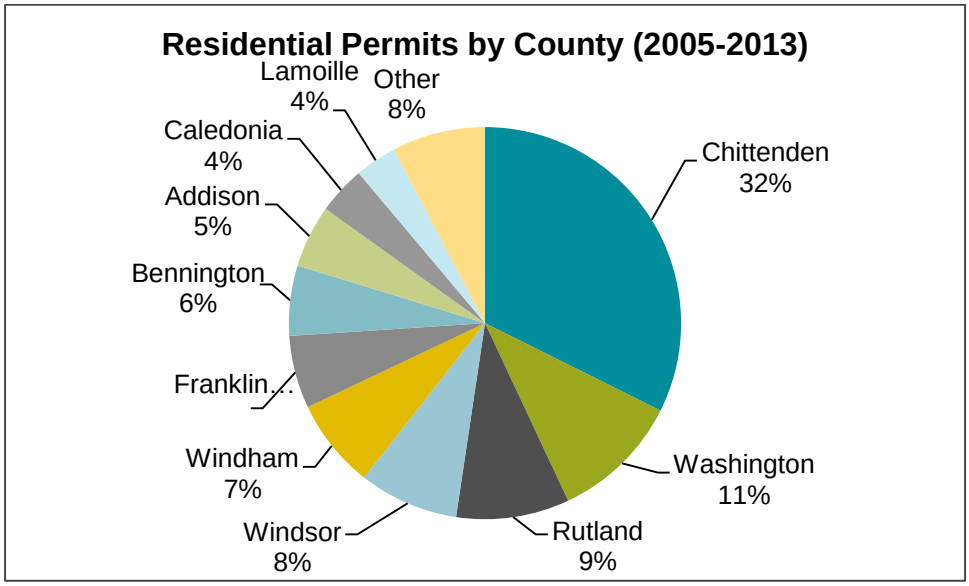




VERMONT

Current Code: 2015 IECC with VT amendments
Effective Date: 03/01/2015
Total New Residential Projects: 15,380
Potential Dollar Savings 2015-2018 with Code Update (in 2015 Dollars): $3,904,122
Potential Carbon Savings 2015-2018 with Code Update: 15,493 tons
Average Cost per Project: $265,202.03





Conclusions

Commercial Building Projects: Over our study period from 2005-2013, regional permit data shows an upward trend in the number of commercial building projects initiated. This is largely due to the fact that the number of renovation projects has risen sharply and is forecasted to continue doing so while new construction project numbers slowly decreased. This growth in renovation projects highlights a significant opportunity to focus on incorporating energy saving retrofits into renovations as part of a broader energy efficiency strategy.

Residential Building Projects: Conversely, the numbers for new residential building projects show a downward trend since 2005. There has been a slight rebound since the market bottomed out in 2009 and these numbers are expected to rise significantly through the coming years (note that this analysis only included new construction for the residential market).

Total Building Projects: The total number of residential and commercial permits in the region also shows a downward slope. This is mainly due to the sharp drop seen in residential construction activity in the region.

Public Building Projects: The share of public building construction projects[14] since 2005 represents 44 percent of the total construction activity. The top three overall construction project types in the region were Government Offices, Pre- and Elementary Schools, and Junior and Senior High Schools. This represents a large opportunity to capture energy savings while ensuring healthy, productive indoor environments through programs designed to lead by example in the public sector by constructing buildings that significantly exceed energy codes in their energy usage characteristics.

Effects of Code Updates on Commercial Construction: Since the period of economic recession in 2008-2009 when the construction activity in the region fell sharply, all 12 of the NEEP states have undergone a commercial code update. Five of these states have updated their energy code twice in this time period. Of these 17 code updates in the region:

- Eleven showed rising trends in permit applications from the year before to the year after the implementation of the new code. Five showed no significant changes in activity and only one showed a downward trend as seen in the graph below:

State	Year of Code Update	Commercial Project Starts Trend	Year of Second Code Update (If Applicable)	Commercial Project Starts Trend
CT	2009	↗	2011	↗
DC	2008	→	NA	
DE	2010	↘	NA	
MA	2008	↗	2010	→

[14] Public Building Numbers Include: Courthouses, Elementary & Pre-Schools, Governmental Offices, Jr. & Sr. High Schools, Libraries, Museums, Military Buildings, Police & Fire Buildings.

MD	2009	↗	2012	→
ME	2010	↗	NA	
NH	2010	↗	NA	
NJ	2010	→	NA	
NY	2008	↗	2011	↗
PA	2009	↗	NA	
RI	2009	↗	2013	↗
VT	2011	→	NA	

These increases in construction activity help illustrate the trend that the timing of new code implementation and the year following are not correlated with any significant drop in construction project activity. All of the states in the region show an upward trend in commercial construction permitting numbers and have higher levels of activity since the low point in 2008.

Effects of Code Updates on Residential Construction: The same number of code updates occurred between 2008 and 2013 on the residential side. Of these 17 code updates:

- Seven showed rising trends in permit applications from the year before to the year after the implementation of the new code. Three showed no significant changes in activity and seven showed a downward trend as seen in the graph below:

State	Year of Code Update	Residential Project Starts Trend	Year of Second Code Update (If Applicable)	Residential Project Starts Trend
CT	2009	↘	2011	→
DC	2008	↘	NA	
DE	2010	→	NA	
MA	2008	↗	2010	↗
MD	2009	→	2012	↗
ME	2010	↘	NA	

NH	2010		NA	
NJ	2010		NA	
NY	2008		2011	
PA	2009		NA	
RI	2009		2013	
VT	2011		NA	

The overall construction activity for new residential buildings in the region fell significantly since peaking in 2005. The region only showed growth in permit numbers in three years compared to the previous year. The residential construction activity during years of code updates was consistent with the regional trend. There was no noticeable drop in construction projects in specific states during these years or the years immediately following.

Dollar Savings Projections: Using projections of construction activity provided by the CMD Group Inc. and developed by Oxford Economics along with building models created by PNNL, we estimate that the regional dollar savings potential of all the NEEP states updating their commercial energy code to the 2015 IECC would be $142,631,071.37 in inflation adjusted 2015 dollars between 2015 and 2018. The regional residential savings with code update would be $117,890,114.13.

Emissions Savings Projections: Using the Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator[15] and the modeled energy usage of the forecasted new buildings we estimated the potential carbon savings of implementing the 2015 IECC energy codes. The potential regional commercial carbon savings is 671,975 metric tons from 2015 to 2018. The regional potential for residential carbon savings is 831,960 metric tons. These savings are the equivalent to taking 316,618 cars off the road for a year.

These savings projections should be of significant interest to states as they file their compliance plans to meet the proposed carbon reduction standards under the EPA's Clean Power Plan (section 111(d) of the federal Clean Air Act).

[15] U.S. Environmental Protection Agency. "Calculations and References." http://www.epa.gov/cleanenergy/energy-resources/refs.html

Building Energy Code Resources

NEEP offers a number of resources on building energy codes including model code policies, beyond code (stretch code, net-zero energy, etc.) guidance, and strategies for code attribution in efficiency programs. For more on NEEP's building energy codes initiative, visit our website here: http://neep.org/initiatives/energy-efficient-buildings/building-energy-codes

NEEP Resources

NEEP Code Adoption Toolkit
NEEP's Code Adoption Toolkit is a collection of state, regional, and national resources developed to aid development and adoption of more efficient energy codes. This document includes links to materials such as: code analyses and comparisons; state amendments and model language; and code case studies and talking points for topics such as stretch codes and the non-energy benefits of codes.
http://www.neep.org/sites/default/files/resources/Adoption-Toolkit.pdf

NEEP Code Compliance Toolkit
NEEP's Code Compliance Toolkit is a collection of state, regional, and national resources developed to improve compliance and enforcement of more efficient energy codes. This document includes links to materials such as: code training materials, FAQs, inspection tools, and field guides; code compliance assessments; and code case studies and talking points for topics like attribution of savings to utility code compliance programs and streamlined permitting.
http://www.neep.org/sites/default/files/resources/Compliance-Toolkit.pdf

NEEP Model Progressive Building Energy Code Policy
The Model Progressive Building Energy Codes Policy Report provides a set of interconnected recommendations aimed at ensuring that states throughout the Northeast and Mid-Atlantic region adopt and achieve compliance with progressively more efficient building energy codes.
http://www.neep.org/sites/default/files/resources/Model%20Progressive%20Building%20Energy%20Codes%20Policy_1.pdf

NEEP's Attributing Building Energy Codes to Energy Efficiency Programs Report
This report details the methods for attributing savings from energy codes to energy efficiency programs in the region.
http://www.neep.org/attributing-building-energy-code-savings-energy-efficiency-programs

NEEP Roadmap to Zero Net Energy Public Buildings
Included in this report are "intermediate-term steps" that NEEP recommends be taken in the next 10-15 years to make zero net energy public buildings a widespread practice across the region. These are followed by a series of "critical next steps" that NEEP suggests must be taken now to pave the way to a future where all new buildings consume only as much energy as they produce.
http://www.neep.org/sites/default/files/resources/Report_zne-public-buildings-neep-2012.pdf

Northeast CHPS Criteria for New Construction and Renovations
The Northeast CHPS Verified Program (NE-CHPS) has been designed to provide guidance and verification for new school projects, renovations, and new schools on existing campuses to achieve high performance goals beyond the building code.
http://www.neep.org/nechps

Massachusetts BAR Pilot
This partnership between NEEP and the Massachusetts Department of Energy Resources (MA DOER) seeks to develop and test new methods of assessing the performance of a building's energy features.
http://www.neep.org/initiatives/energy-efficient-buildings/building-asset-rating

Additional Resources

U.S. Department of Energy Code Compliance Tools
REScheck™ and COMcheck™ are software tools that simplify and clarify compliance for the IECC model energy code and a number of state and local codes.
http://www.energycodes.gov/compliance/tools

U.S. Department of Energy Model Energy Code Policies
This page examines model policies from States and local jurisdictions across the nation that have demonstrated leadership in developing programs encouraging and requiring compliance with energy codes, stretch codes (e.g., above-minimum codes) and green building techniques, energy-efficiency practices, and environmentally-friendly procedures.
https://www.energycodes.gov/resource-center/model-policies

U.S. Department of Energy Building Energy Code Resource Guide: Code Officials Edition
This guide includes practical plan review and inspection resources, including the U.S. Department of Energy Building Energy Codes Program's REScheck™ and COMcheck™ quick reference guides, case studies, and sample inspection checklists; as well as excerpts from International Code Council's commentaries, workbooks, and code companion materials.
https://www.energycodes.gov/building-energy-code-resource-guide-code-officials-edition

The Building Codes Assistance Project's Online Code Environment and Advocacy Network (OCEAN)
OCEAN is an interactive resource designed to share experiences, best practices, educational resources, and news about building energy codes. By creating a virtual community, OCEAN enables stakeholders to discuss and learn about code issues, connect to trainers and educators, and find policies and program ideas that can serve as models.
http://bcap-energy.org/ocean/

Endnotes

[i] **Connecticut:** *Other includes buildings of the following types in order: Offices, Warehouses, Parking Garages, Nursing, Homes, Assisted Living, Religious, Medical misc., Special Vocational, Transportation Terminals, Courthouse, Military, Hotels, Motels, Industrial Labs, Labs, School Labs, Sports and Convention Centers, Manufacturing and Prisons.

[ii] **District of Columbia:** *Other includes buildings of the following types in order: Religious, Hotels, Motels, Transportation Terminals, Military, Courthouses, Police, Fire, Special, Vocational, Industrial Labs, Labs, School Labs, Medical misc., Parking Garages, Warehouses, Prisons, Nursing Homes, Assisted Living, Sport and Convention Centers.

[iii] **Delaware: *** Other includes buildings of the following types in order: Warehouses, Military, Prisons, Religious, Medical misc., Library, Museum, Courthouse, Special Vocational, Hotels, Motels, Transportation Terminals, Nursing Homes, Assisted Living, Industrial Labs, Labs, School Labs, Parking Garages, Sport, Convention Centers, Manufacturing

[iv] **Massachusetts:** *Other includes buildings of the following types in order: Religious, Police, Fire, Medical misc., Library, Museum, Military, Special Vocational, Transportation Terminals, Prisons, Parking Garages, Industrial Labs, Labs, School Labs, Hotels, Motels, Nursing Homes, Assisted Living, Courthouse, Sport and Convention Centers and Manufacturing.

[v] **Maryland:** *Other includes buildings of the following types in order: Religious, Police, Fire, Medical misc., Library, Museum, Military, Special Vocational, Transportation Terminals, Prisons, Parking Garages, Industrial Labs, Labs, School Labs, Hotels, Motels, Nursing Homes, Assisted Living, Courthouse, Sport and Convention Centers and Manufacturing.

[vi] **Maine:** *Other includes buildings of the following types in order: Offices, Library, Museum, Transportation Terminals, Military, Medical misc., Parking Garages, Manufacturing, Courthouse, Nursing Homes, Assisted Living, Religious, Hotels, Motels, Industrial Labs, Labs, School Labs, Special, Vocational, Prisons, Sport and Convention Centers.

[vii] **New Hampshire:** *Other includes buildings of the following types in order: Library, Museum, Warehouses, Nursing Homes, Assisted Living, Medical misc., Military, Hotels, Motels, Parking Garages, Religious, Manufacturing, Transportation Terminals, Courthouse, Industrial Labs, Labs, School Labs, Prisons, Special Vocational, Sports and Convention Centers.

[viii] **New Jersey:** *Other includes buildings of the following types in order: Hospitals, Clinics, Warehouses, Special, Vocational, Nursing Homes, Assisted Living, Transportation Terminals, Religious, Parking Garages, Prisons, Medical misc., Military, Courthouse, Hotels, Motels, Sport, Convention Centers, Industrial Labs, Labs, School Labs, and Manufacturing.

[ix] **New York:** *Other includes buildings of the following types in order: Hospitals, Clinics, Warehouses, Special, Vocational, Nursing Homes, Assisted Living, Transportation Terminals, Religious, Parking Garages, Prisons, Medical misc., Military, Courthouse, Hotels, Motels, Sport, Convention Centers, Industrial Labs, Labs, School Labs, and Manufacturing.

[x] **Pennsylvania:** *Other includes buildings of the following types in order: Library, Museum, Police, Fire, Religious, Nursing Homes, Assisted Living, Prisons, Special, Vocational, Parking Garages, Medical misc., Military, Transportation Terminals, Hotels, Motels, Courthouse, Manufacturing, Sports and Convention Centers, Industrial Labs, Labs, and School Labs.

[xi] **Rhode Island:** *Other includes buildings of the following types in order: Library, Museum, Offices, Warehouses, Transportation Terminals, Industrial Labs, Labs, School Labs, Prisons, Sports and Convention Centers, Medical misc., Parking Garages, Special, Vocational, Nursing Homes, Assisted Living, Hotels, Motels, Courthouse, Religious, and Manufacturing.

[xii] **Vermont:** *Other includes buildings of the following types in order: Warehouses, Police, Fire, Library, Museum, Medical misc., Nursing Homes, Assisted Living, Prisons, Parking Garages, Hotels, Motels, Religious, Manufacturing, Special, Vocational, Transportation Terminals, Courthouse, Industrial Labs, Labs, School Labs, Sports and Convention Centers.