ALLIANCE TO SAVE ENERGY

Creating an Energy-Efficient World

Potential nationwide savings from adoption of the 2012 IECC

Estimated by the Alliance to Save Energy

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The Alliance the Save Energy estimates the following annual savings in the residential and commercial sectors as a theoretical potential, if all states adopted the 2012 International Energy Conservation Code in 2012 and achieved full compliance by 2013:[1]

- ***More than 3.5 quadrillion Btu of annual source energy savings by 2030;***
- ***About $40 billion (real 2008 dollars) annual energy cost savings for consumers and businesses by 2030;***
- ***About 200 million metric tons of carbon dioxide emissions avoided annually by 2030.***

These estimates assume savings from all buildings covered by code, including new construction, major renovations and additions among single-family and multifamily homes[2] as well as commercial buildings.

Assumptions: energy intensity, code impact, relevant floorspace, overall savings

New housing:

- Assumed average baseline energy intensity of new residential construction is 59 kBtu of source energy per square foot for code-covered end uses (heating, cooling, water heating and lighting). This assumption is based on total residential energy use data and average dwelling size data for all housing of the most recent vintage (2000-05) in the 2005 RECS.
- Assumed average baseline performance of new residential construction is equal to minimum performance under the 2006 IECC. Even though some states have already adopted the 2009 IECC, requiring new construction to exceed the 2006 IECC, other states have not yet adopted codes that are equivalent to the 2006 IECC. For our baseline, we assume that the national average is equivalent to the 2006 IECC.
- We assume that on average, compliance with the 2012 IECC reduces energy consumption for code-covered end uses by 30% compared to construction that meets the minimum requirements of the 2006 IECC. This average is based on modeling by ICF International for different climate zones and building types that is regionally weighted according to U.S. Census

[1] While recognizing that these code adoption and compliance assumptions are unrealistically high, we use them for estimating purposes in order to understand the magnitude of changes in the model code itself. These numbers can then be used as base to further estimate the impact of differing adoption timetables and differences in levels of code compliance.

[2] But excluding manufactured housing, which is generally not subject to local building energy codes.

housing starts data. With 59 kBtu/ft^2 baseline source energy consumption, 30% savings from the 2012 IECC result in 18 kBtu/ft^2 source energy savings per square foot of new construction.

- The assumed amount of added floor space through new housing built between 2013 and 2030 is 71 billion ft^2 based on the 2010 Annual Energy Outlook. This excludes manufactured homes.
- With 71 billion ft^2 new construction through 2030 and 18 kBtu/ft^2 source energy savings, annual source energy savings by 2030 are more than 1.25 quadrillion Btu.

Existing housing (additions and renovations):

- Assumed average baseline energy intensity of existing housing is 69 kBtu of source energy per square foot for code-covered end uses (heating, cooling, water heating and lighting). This assumption is based on energy use and dwelling size data for the overall housing stock in the 2005 RECS.
- Assumed average baseline performance of residential additions and major renovations is equal to minimum performance under the 2006 IECC.
- We assume that additions complying with the 2012 IECC have 30% reduced energy consumption for code-covered end uses if compared to additions that meet the minimum requirements of the 2006 IECC. This assumes that the impact of the code on additions is equal to its impact on new construction. With 69 kBtu/ft^2 baseline source energy consumption, 30% savings from the 2012 IECC results in 18 kBtu/ft^2 source energy savings per added square foot.
- We assume the impact of the code on homes undergoing major renovations is one third of its impact on new construction. This would mean that major renovations complying with the 2012 IECC result in 10% reduced energy consumption for code-covered end uses if compared to renovations that meet the minimum requirements of the 2006 IECC. With 69 kBtu/ft^2 baseline source energy consumption, 10% savings from the 2012 IECC result in 7 kBtu/ft^2 source energy savings per renovated square foot.
- The assumed amount of added floor space through enlargement of existing residences between 2013 and 2030 is 8 billion ft^2. This is based on the Annual Energy Outlook's assumption that each year, single family residential floor space pre-dating 2005 is increased by about 0.3%.
- We assume that 0.7% of single and multifamily residential floor space pre-dating 2005 undergoes major renovations, resulting in 21 billion ft^2 being renovated between 2013 and 2030. This assumes that among existing homes, the floorspace that is either renovated or added each year is almost 1% on average of the residential floor space pre-dating 2005. This is about 40% of the floorspace of annual new construction (which is projected to be about 2.3% to 2.5% of the residential floor space pre-dating 2005) and reflects that between 2000 and 2006 the monetary value of major improvements and additions to existing residential buildings was about 40% of the value of new residential construction.[3]
- With 8 billion ft^2 added and 21 billion ft^2 renovated through 2030 and with 18 kBtu/ft^2 and 7 kBtu/ft^2 source energy savings respectively, annual source energy savings by 2030 are about 0.3 quadrillion Btu.

Commercial buildings, new construction and additions

- Assumed average baseline energy intensity of new commercial floor space is 144 kBtu of source energy per square foot for code-covered end uses (heating, cooling, ventilation, water heating and lighting). This assumption is based on energy intensity data for buildings of the most recent vintage (2000-03) in the 2003 CBECS.

[3] Buildings Energy Data Book, figures 2.5.2. and 2.6.1., data for 2000, 2003, 2004, 2005 and 2006. www.buildingsdatabook.eren.doe.gov.

- Assumed average baseline performance of new commercial construction and additions is equal to minimum performance under the 2006 IECC. Even though some states have already adopted the 2009 IECC, requiring new construction to exceed the 2006 IECC, other states have not yet adopted codes that are equivalent to the 2006 IECC. For our baseline, we assume that the national average is equivalent to the 2006 IECC.
- We assume that on average, compliance with the 2012 IECC reduces energy consumption for code-covered end uses by 30%. compared to construction that meets the minimum requirements of the 2006 IECC. This is based on an analysis by ICF International of commercial prototype buildings in several climate zones. With 144 kBtu/ft^2 baseline source energy consumption, 30% savings from the 2012 IECC results in 43 kBtu/ft^2 source energy savings per square foot.
- The assumed amount of new commercial floor space added between 2013 and 2030 is 41 billion ft^2 based on the 2010 Annual Energy Outlook.
- With 41 billion ft^2 of new floor space through 2030 and 43 kBtu/ft^2 source energy savings, annual source energy savings by 2030 are more than 1.75 quadrillion Btu.

Commercial building renovations:

- Assumed average baseline energy intensity of existing commercial floor space is 143 kBtu of source energy per square foot for code-covered end uses (heating, cooling, ventilation, water heating and lighting). This assumption is based on energy intensity data for the overall commercial stock in the 2003 CBECS.
- Assumed average baseline performance of major commercial renovations is equal to minimum performance under the 2006 IECC.
- We assume that major renovations complying with the 2012 IECC result in 10% reduced energy consumption for code-covered end uses if compared to renovations that meet the minimum requirements of the 2006 IECC. Based on CBECS data,[4] roughly 50% of code-relevant systems (i.e. lighting, HVAC, plumbing, walls, roofs and windows) were replaced, renovated or upgraded among those buildings were major renovations were performed between 1980 and 2003. Based on this, we could assume that the code's impact on renovated floorspace is half of its impact on new construction. However, not all replacements, renovations or upgrades of code-relevant systems are covered by code,[5] so we assume that the code's impact on renovated floor space is 33% of its impact on new construction, resulting in a 10% improvement with a 30% improved code. With 143 kBtu/ft^2 baseline source energy consumption, 10% savings from the 2012 IECC result in 14 kBtu/ft^2 source energy savings per renovated square foot.
- The assumed amount of renovated commercial floor space between 2013 and 2030 is 27 billion ft^2. This is based on CBECS data suggesting that an annual average of about 2% of commercial floor space undergoes renovations.[6]
- With 27 billion ft^2 renovated through 2030 and with 14 kBtu/ft^2 source energy savings, annual source energy savings by 2030 are more than 0.35 quadrillion Btu.

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[4] Commercial Building Energy Consumption Survey (CBECS). 2003. Table B9. www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set3/2003pdf/b9.pdf.

[5] The efficiency of some HVAC and water heating equipment is covered by national standards and not determined by code. Where ceiling, wall or floor cavities are not exposed or already filled with insulation, no insulation upgrade is required.

[6] Commercial Building Energy Consumption Survey (CBECS). 2003. Table B9.

Assumptions: energy cost savings and avoided emissions

Energy cost savings:

- The 2010 Annual Energy Outlook projects source energy use as well as non-renewable energy expenditures (in real 2008 dollars) by sector.
- Dividing a projected $280.4 billion residential energy expenditures in 2030 by 23.4 quadrillion (10^{15} Btu, or "quad") Btu residential source energy consumption in 2030 results in a projected $12 billion per quad residential source energy consumption. Our assumed 1.57 quadrillion Btu residential source energy savings would thus yield $18.8 billion residential energy cost savings by 2030 (in 2008 dollars).
- Dividing a projected $234.8 billion commercial energy expenditures in 2030 by 23.1 quadrillion Btu commercial source energy consumption in 2030 results in a projected $10.1 billion per quad commercial source energy consumption. Our assumed 2.14 quadrillion Btu commercial source energy savings would thus yield $21.6 billion commercial energy cost savings by 2030 (in 2008 dollars).

Avoided CO_2 emissions:

- The 2010 Annual Energy Outlook projects source energy use as well carbon dioxide emissions by sector.
- Dividing a projected 1255 million metric tons (MMT) residential CO_2 emissions in 2030 by 23.4 quadrillion Btu residential source energy consumption in 2030 results in a projected 54 MMT per quad residential source energy consumption. Our assumed 1.57 quadrillion Btu residential source energy savings would thus avoid 85 MMT by 2030.
- Dividing a projected 1261 MMT commercial CO_2 emissions in 2030 by 23.1 quadrillion Btu commercial source energy consumption in 2030 results in a projected 54 MMT per quad commercial source energy consumption. Our assumed 2.14 quadrillion Btu commercial source energy savings would thus avoid 116 MMT by 2030.