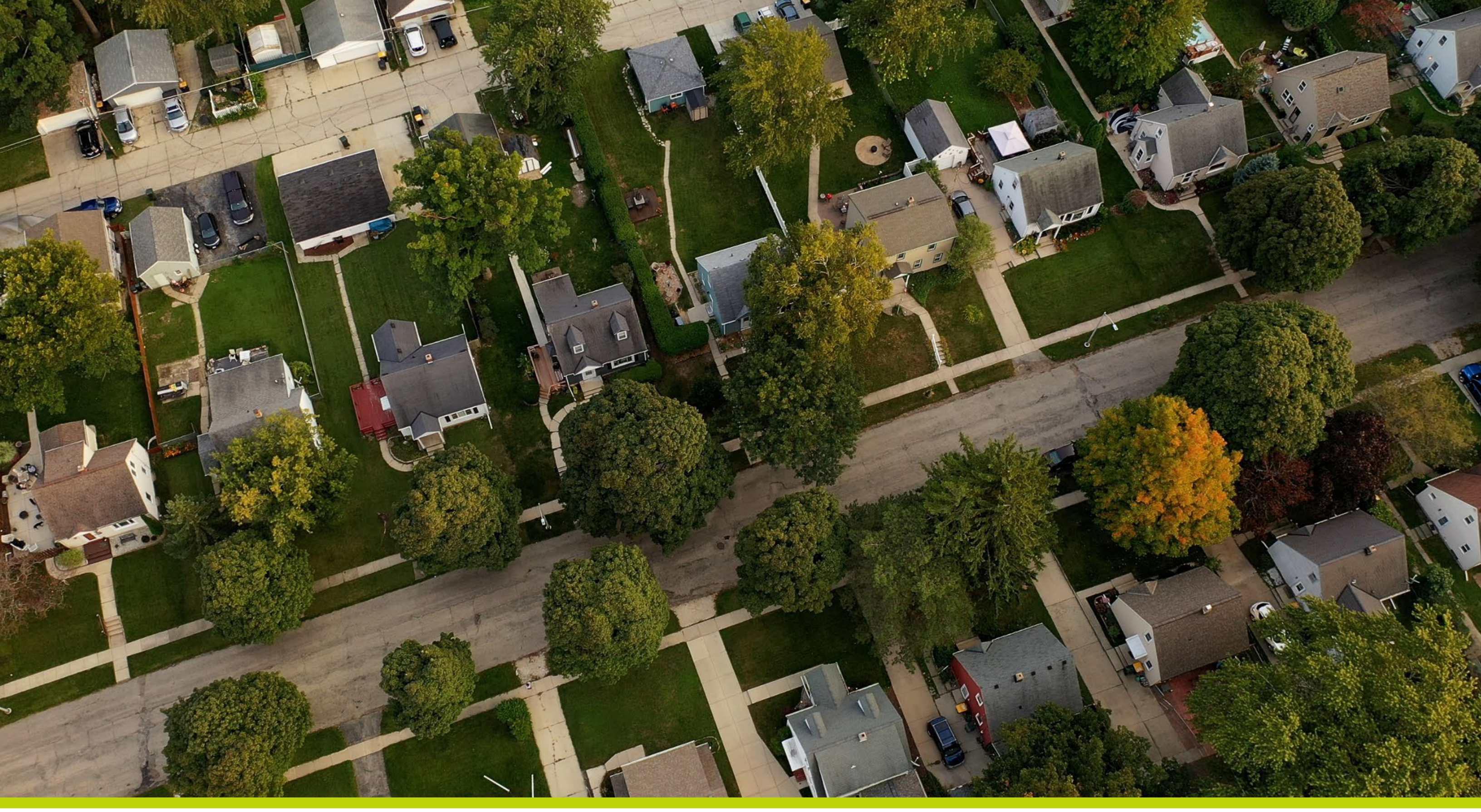

Cost-Effectiveness Analysis of the Residential Provisions of the 2026 Illinois Stretch Energy Code

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Date: **May 28, 2026**

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About Energy Solutions

Energy Solutions is a mission-driven clean energy implementation firm that specializes in programs and policies that align with the market to deliver significant resource impacts. For over 30 years we've been pioneering market-informed solutions that deliver reliable, large-scale and cost-effective savings to our utility, government, and private sector clients across North America. Our passionate, smart employee-owners are also leaders in the development and implementation of advanced policies regulating building energy performance and strongly believe that effective building energy policy requires robust and accurate analysis that demonstrates the policies' energy, cost, and environmental impacts.

Executive Summary

The State of Illinois is developing its second-cycle residential stretch energy code, which amends the 2024 International Energy Conservation Code (IECC).[1] To inform this process, the State of Illinois engaged Energy Solutions to conduct a cost-effectiveness analysis to evaluate the energy and economic impacts of the proposed residential provisions for the 2026 Illinois Stretch Energy Code.

The proposed stretch code lowers household energy consumption and reduces ongoing utility expenses, while also ensuring new homes are built ready for future electrification. This approach helps homeowners avoid the higher costs associated with retrofitting these technologies later.

The analysis finds that the 2026 Illinois Stretch Energy Code is cost-effective, delivering both short-term and long-term consumer benefits when homes are built to the stretch code as compared with the 2024 IECC code. As shown in Table 1, a single-family home built with a heat pump heating system is projected to net approximately $4,160 (2026 PV$) in life-cycle energy cost savings with an additional $7,080 (2026 PV$) in avoided future electrification and decarbonization retrofit costs.

Table 2 shows the individual consumer impacts of the 2026 Illinois Stretch Energy Code for single-family homes with heat pump heating systems. The results indicate a net annual consumer cash flow of $93 (2026 PV) and first-year energy cost savings of $258 (2026 PV) under the stretch code. Impacts for single-family homes across all heating system types, by individual amendment, are presented in the Consumer and Societal Impact Results Section.

The implementation of the 2026 Illinois Stretch Energy Code for single-family homes with heat pump heating systems will reduce Greenhouse Gas (GHG) emissions by 54,000 metric tons of CO_2e over 30 years (see Table 3).[2] This reduction is equivalent to the annual emissions of 12,600 gasoline-powered passenger vehicles. Because homes with heat pump systems only represent 36% of homes, the total impact of adopting the 2026 Illinois Stretch Energy Code is even larger. Table 3 reports statewide societal benefits for efficiency amendments (measures) only, as decarbonization and flexibility measures do not generate energy savings, energy cost savings, or emissions impacts.

Adopting the 2026 Illinois Stretch Energy Code will deliver homes that are more energy-efficient, less costly to operate, and built to modern performance standards that support occupant health, comfort, and resilience.

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[1] 2024 International Energy Conservation Code (IECC). https://codes.iccsafe.org/content/IECC2024P1

[2] This value reflects the 30-year impacts associated with one year of new construction. Total cumulative impacts over multiple years of code adoption would be significantly greater.

Table 1. Individual Consumer Lifecycle Impact of 2026 Illinois Stretch Energy Code

Metric	Illinois Stretch Energy Code (2026 PV$)
Lifecycle Energy Cost Savings	4,160
Lifecycle Decarbonization Cost Savings	7,080

Table 2. Individual Consumer Cost Savings Impact of 2026 Illinois Stretch Energy Code

Metric	Illinois Stretch Energy Code (2026 PV$)
Net Annual Consumer Cash Flow in Year 1 (Savings)	93
First-Year Energy Cost Savings	258

Table 3. Statewide Societal Benefits[3]

Statewide Impact	First-Year	30 Years
Energy Cost Savings (2026 PV million $)	2.01	32.3
Electricity Savings (GWh)	12.8	397
Natural Gas and Fuel Oil Savings (MMThrems)	0	0
GHG Emissions Reduction (metric tons CO2e)	4,510	54,000
NOx Emissions Reduction (metric tons)	1.20	37.2
SOx Emissions Reduction (metric tons)	1.80	55.9

The 2026 Illinois Stretch Energy Code includes the following provisions:

- **Passive House compliance paths** — Allows homeowners certified under Passive House U.S. (Phius) or Passive House International (PHI) homes to serve as alternate compliance pathways.
- **Mandatory envelope, ventilation, and duct upgrades** — Requires reduced envelope leakage, installation of H/ERVs, and placement of all ducts within conditioned space.
- **R408 energy credit requirements** — Requires 16 credits for all-electric homes and 31 credits for buildings with one or more fuel-burning appliances/equipment.
- **EV readiness** — Requires EV-ready infrastructure or an installed EV Charger, consistent with Illinois state law (Appendix RE).

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[3] This statewide benefit includes only the benefits attributable to the efficiency measures in the 2026 Illinois Stretch Energy Code and does not incorporate additional benefits associated with the code's decarbonization and flexibility measures.

- **Electric readiness** — Establishes electric-ready requirements for new homes (Appendix RK).
- **Solar readiness** — Requires solar-ready design features for new homes (Appendix RL).
- **Demand-responsive equipment** – Requires demand-responsive thermostats and water heaters (Appendix RJ).
- **Performance path updates** — Shift performance compliance from site energy costs to site energy.
- **R405 and R406 adjustments** — Updates performance targets and incorporates new mandatory measures to align with R408 energy-reduction requirements.
- **Existing home requirements** — Includes an existing-home energy credit, duct leakage testing, HVAC load calculations, and controls requirements.
- **Appendix RB removal** — Removes Appendix RB for Solar-Ready Buildings, replaced by the updated solar-readiness home requirements in Appendix RL.

As noted above, the Stretch Code includes both energy-efficiency measures and mandatory decarbonization and grid-flexibility measures, such as electric-ready provisions for mixed-fuel homes, demand response controls for thermostats and water heaters, and readiness for future renewable-energy systems. Installing these measures during construction enables homeowners to adopt them later at a far lower cost than through retrofits. Although these measures were not included in the energy-simulation modeling, their incremental costs were assessed through a 30-year cash-flow analysis. When avoided retrofit costs are considered, installing these measures during construction yields $7,080 (2026 PV$) in lifecycle cost savings. Additional details are provided in the Methodology section.

Methodology

To assess the impacts of the 2026 Illinois Stretch Energy Code, Energy Solutions analyzed the prescriptive requirements of the stretch code and compared the simulated results to the unamended version of the 2024 IECC using the U.S. Department of Energy (DOE) Residential Building Prototype[4] models and DOE's *Methodology for Evaluating Residential Energy Code Updates*.[5] The DOE methodology evaluates the primary prescriptive requirements of model energy codes for new home construction; therefore, the 2026 Illinois Stretch Energy Code provisions related to performance compliance, Energy Rating Index (ERI) compliance, existing buildings, and the all-electric appendix are not considered in the analysis.

Electric-ready provisions, renewable-energy infrastructure readiness, and demand response controls requirements fall outside the scope of the traditional energy analysis because they do not affect total

[4] U.S. Department of Energy (DOE), "Building Energy Codes Program." https://www.energycodes.gov/prototype-building-models
[5] U.S. Department of Energy (DOE), "Methodology for Evaluating Residential Energy Code Updates." https://www.energycodes.gov/sites/default/files/2024-10/residential_methodology_2024.pdf

energy use. For these measures, the cost of implementation during new construction differs from the cost of adding the same features as a retrofit to existing homes. The avoided future retrofit costs– defined as the difference between new construction cost and retrofit cost—are included in the cost-effectiveness analysis and are described further in the Decarbonization and Grid Flexibility Measures section. Electrical-vehicle charging infrastructure is not evaluated in this analysis, as it is required under state law.[6]

Energy Solutions focused its analysis on the U.S. DOE's heated-basement prototype[7] and evaluated multiple HVAC system configurations. Simulations were conducted for the single-family prototype only, which represents the most common residential building type constructed in Illinois. All buildings were modeled with central air conditioning and one of four heating system types: gas furnace, oil furnace, heat pump, or electric furnace. Table 4 presents the Illinois-specific foundation type weights based on current construction practices, informed by a recent state residential energy code field study.[8]

Table 4. Weighting Factors by Foundation Type

Parameter	Weight (%)
Heated-Basement	93.4%
Slab-on-Grade	3.8%
Unheated Basement	1.9%
Crawlspace	0.9%

The Stretch Code enables compliance flexibility by providing separate compliance pathways (prescriptive, performance, and ERI). Those following the prescriptive pathway are also given the flexibility to choose from a measure table in Section R408 with 46 options to meet an additional efficiency requirement. This analysis is based on the prescriptive compliance option (R401.2.1) with additional energy efficiency measures achieving as close to the minimum number of credits required in the Stretch Code for an electric building (16). The R408 credit amendment (16 for electric, 31 for fuel burning) was determined by the site EUI reductions mandated by the Illinois Climate and Equitable Jobs Act (CEJA).[9] The electric pathway requiring 16 credits results in the lowest incremental construction cost for compliance, and thus was the pathway demonstrated in this report.

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[6] Illinois General Assembly, PROPERTY (765 ILCS 1085/) Electric Vehicle Charging Act. https://www.ilga.gov/Legislation/ILCS/Articles?ActID=4407&ChapterID=62&Chapter=PROPERTY&MajorTopic=RIGHTS%20AND%20REMEDIES

[7] U.S. Department of Energy, "Prototype Building Models." https://www.energycodes.gov/prototype-building-models

[8] Midwest Energy Efficiency Alliance, "IL Energy Code Compliance Field Study Update," June 2019. https://www.mwalliance.org/sites/default/files/IL%20Collaborative%20060319_updated.pdf

[9] Illinois Environmental Protection Agency, Illinois Climate & Equitable Jobs Act. https://epa.illinois.gov/topics/ceja.html

This approach is one of several possible pathways for complying with the energy code. The measures selected for this analysis are commonly implemented in practice, although they may not constitute the most cost-effective solution for every project. The code's built-in compliance flexibility enables tailored strategies that balance incremental construction costs, energy cost savings, and emissions reductions on a case-by-case basis.

Table 5 summarizes the energy credits selected to meet the R408 additional efficiency requirements for buildings in Climate Zone 4 (CZ4A) and Climate Zone 5A (CZ5A). Additional individual code amendments were also analyzed for cost-effectiveness and are presented in Table 6 below.

Table 5. Energy Credit Options for Compliance with Illinois Stretch Energy Code Analysis

Energy Credit Measure	Electric CZ 4A	Electric CZ 5A
R408.2.1.2(1): 0.25 U-factor Windows	2	1
R408.2.2 (14)b: High Performance Electric Heat Pump	12	12
R408.2.3(8)c: Compact Hot Water Distribution	2	2
R408.2.6a: Energy-Efficient Appliances	NA	1
Total Credits	**16**	**16**

Table 6. 2026 Illinois Stretch Energy Code Individual Amended Requirements Analyzed

Energy Code Section	Summary of Change
R402.1.2 Window U-Factor	Reduction of minimum window U-factor from 0.28 to 0.27 in CZ5
R402.5.1.2 Air Leakage	Reduction in maximum air leakage rate from 3.0 ACH50 to 2.5 ACH 50 in CZ4 & CZ5
R403.3.3 Ductwork in Conditioned Spaces	Requirement for new ductwork to be located within conditioned space
R403.6.1 H/ERV	Requirement that buildings use heat recovery or energy recovery ventilation systems
R408.2 Additional Efficiency Requirements	Increase in requirement for additional efficiency from 10 to 16 credits for electric buildings (and 31 for fuel burning). Measures chosen are shown in Table 5

The energy use for the single-family prototype is simulated in EnergyPlus with Typical Meteorological Year 3 (TMY3) weather data for CZ 4A and CZ 5A.[10] National cost estimates for all stretch code

[10] TMY3 weather files are standardized hourly weather datasets developed from historical climate observations and are commonly used for building energy simulation.

amendments were adjusted using an Illinois-specific construction cost multiplier[11] and appropriate Consumer Price Index (CPI) multipliers[12] to bring costs to 2026 dollars.

Life-Cycle Cost (LCC) is the primary metric used by DOE to evaluate the economic impacts of building energy codes. It represents the present value of all relevant costs over a 30-year period, including upfront construction and equipment costs, energy cost savings, replacement costs, and the remaining (residual) value of components at the end of the analysis period.

In accordance with the U.S. DOE's Methodology for Evaluating Residential Energy Code Updates, this report analyzes the impacts over 30 years of operation for one year of anticipated new construction projects. The full benefits of the proposed code changes would be much greater than the values presented in this report, because each additional year of new construction projects would generate additional lifecycle benefits.

An updated building energy code, such as the 2026 Illinois Stretch Energy Code, is considered cost-effective when it produces a positive net effect on LCC. This analysis also incorporates the avoided retrofit costs associated with decarbonization and grid-flexibility (readiness) measures included in the updated code. Energy savings from energy use simulation are converted to energy cost savings using Illinois' 2025 fuel prices. Electricity, natural gas, and fuel oil are the fuel types considered in this analysis. To avoid seasonal fluctuations and regional variations in the energy price, the average annual energy prices were utilized.

The 2025 fuel prices for Illinois are obtained from the U.S. Energy Information Administration's (EIA) State Energy Data System (SEDS), and adjusted to 2026 dollars using the average rate of inflation in 2025, 2.6%.[13] These prices are escalated over the analysis period based on annual escalation rates from the 2025 Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis published by the National Institute of Standards and Technology (NIST).[14]

As shown in Table 7, the average annual commercial electricity price is estimated to be 18.2 ¢/kWh in 2026. The cost of natural gas delivered to commercial consumers in Illinois is estimated at 1.12 $/therm in 2026. In addition, the Illinois average wholesale price of distillate fuel oil is estimated at 2.77 $/therm.

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[11] RSMeans Data: Construction Cost Estimating Software. https://www.rsmeans.com
[12] U.S. Bureau of Labor Statistics, "Consumer Price Index Data from 1913 to 2026." https://www.usinflationcalculator.com/inflation/consumer-price-index-and-annual-percent-changes-from-1913-to-2008/
[13] U.S. Energy Information Administration (EIA), State Energy Data System (SEDS). https://www.eia.gov/states/IL/data/dashboard/prices-rates-revenues-costs-expenditures
[14] National Institute of Standards and Technology, "Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis – 2025, Annual Supplement to NIST Handbook 135." https://doi.org/10.6028/NIST.IR.85-3273-40sup1

Table 7. 2026 Fuel Prices Used in the Analysis

Electricity (2026$/kWh)	Natural Gas (2026$/Therm)	Fuel Oil (2026$/Therm)
0.182	1.12	2.77

The inflation rate is estimated as the average annual inflation rate from 2020 to 2025 based on data obtained from the U.S. Bureau of Labor Statistics.[15] The property tax rate was estimated by calculating the average effective property tax rate across counties in Illinois for 2024, using county-level effective property tax rate data obtained from the Tax Foundation dataset.[16] The median household income in Illinois is approximately $83,000 annually,[17] which places the typical household into the 22% marginal federal income tax bracket.[18] Illinois maintains a flat state income tax of 4.95%.[19] The financial and economic parameters used in this analysis are summarized in Table 8 for reference.

Table 8. Financial and Economic Parameters Used in the Analysis

Parameter	Average Income Homebuyer
Mortgage interest rate (fixed rate)	5%
Loan fees	1%
Loan term	30 years
Down payment	13%
Nominal discount rate (equal to mortgage rate)	5%
Inflation rate	3.92%
Marginal federal income tax	22%
Marginal state income tax	4.95%
Property tax	1.61%

To evaluate cost-effectiveness, the Energy Solutions team estimated the incremental construction costs associated with building to the stretch code when compared to the 2024 IECC. For this analysis, a variety of cost data sources listed below were used. All costs were converted to 2026 dollars and adjusted for Illinois.

- **R402.1.2 Window U-Factor** – Cost data to reduce from U-0.28 to U-0.27 for CZ5A are drawn from the *ENERGY STAR® Windows, Doors, and Skylights Version 7.0 Criteria Analysis*

[15] U.S. Bureau of Labor Statistics, "Current U.S. Inflation Rates (2000-2026)" https://www.usinflationcalculator.com/inflation/current-inflation-rates/
[16] Tax Foundation, "Property Taxes by State and County 2026," Table 1. https://taxfoundation.org/data/all/state/property-taxes-by-state-county/
[17] U.S. Census Bureau, "Quick Facts – Illinois," 2026. https://www.census.gov/quickfacts/fact/table/IL/BZA210223
[18] Internal Revenue Services (IRS), "Federal income tax rates and brackets," 2026. https://www.irs.gov/filing/federal-income-tax-rates-and-brackets
[19] Illinois Department of Revenue, "Income Tax Rates," 2026. https://tax.illinois.gov/research/taxrates/income.html

Report,[20] *PNNL National Cost-Effectiveness of the Residential Provisions of the 2024 IECC,*[21] and supplemental information from local window manufacturers.[22]

- **R402.5.1.2 Air Leakage** and **R403.3.3 Ductwork in Conditioned Spaces** – Cost data to reduce from 3.0 ACH50 to 2.5 ACH50 are sourced from the *PNNL National Cost-Effectiveness of the Residential Provisions of the 2024 IECC*.
- **R403.6.1 H/ERV–** A ventilation engineering consultant[23] provided costs that included equipment, materials, and labor for H/ERVs.
- **R408.2 Additional Efficiency Requirements** – Cost data for the 16-credit measure package are based on the *PNNL National Cost-Effectiveness of the Residential Provisions of the 2024 IECC* for all credits referenced in Table 5, Table 5. Energy Credit Options for Compliance with Illinois Stretch Energy Code Analysis except R408.2.2 (14)b: High Performance Electric Heat Pump, which uses cost data according to the Midwest Collaborative's *Heat Pump Pricing Study.*[24]
- **Appendix RJ and Appendix RL** – New construction costs for demand response controls and on-site solar readiness are drawn from the HIRL's *2024 IECC Cost Analysis for Single-Family Homes,*[25] while retrofit costs are sourced from the *PNNL Cost-Effectiveness Analysis of the Residential Provisions of the Illinois Stretch Energy Code Update.*[26]
- **Appendix RK** – Both new-construction and retrofit costs for electric readiness are sourced from uses the *PNNL Cost-Effectiveness Analysis of the Residential Provisions of the Illinois Stretch Energy Code Update*.[26]

The incremental costs were calculated separately for each code change and then aggregated by climate zone, as shown in Table 9 and Table 10. Costs are categorized according to the nature of the proposed code—energy efficiency measures or decarbonization and grid flexibility (readiness) measures. To reflect Illinois-specific construction conditions, a construction-cost multiplier of 1.0507, derived from the 2026 RS Means location factor for the national average, was applied, and all costs were converted to 2026 dollars. Based on these adjustments, the average incremental costs to meet the 2026 Illinois Stretch Energy Code, relative to the 2024 IECC, are $2.31 per square foot, depending on building type and climate zone.

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[20] ENERGY STAR® Windows, Doors, and Skylights Version 7.0 Criteria Analysis Report, July 2021. https://www.energystar.gov/sites/default/files/asset/document/ES_Residential_WDS_Draft%201_Criteria%20Analysis%20Report.pdf

[21] US Department of Energy (DOE), "National Cost Effectiveness of the Residential Provisions of the 2024 IECC." https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-35986.pdf

[22] Benjamin Griswold, "Illinois Stretch Code Pricing Difference," Received by Scott Farbman, April 20, 2026.

[23] Mike Moore, "HRV Modeling Results – R405 Heated Basement Prototypes," Received by Scott Farbman, April 6, 2026.

[24] Midwest Collaborative, "Heat Pump Pricing Study." https://mwcollab.org/sites/mwcollab/files/2026-04/Heat%20Pump%20Pricing%20Study.pdf

[25] Home Innovation Research Labs, "2024 IECC Cost Analysis for Single-Family Homes." https://www.nahb.org/-/media/NAHB/advocacy/docs/top-priorities/codes/code-adoption/2024-iecc-cost-analysis-hirl.pdf

[26] PNNL, "Cost-Effectiveness Analysis of the Residential Provisions of the Illinois Stretch Energy Code Update." https://cdb.illinois.gov/content/dam/soi/en/web/cdb/business/codes/ecacouncil/stretch/docs/residential-stretch-code-cost-analysis-4-11-24.pdf

Table 9. Residential Construction Cost Increases per square foot for the 2026 Illinois Stretch Energy Code Individual Efficiency Amendments

Amendment	Summary of Change	CZ4A ($/ft^2)	CZ5A ($/ft^2)
R402.1.2 Window U-Factor	Reduction to U-0.27	N/A	0.07
R402.5.1.2 Air Leakage	Reduction to 2.5 ACH 50	0.14	0.14
R403.3.3 Ductwork in Conditioned Spaces	New ductwork shall not be located outside conditioned space	0.14	0.14
R403.6.1 H/ERV	Buildings shall be provided with heat recovery or energy recovery ventilation system	0.28	0.28
R408.2 Additional Efficiency Requirements	Increase to 16 credits for electric buildings	1.47	0.55
Combined		2.03	1.18

Table 10. Residential Construction Cost Increase for the 2026 Illinois Stretch Energy Code

Heated Basement Single Family Prototype		
Climate Zone	**Measure Type**	**Cost Increase** ($/ft^2)
4A	Efficiency*	2.03
	Decarbonization and Grid Flexibility**	1.02
5A	Efficiency*	1.18
	Decarbonization and Grid Flexibility**	1.02
State Average	Combined	2.31

*References combined total incremental cost per square foot from Table 9

**References combined total incremental cost per square foot from Table 11

The GHGs considered in this analysis include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Emission factors were developed for each fuel type (electricity, natural gas, and fuel oil) and for each gas using multiple data sources.

Electricity emission factors between 2027 and 2056 were derived from the National Laboratory of Rockies (NLR) Cambium dataset, based on a 95% decarbonization scenario by 2050.[27] This

[27] National Laboratory of Rockies, "Cambium | Energy Systems Analysis | NLR." https://www.nlr.gov/analysis/cambium

decarbonization scenario is a statutory goal from the Climate & Equitable Jobs Act (CEJA) legislation, which requires 100% clean energy by 2050.[28] These factors vary over time to reflect changes in the grid. In contrast, emission factors for natural gas and fuel oil are assumed to remain constant over the analysis period.

Nitrogen oxides (NOx) and sulfur oxides (SOx) emission factors for natural gas and fuel oil were obtained from the U.S. Environmental Protection Agency's (EPA) Compilation of Air Pollutant Emission Factors (AP-42).[29] The electricity NOx and SOx emission factors were sourced from the U.S. Energy Information Administration's (EIA) 2024 State Electricity Profiles.[30] Emissions reductions associated with the 2026 Illinois Stretch Code were calculated by applying these emission factors to the estimated energy savings.

Decarbonization and Grid Flexibility Measures

The 2026 Illinois Stretch Code mandates that all new homes incorporate three measures to advance building decarbonization and improve grid flexibility: electric readiness for mixed-fuel homes, demand response controls for thermostats and water heaters, and readiness for future renewable energy systems. While these measures increase initial construction costs, they provide significant benefits—reducing emissions and enhancing grid performance at the societal level and improving indoor environmental quality at the occupant level.

Although these requirements do not generate immediate energy savings or energy cost savings and fall outside the scope of traditional DOE cost-effectiveness analysis, they offer meaningful long-term economic benefits. To capture these benefits, the Energy Solutions team estimated savings by comparing the lower cost of installing these features during new construction with the higher costs incurred if they were added later as retrofits.

While the stretch code makes Appendix RE Electric Vehicle Charging Infrastructure mandatory, the requirements in this section reference the state's Electric Vehicle Charging Act.[31] Because this act already applies to all new residential construction, the cost of meeting these requirements is not included in the analysis.

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[28] Climate & Equitable Jobs Act (CEJA) | Lake County, IL. https://www.lakecountyil.gov/5169/Climate-Equitable-Jobs-Act-CEJA

[29] Environmental Protection Agency, "Compilation of Air Pollutant Emissions Factors from Stationary Sources (AP-42)." https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors-stationary-sources

[30] U.S. Energy Information Administration, "Illinois Electricity Profile 2024." https://www.eia.gov/electricity/state/illinois/

[31]U.S. Energy Information Administration, PROPERTY (765 ILCS 1085/) Electric Vehicle Charging Act. https://www.ilga.gov/Legislation/ILCS/Articles?ActID=4407&ChapterID=62&Chapter=PROPERTY&MajorTopic=RIGHTS%20AND%20REMEDIES

Table 11 presents a comparison of the costs of incorporating decarbonization and grid-flexibility measures during initial construction versus the higher costs associated with adding them later through retrofits. The results indicate that installing these measures upfront yields an average consumer savings of approximately $2.89 per square foot. By integrating these requirements into the energy code, homeowners avoid future retrofit expenses of a similar magnitude, effectively reducing long-term costs.

Table 11. Installation and Avoided Costs of Decarbonization and Grid Flexibility Amendments

Measure	New Construction Cost ($/ft^2)	Retrofit Cost ($/ft^2)	Avoided Cost ($/ft^2)
Electric Readiness	0.56	1.11	0.56
Renewable Energy Infrastructure Readiness	0.35	1.77	1.42
Demand Response	0.11	1.02	0.91
Total Costs	1.02	3.90	2.89
Total Life Cycle Costs (2026 $ PV)	$0.92	$3.90	$2.98

To evaluate the cost-effectiveness of the decarbonization and grid flexibility measures in the Stretch Code, Energy Solutions followed PNNL's approach, in which the present value of the additional mortgage costs, property taxes, and tax deductions from these measures (new construction) were compared to the present value of the costs for future installation of the same measures (retrofit).[32]

To quantify the additional mortgage costs, a fixed-payment loan model was applied with a 5% mortgage interest rate and a 13% down payment over a 30-year period. Each scheduled payment was then discounted to its present value using a 5% discount rate and the specific year in which the payment occurs within the analysis period, following a standard present value methodology. Additional property taxes and income tax deductions were calculated using the federal income tax, state income tax, and property tax rates defined in Table 8. The present values of all costs and benefits over the analysis period were aggregated into a cumulative present value. This value reflects the present value cost of the new construction requirements for the decarbonization and grid-flexibility measures.

Future retrofit costs were estimated for each year of the analysis period by multiplying the total retrofit cost by the probability of implementation (100% probability divided by 30) and discounting future costs to present value using an inflation rate of 3.92%. The decarbonization and grid-flexibility measures were modeled with a linear increase in implementation probability, reaching 100% by the end of the 30-

[32] U.S. Department of Energy (DOE), "Cost-Effectiveness Analysis of the Residential Provisions of the Illinois Stretch Energy Code Update." https://cdb.illinois.gov/content/dam/soi/en/web/cdb/business/codes/ecacouncil/stretch/docs/residential-stretch-code-cost-analysis-4-11-24.pdf

year period, consistent with Illinois' statutory goal of achieving 100% clean energy by 2050.[33] Each year's future retrofit cost was converted to a present value based on the 3.92% inflation rate and the timing of the cost within the analysis period, and the discounted values were aggregated to determine the present value of the retrofit costs for the decarbonization and grid flexibility measures.

Life-cycle cost savings were then calculated as the difference between the present value of the retrofit costs and the present value of the incremental new construction costs.

Table 11 shows that the 2026 present value of the retrofit costs is $3.90/ft^2$ while the present value of the associated mortgage-related construction costs is $0.92/ft^2$ resulting in a life-cycle cost savings of $2.98/ft^2$.

Consumer and Societal Impact Results

Adopting the 2026 Illinois Stretch Energy Code offers a wide range of benefits, including energy savings, energy cost savings, and environmental benefits from reduced emissions.

Table 12 to Table 17 present the first-year statewide impacts of the 2026 Illinois Stretch Energy Code and the impacts over a 30-year analysis period. The stretch code also provides indirect benefits, such as a more resilient and responsive grid through enhanced demand response in buildings. Both the R408 additional efficiency requirement and the combined amendments with interactive effect analyze new construction with heat pump as the heating system type only in both the baseline and proposed cases, representing 36.37% of the total expected construction.

Table 12 shows that efficiency amendments provide considerable statewide electricity savings. H/ERV (R403.6.1), reduced air leakage (R402.5.1.2), and R408 additional efficiency requirements (R408.2) contribute the largest statewide electricity savings. The total statewide savings for single-family buildings with heat pumps amount to about 12.8 GWh in the first year and 397 GWh over 30 years. As shown in Table 13, the largest statewide fossil fuel (i.e., natural gas and fuel oil) savings are attributed to H/ERV (R403.6.1) by having 1.20 MMTherms in the first year and 37.1 MMTherms over 30 years.

[33] Illinois Environmental Protection Agency, "Climate and Equitable Jobs Act." https://epa.illinois.gov/topics/ceja.html

Table 12. Statewide Electricity Savings for Individual Efficiency Amendments

Amendments	System Type	First-Year (GWh)	30 Year (GWh)
R402.1.2 Window U-Factor	All Heating System Types	0.65	20.1
R402.5.1.2 Air Leakage		7.02	218
R403.3.3 Ductwork in Conditioned Spaces		3.48	108
R403.6.1 H/ERV		11.8	367
R408.2 Additional Efficiency Requirements*	Heat Pumps	7.05	219
Combined Amendments with Interactive Effect*		12.8	397

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case.

Table 13. Statewide Natural Gas and Fuel Oil Savings for Individual Efficiency Amendments

Amendments	System Type	First-Year (MMTherms)	30 Year (MMTherms)
R402.1.2 Window U-Factor	All Heating System Types	0.06	1.73
R402.5.1.2 Air Leakage		0.59	18.1
R403.3.3 Ductwork in Conditioned Spaces		0.58	18.0
R403.6.1 H/ERV		1.20	37.1
R408.2 Additional Efficiency Requirements*	Heat Pumps	0	0
Combined Amendments with Interactive Effect*		0	0

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case.

Table 14 shows statewide first-year and lifecycle energy cost savings from residential amendments. The first-year statewide savings span from $0.156 million to nearly $3 million, while 30-year present value savings range from about $2.57 million to over $49 million. The statewide energy cost savings of the combined amendments for buildings with heat pumps are estimated at approximately $2.01 million in the first year, and over $32 million over the 30-year analysis period.

Table 14. Statewide Energy Cost Savings for Individual Efficiency Amendments

Amendments	System Type	First-Year (2026 PV Million $)	30 Year (2026 PV Million $)
R402.1.2 Window U-Factor	All Heating System Types	0.156	2.57
R402.5.1.2 Air Leakage		1.67	27.5
R403.3.3 Ductwork in Conditioned Spaces		1.11	18.5
R403.6.1 H/ERV		3.02	49.8
R408.2 Additional Efficiency Requirements*	Heat Pumps	1.10	17.8
Combined Amendments with Interactive Effect*		2.01	32.3

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case.

Table 15 presents the statewide GHG emissions reductions associated with the individual efficiency amendments. In the first year, estimated statewide GHG reductions range from 525 metric tons CO2e for the window U-factor (R402.1.2) to 10,500 metric tons CO_2e for the H/ERV (R403.6.1). Over 30 years, statewide GHG emissions reductions increased substantially, ranging from 11,600 metric tons CO_2e for the window U-factor measure to 241,000 metric tons CO_2e for H/ERV measure, while the air leakage and ductwork measures yield 123,000 and 107,000 metric tons CO2e reductions, respectively. The combined amendments with interactive effects in buildings with heat pumps result in 4,510 metric tons CO_2e reduction in the first year and 54,000 metric tons CO_2e over 30 years, equivalent to removing 12,600 gasoline-powered passenger vehicles from the road for one year.[34]

Table 15. Statewide GHG Emissions Reduction for Individual Efficiency Amendments

Amendments	System Type	First-Year (Metric Tons CO2e)	30 Year (Metric Tons CO2e)
R402.1.2 Window U-Factor	All Heating System Types	525	11,600
R402.5.1.2 Air Leakage		5,570	123,000
R403.3.3 Ductwork in Conditioned Spaces		4,310	107,000
R403.6.1 H/ERV		10,500	241,000
R408.2 Additional Efficiency Requirements*	Heat Pumps	2,480	29,700
Combined Amendments with Interactive Effect*		4,510	54,000

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case.

Table 16 and Table 17 present the estimated statewide reductions in NOx and SOx emissions for each efficiency amendment. For NOx emissions, first-year statewide reductions range from 0.3 metric tons for the window improvements (R402.1.2) to 6.1 metric tons for the H/ERV (R403.6.1), with additional contributions to NOx reduction from air leakage (3.1 metric tons), ductwork in conditioned spaces (2.7 metric tons), and additional efficiency requirements (0.7 metric tons). Over 30 years, statewide reductions range from 9 to 187 metric tons across the measures, with the highest reduction coming from H/ERV (R403.6.1). The combined amendments with an interactive effect, for buildings with heat pumps, result in a 1.2 metric ton reduction in NOx emissions in the first year and 37.2 metric tons over 30 years.

As shown in Table 17, the first-year statewide reductions in SOx range from 0.1 to 1.8 metric tons across individual measures and from 3.1 to 56 metric tons over 30 years. The combined

[34] United States Environmental Protection Agency (EPA), "Greenhouse Gas Equivalencies Calculator." https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

amendments yield 1.80 metric tons of SOx reduction in the first year and 55.9 metric tons over the 30-year period.

Table 16. Statewide NOx Emissions Reduction for Individual Efficiency Amendments

Amendments	System Type	First-Year (Metric Tons)	30 Year (Metric Tons)
R402.1.2 Window U-Factor	All Heating System Types	0.3	9.0
R402.5.1.2 Air Leakage		3.1	95.1
R403.3.3 Ductwork in Conditioned Spaces		2.7	84.4
R403.6.1 H/ERV		6.1	187
R408.2 Additional Efficiency Requirements*	Heat Pumps	0.7	20.5
Combined Amendments with Interactive Effect*		1.2	37.2

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case.

Table 17. Statewide SOx Emissions Reduction for Individual Efficiency Amendments

Amendments	System Type	First-Year (Metric Tons)	30 Year (Metric Tons)
R402.1.2 Window U-Factor	All Heating System Types	0.10	3.05
R402.5.1.2 Air Leakage		1.06	32.9
R403.3.3 Ductwork in Conditioned Spaces		0.56	17.5
R403.6.1 H/ERV		1.82	56.3
R408.2 Additional Efficiency Requirements*	Heat Pumps	0.99	30.8
Combined Amendments with Interactive Effect*		1.80	55.9

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case.

The 2026 Illinois Stretch Energy Code reduces energy use and operating costs for occupants. It also ensures that homes are ready for electrified technologies, which avoid expensive retrofits in the future, and contribute to healthier and more durable homes. According to Table 18, the life-cycle energy cost savings for a single-family home with a heated basement and a heat pump as a heating system over a typical 30-year mortgage period are estimated as $4,160 (2026 PV$). The total life-cycle cost savings from decarbonization and flexibility measures are estimated as $7,080 (2026 PV$), as shown in Table 19.

Table 18. Individual Consumer Life-Cycle Energy Cost Savings

Amendments	System Type	Life-cycle Energy Cost Savings (2026 PV$)
R402.1.2 Window U-Factor	All Heating System Types	139
R402.5.1.2 Air Leakage		1,280
R403.3.3 Ductwork in Conditioned Spaces		864
R403.6.1 H/ERV		2,330
R408.2 Additional Efficiency Requirements*	Heat Pumps	2,290
Combined Amendments with Interactive Effect*		4,160

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case

Table 19. Individual Consumer Life-Cycle Decarbonization Cost Savings

Amendments	Life-Cycle Decarbonization Cost Savings (2026 PV$)
Demand Response Controls	2,190
Electric Readiness	1,440
Renewable Energy Infrastructure Readiness	3,450
Total	7,080

Table 20 presents the net annual consumer cash flow in the first year, expressed in 2026 present value dollars (2026 PV$) for each individual amendment. The net annual cash flow reflects the difference between benefits (or savings) and costs. The positive value indicates that benefits exceed costs. The 2026 present value of cash flow in the first year for window improvements (R402.1.2) is $0.11, while air leakage, ductwork in conditioned spaces, and H/ERV amendments yield higher cash flows in the first year. For single-family homes with a heat pump heating system, the additional efficiency requirements (R408.2) show a positive present value of $56. The combined amendments with interactive effects generate a net annual cash flow of $93 (2026 PV$).

Table 21 summarizes the corresponding first-year energy cost savings for each amendment, expressed in 2026 present value dollars (2026 PV$). The energy cost savings for an individual consumer (one single-family home) are $8 for window improvement, $78 for air leakage, $52 for ductwork in conditioned spaces, and $141 for H/ERV. The additional efficiency requirements amendment results in first-year energy cost savings of $142. The combined amendments with interactive effects yield total first-year energy cost savings of $258 (2026 PV$).

Table 20. Net Annual Consumer Cash Flow in Year 1 for Individual Consumer

Amendments	System Type	Net Annual Cash Flow in Year 1 (2026 PV$)
R402.1.2 Window U-Factor	All Heating System Types	0.11
R402.5.1.2 Air Leakage		60
R403.3.3 Ductwork in Conditioned Spaces		34
R403.6.1 H/ERV		106
R408.2 Additional Efficiency Requirements*	Heat Pumps	56
Combined Amendments with Interactive Effect*		93

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case.

Table 21. First-Year Energy Cost Savings for Individual Consumer

Amendments	System Type	First-Year Energy Cost Savings (2026 PV$)
R402.1.2 Window U-Factor	All Heating System Types	8
R402.5.1.2 Air Leakage		78
R403.3.3 Ductwork in Conditioned Spaces		52
R403.6.1 H/ERV		141
R408.2 Additional Efficiency Requirements*	Heat Pumps	142
Combined Amendments with Interactive Effect*		258

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case.

Table 22 shows the consumer cash flows from compliance with the Stretch energy code. The years to cumulative positive savings (parameter F) are estimated by dividing the first cost and down payment by the savings. The difference between the years to cumulative positive savings and simple payback period is that the former accounts for the mortgage down payment.

Table 22. Consumer Cash Flow from Compliance with the 2026 Illinois Stretch Energy Code

	Cost/Benefit Components	
A	Incremental down payment and other first costs	$207
B	Annual energy savings (year one)	$279
C	Annual mortgage increase	$80
D	Net annual cost of mortgage interest deductions, mortgage insurance, and property taxes (year one)	$0.20
E= [B-(C+D)]	Net annual cash flow savings (year one)	$199
F = [A/E]	Years to cumulative positive savings, including up-front cost impacts	1 year

On a statewide basis, the cost-effectiveness analysis indicates that adopting the 2026 Illinois Stretch Energy Code in place of the 2024 IECC—using a prescriptive heat-pump compliance path—results in a simple payback period of 11.4 years, as shown in Table 23.

Simple payback represents the time required for energy cost savings from an efficiency measure to recover its additional upfront cost. It compares the incremental construction cost to the first-year reduction in utility bills and is commonly used as a basic indicator of the financial viability of energy-efficiency improvements. However, simple payback provides only a partial view of consumer economics. It does not incorporate financing effects, taxes, equipment maintenance costs, replacement costs, or other long-term financial considerations. Because it focuses solely on incremental construction costs and first-year savings, it does not capture the broader economic impacts of many modern technologies.

In particular, simple payback does not reflect the benefits of decarbonization measures that provide value through demand response or by avoiding future retrofit costs—such as pre-wiring for electric equipment or renewable-energy systems. These benefits accrue over time but are not represented in a simple payback calculation.

Table 23. Simple Payback Period and Construction Cost Increases

Amendments	Simple Payback (Years)	Average ($/ft2)
R402.1.2 Window U-Factor	17.6	0.1
R402.5.1.2 Air Leakage	4.2	0.1
R403.3.3 Ductwork in Conditioned Spaces	6.2	0.1
R403.6.1 H/ERV	4.4	0.3
R408.2 Additional Efficiency Requirements*	10.8	0.7
Combined Amendments with Interactive Effect*	**11.4**	**$1.3**

*Representative of new construction with heat pump as the heating system type in both baseline and proposed case.

Given these limitations, LCC is the preferred metric for assessing the cost-effectiveness of the code or specific amendments. LCC provides a more complete evaluation by accounting for all relevant costs and savings associated with an efficiency investment over a 30-year period, offering a more accurate representation of the affordability of homeownership than simple payback alone.

Beyond the direct economic impacts quantified in this analysis, homes built to modern energy-efficient codes are associated with improved mortgage performance. National studies show that energy-efficient homes have, on average, a 32 percent[35] lower mortgage default rate, and more recent research indicates a 5.5 percent decrease in 30-day mortgage delinquency for every one-point increase in DOE's Home Energy Score. Although monthly mortgage payments remain relatively stable, energy costs can fluctuate significantly throughout the year. These fluctuations are more pronounced in inefficient homes, where higher and more variable utility bills can place greater strain on first-time and lower-income homebuyers. Illinois also faces elevated housing-market risk, with one of the highest foreclosure rates in the country—approximately one in every 2,238 homes.[36]

By adopting the 2026 Illinois Stretch Energy Code, municipalities can help ensure that more residents experience stable, predictable energy bills, reducing financial strain and improving the affordability of housing by an estimated $258 per year through energy cost savings. Beyond the direct economic benefits, homes built to modern energy-efficient standards offer improved comfort, better indoor air quality, and enhanced durability. These homes also perform more reliably during extreme weather events, supporting a healthier, safer, and more resilient indoor environment for occupants.

Homes built to the stretch-code performance levels offer residents greater protection during increasingly frequent severe weather events in Illinois.[37] A tighter building envelope helps maintain stable indoor temperatures during power outages, allowing occupants to shelter in place more safely. When paired with the stretch code's solar-ready provisions, energy-efficient equipment can continue operating if back-up power is available, further supporting indoor comfort and safety. By adopting the 2026 Illinois Stretch Energy Code, municipalities can provide their communities with more resilient, disaster-ready homes that are better equipped to withstand and recover from extreme weather events.[38]

With data center construction increasing electricity demand during peak hours,[39] grid-interactive energy-efficient buildings will play a significant role in reducing infrastructure strain by reducing demand during those same peak hours. Homes built to the 2026 Illinois Stretch Energy Code will

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[35] UNC Center for Community Capital and Institute for Market Transformation, "Home Energy Efficiency and Mortgage Risks," 2013.
https://www.imt.org/wp-content/uploads/2018/02/IMT_UNC_HomeEEMortgageRisksfinal.pdf
[36] Megan Hunt, "U.S. Foreclosure Rates by State – April 2026," Attom Data Solutions, May 15, 2026. https://www.attomdata.com/news/most-recent/foreclosure-rates-by-state/,
[37] National Centers for Environmental Information, "Billion-Dollar Weather and Climate Disasters | Illinois Summary." https://www.ncei.noaa.gov/access/billions/state-summary/IL
[38] American Council for an Energy-Efficient Economy (ACEEE), "Ignoring Resilience Benefits Limits Growth of Energy Efficiency Programs," March 5, 2024. https://www.aceee.org/blog-post/2024/03/ignoring-resilience-benefits-limits-growth-energy-efficiency-programs
[39] Jessica Bell and Jeffrey Hammons, "Data Centers: Straining The Grid and Your Wallet," State Energy & Environmental Impact Center, NYU School of Law, October 16, 2025. https://stateimpactcenter.org/insights/data-centers-straining-the-grid-and-your-wallet

reduce peak energy demand on the grid, while simultaneously reducing the need for additional fossil fuel generation.[40]

The consumer and societal impacts of the stretch code are considerable and would contribute significantly to municipalities pursuing climate goals, while also ensuring long-term affordable housing within their communities. In 2022, direct and indirect greenhouse gas emissions from commercial and residential building sectors accounted for 31% of total U.S. greenhouse gas emissions.[41] Municipalities that adopt the 2026 Illinois Stretch Energy Code would have a positive impact on the environment, while helping combat climate change, which is contributing to the increase in severe weather events.[42]

States that adopt the most up-to-date model energy codes often receive more favorable treatment from insurance underwriters because they score higher on the ISO's Building Code Effectiveness Grading Schedule (BCEGS®). This national program evaluates long-term building-code adoption and enforcement on a scale of one (indicating exemplary performance) to ten. At present, Illinois has a BCEG rating of six[43], reflecting opportunities for improvement in statewide code implementation and enforcement.

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[40] American Council for an Energy-Efficient Economy (ACEEE), "As Grid Decarbonizes, Energy Efficiency More Critical than Ever to Reduce Costs." https://www.aceee.org/press-release/2023/06/grid-decarbonizes-energy-efficiency-more-critical-ever-reduce-costs

[41] United States Environmental Protection Agency, "Commercial and Residential Sector Emissions." https://www.epa.gov/ghgemissions/commercial-and-residential-sector-emissions

[42] National Aeronautics and Space Administration (NASA), "Extreme Weather and Climate Change." https://science.nasa.gov/climate-change/extreme-weather/

[43] ISO, "National Building Code Assessment Report." https://www.isomitigation.com/49404c/siteassets/downloads/iso-bcegs-state-report_web.pdf