Pacific Northwest
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Energy Savings Analysis 2024 Residential IECC Interim Progress Indicator

Pacific Northwest National Laboratory

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U.S. DEPARTMENT OF ENERGY BATTELLE

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Topics

- Progress Indicator Background
- Proposal Summary
- Interim Progress Indicator Results
- Discussion on Specific Proposals

Progress Indicator Background

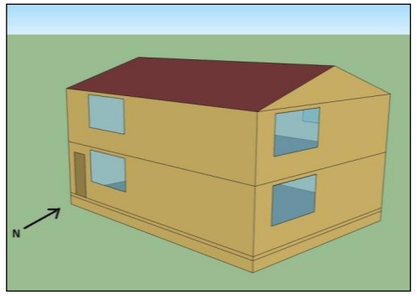
Interim Progress Indicator

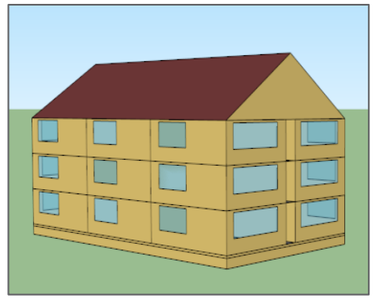
- Track progress of the 2024 IECC residential provisions based on Public Comment Draft - IECC2024-PCD1-102022
- Evaluating decarbonization and grid flexible proposals

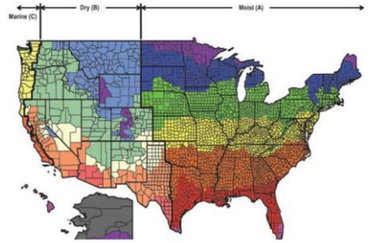
Large Scale Building Energy Simulation

- **2 building types:** single-family (sf) & multi-family (mf)
- **4 foundation types:** heated basement, unheated basement, slab on grade, vented crawlspace
- **4 heating Systems:** gas, oil, electric furnace all with split central air conditioner, and heat pump
- **Weather locations:** 19 (sf) & 18 (mf) represent all U.S. climate zones, moisture regime, humidity and tropical designation defined by the IECC
- **Weights:** Assign new building construction weighting factor to each building type in each representative climate location for each Climate Zone
- Total 296 E+ models for each code edition or set of energy code requirements

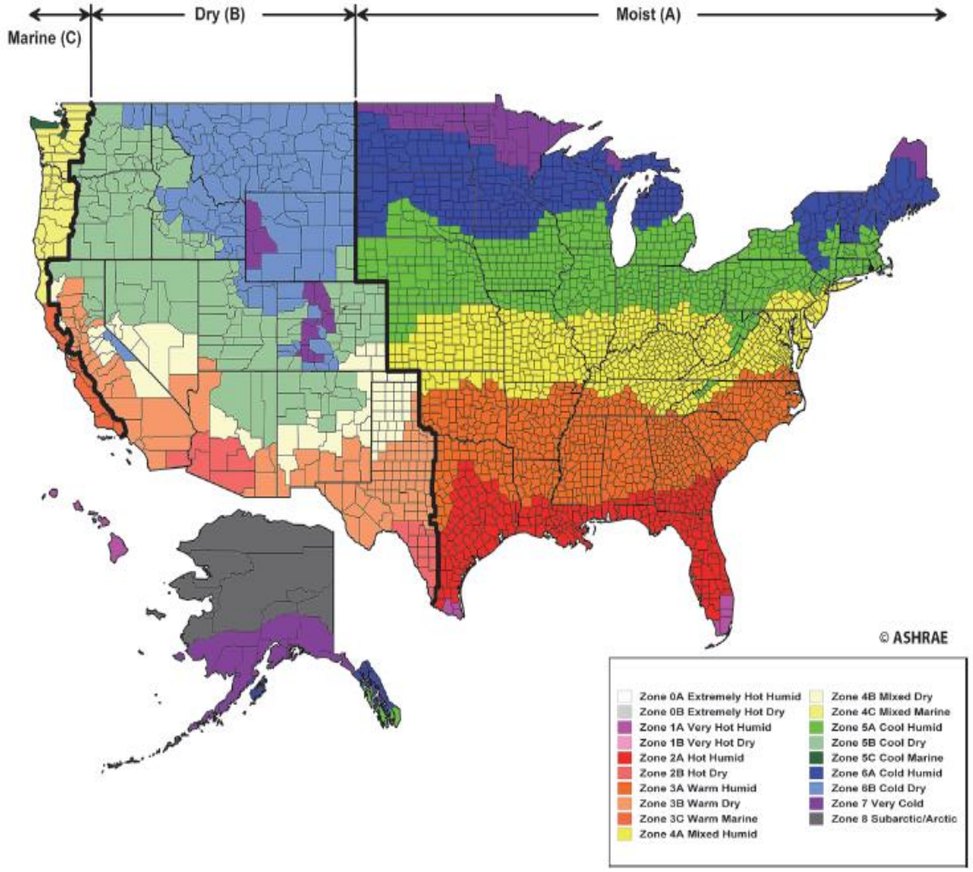
Calculate the national weighted energy use intensity, energy costs, and savings by climate zone







Climate Zones and Representative Cities



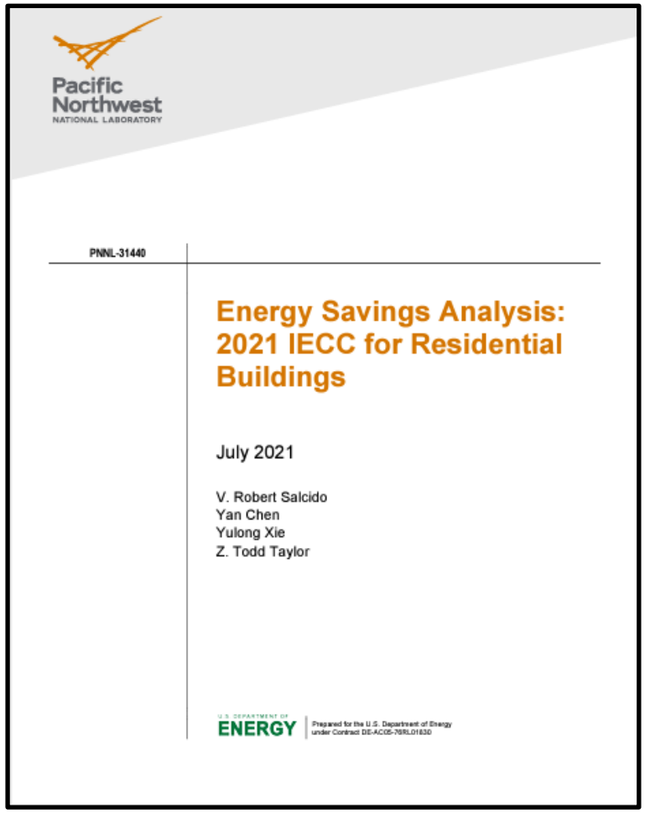
Climate Zone	Climate Zone Name	Representative City
1A*	Very Hot Humid	Honolulu, HI (tropical)
1A	Very Hot Humid	Miam, FL
2A	Hot Humid	Tampa, FL
2B	Hot Dry	Tucson, AZ
3A	Warm Humid	Atlanta, GA
3A, WH	Warm Humid	Montgomery, AL
3B	Warm Dry	El Paso, TX
3C	Warm Marine	San Diego, CA
4A	Mixed Humid	New York, NY
4B	Mixed Dry	Albuquerque, NM
4C	Mixed Marine	Seattle, WA
5A	Cool Humid	Buffalo, NY
5B	Cool Dry	Denver, CO
5C	Cool Marine	Port Angeles, WA
6A	Cold Humid	Rochester, MN
6B	Cold Dry	Great Falls, MT
7	Very Cold	International Falls, MN
8	Subarctic/Arctic	Fairbanks, AK

IECC 2021 / ASHRAE Standard 169-2013

*For tropical climate region determination

PNNL/DOE Prototype Building Models IECC

Zone/Regime	Complete Set	2015 IECC	2018 IECC	2021 IECC
1A	ZIP	ZIP	ZIP	ZIP
2A	ZIP	ZIP	ZIP	ZIP
2B	ZIP	ZIP	ZIP	ZIP
3A	ZIP	ZIP	ZIP	ZIP
3B	ZIP	ZIP	ZIP	ZIP
3C	ZIP	ZIP	ZIP	ZIP
4A	ZIP	ZIP	ZIP	ZIP
4B	ZIP	ZIP	ZIP	ZIP
4C	ZIP	ZIP	ZIP	ZIP
5A	ZIP	ZIP	ZIP	ZIP
5B	ZIP	ZIP	ZIP	ZIP
5C	ZIP	ZIP	ZIP	ZIP
6A	ZIP	ZIP	ZIP	ZIP
6B	ZIP	ZIP	ZIP	ZIP
7	ZIP	ZIP	ZIP	ZIP
8	ZIP	ZIP	ZIP	ZIP



2021 IECC

https://www.energycodes.gov/prototype-building-models
https://www.energycodes.gov/sites/default/files/2021-07/2021_IECC_Final_Determination_AnalysisTSD.pdf

Construction Weighting Factors (%) – Based on 2009-2020 data

Building Type / Climate Zone:	1	2	3	4	5	6	7	8	Weights by Bldg Type
Single Family	2.89	15.71	20.14	11.76	12.26	2.92	0.33	0.02	66.04
Multifamily	1.41	6.72	8.9	7.73	7.25	1.75	0.20	0.00	33.96
Weights by Climate Zone	4.30	22.43	29.04	19.49	19.51	4.68	0.53	0.02	100.00

Foundation Type	Weights
Slab	50.86
Heated Basement	11.77
Unheated Basement	9.93
Crawlspace	27.44

Heating System Type	Weights
Electric Furnace	5.64
Gas Furnace	49.15
Heat Pump	43.93
Oil Furnace	1.29

2024 IECC Public Review Proposal Summary

105 Proposals Posted in 2024 IECC Public Review

Proposal Numbers					
CECPI-2-21	REPI-007-21	REPI-050-21	REPI-074-21	REPI-102-21 Part I	REPI-143-21
CECPI-3-21	REPI-009-21	REPI-051-21	REPI-078-21	REPI-102-21 Part II	REPI-144-21
CEPI-008-21 Part II	REPI-011-21	REPI-052-21	REPI-079-21	REPI-105-21	REPI-145-21
CEPI-015-21 Part II	REPI-013-21	REPI-053-21	REPI-080-21	REPI-106-21	REPI-150-21
CEPI-015-21 Part III	REPI-018-21	REPI-054-21	REPI-082-21	REPI-108-21	REPI-151-21
CEPI-019-21 Part II	REPI-020-21	REPI-055-21	REPI-083-21	REPI-111-21	REPI-152-21
CEPI-024-21 Part II	REPI-021-21	REPI-057-21	REPI-085-21	REPI-115-21	REPI-153-21
CEPI-082-21 Part II	REPI-026-21	REPI-058-21	REPI-086-21	REPI-117-21	REPI-154-21
IRCPI-1-21	REPI-028-21	REPI-060-21	REPI-087-21	REPI-118-21	REPI-155-21
IRCPI-3-21	REPI-030-21	REPI-061-21	REPI-089-21	REPI-120-21	REPI-156-21
IRCPI-4-21	REPI-033-21	REPI-063-21	REPI-090-21	REPI-121-21	REPI-157-21
IRCPI-6-21	REPI-035-21	REPI-064-21	REPI-091-21	REPI-122-21	REPI-158-21
IRCPI-7-21	REPI-037-21	REPI-065-21	REPI-093-21	REPI-124-21	REPI-160-21
RECPI-10-21	REPI-039-21	REPI-066-21	REPI-094-21	REPI-126-21	REPI-161-21
RECPI-2-21	REPI-040-21	REPI-068-21	REPI-095-21	REPI-131-21	REPI-163-21
RECPI-6-21	REPI-042-21	REPI-069-21	REPI-096-21	REPI-136-21	
RECPI-7-21	REPI-043-21	REPI-070-21	REPI-099-21	REPI-140-21	
REPI-004-21	REPI-047-21	REPI-073-21	REPI-101-21	REPI-142-21	

Not All Proposals Can be Characterized as Having Direct and Quantifiable Energy Savings Impacts.

Common reasons and examples:

- **Alternate Compliance:** Proposals modifying or adding requirements to an optional performance path - R405 Total Building Performance or R406 Energy Rating Index (ERI)
- **Definitions:** Changes or adds a new definition (e.g., emittance, duct airflow balancing, radiant barrier, sensible recovery efficiency)
- **Editorial/Clarification:** Editorial or clarification to an existing requirement
- **Grid Integration:** Improves integration of building performance with the corresponding electrical grid (e.g., demand responsive thermostats and water heaters)
- **No Direct Quantifiable Impact**: Outside the scope of the energy savings analysis methodology or adds a new requirement that is accounted for elsewhere (e.g., decarbonization construction site waste, envelope backstop)
- **Specialized Measures:** Equipment, technology or system not represented in prototypical buildings (e.g., de-icing, gas fireplace efficiency)
- **Alterations or Existing Buildings:** Methodology is focused on new construction
- **Appendix**: A proposal modifying or adding requirements into an optional Appendix

This approach is consistent with standard approach utilized for similar DOE/PNNL energy savings analysis, including DOE model energy code *determinations*

30 of the 105 Proposals Have an *Impact on Energy Savings* in Residential Buildings.

Proposal Numbers					
CECPI-2-21	REPI-007-21	**REPI-050-21**	**REPI-074-21**	REPI-102-21 Part I	**REPI-143-21**
CECPI-3-21	REPI-009-21	REPI-051-21	REPI-078-21	REPI-102-21 Part II	**REPI-144-21**
CEPI-008-21 Part II	REPI-011-21	REPI-052-21	REPI-079-21	REPI-105-21	**REPI-145-21**
CEPI-015-21 Part II	REPI-013-21	REPI-053-21	**REPI-080-21**	REPI-106-21	REPI-150-21
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CEPI-024-21 Part II	**REPI-021-21**	REPI-057-21	**REPI-085-21**	REPI-115-21	REPI-153-21
CEPI-082-21 Part II	REPI-026-21	REPI-058-21	**REPI-086-21**	REPI-117-21	REPI-154-21
IRCPI-1-21	**REPI-028-21**	REPI-060-21	REPI-087-21	**REPI-118-21**	REPI-155-21
IRCPI-3-21	REPI-030-21	REPI-061-21	**REPI-089-21**	REPI-120-21	REPI-156-21
IRCPI-4-21	**REPI-033-21**	**REPI-063-21**	REPI-090-21	REPI-121-21	REPI-157-21
IRCPI-6-21	REPI-035-21	**REPI-064-21**	**REPI-091-21**	**REPI-122-21**	REPI-158-21
IRCPI-7-21	REPI-037-21	**REPI-065-21**	**REPI-093-21**	REPI-124-21	REPI-160-21
RECPI-10-21	**REPI-039-21**	REPI-066-21	REPI-094-21	**REPI-126-21**	REPI-161-21
RECPI-2-21	REPI-040-21	**REPI-068-21**	REPI-095-21	REPI-131-21	**REPI-163-21**
RECPI-6-21	REPI-042-21	REPI-069-21	REPI-096-21	REPI-136-21	
RECPI-7-21	REPI-043-21	REPI-070-21	**REPI-099-21**	REPI-140-21	
REPI-004-21	REPI-047-21	REPI-073-21	REPI-101-21	**REPI-142-21**	

Green font indicates energy savings, **Red** font indicates energy increase, **Orange** font indicates a range of potential energy impacts

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A Closer Look at the Set of 30 Proposals…

Proposal Number	Description	Proposal Number	Description
CEPI-082-21 Part II	Roof gutter de-icing	REPI-085-21	Duct testing multifamily units
RECPI-10-21	Setting SWH equipment efficiencies for R408	REPI-086-21	Duct leakage reformatting
REPI-018-21	R408 Additional energy efficiency credits	REPI-089-21	Pipe insulation requirements (1 inch thickness = R7)
REPI-020-21	Increase R405 stringency for homes over 5,000 sq ft	REPI-091-21	Hot water compact design
REPI-021-21	ERI remove 5% from R408	REPI-093-21	HRV in CZ 6
REPI-028-21	Fenestration table improvements	REPI-099-21	Electric resistance zone heat unit
REPI-033-21	Ceiling insulation reduction	REPI-118-21	Performance path envelope backstop
REPI-039-21	Attic knee or pony wall	REPI-122-21	R405 standard reference home adjustments
REPI-050-21	Air sealing HVAC register boots penetrations	REPI-126-21	New ERI targets with and without OPP
REPI-063-21	Air tightness improvements - CZ 0-2	REPI-142-21	Compact hot water design in R408
REPI-064-21	Air tightness improvements - CZ 3-8	REPI-143-21	Unconditioned spaces or low energy spaces existing homes
REPI-065-21	Gas fireplace efficiency	REPI-144-21	Existing buildings additional efficiency credits
REPI-068-21	Cool roofs	REPI-145-21	Alterations duct leakage testing
REPI-074-21	Fireplace pilot lights	REPI-152-21	Alterations HVAC controls
REPI-080-21	Ducts in conditioned space – added exception	REPI-163-21	Reduction of Appendix RC ERI targets without PV

Green font indicates energy savings, **Red** font indicates energy increase, **Orange** font indicates a range of potential energy impacts

Of the 30 Proposals with Energy Savings, 8 can be captured via the Progress Indicator Analysis

Number	Description
REPI-018-21	Additional Energy Efficiency Credits (10 energy credits)
REPI-028-21	Fenestration Table-Improved Window and Skylight U-factors in CZ 4C - 8
REPI-033-21	Ceiling Insulation changes in CZ 4-8 from R-60 to R-49
REPI-063-21	CZ 0-2 to 4.0 ACH50
REPI-064-21	CZ 6-8 to 2.5 ACH50
REPI-089-21	Pipe Insulation Requirements update (1 inch thickness = R7)
REPI-091-21	Hot water compact design
REPI-093-21	HRV in CZ 6

This is the final set of proposals which are deemed to have a direct and quantifiable impact on building energy efficiency, and which can be reasonably represented via the energy savings analysis.

Ultimately, the PNNL analysis is intended to represent average expected impacts across the range of climate zones, building types, system types and foundation types.

These proposals drive the estimated energy savings and results reported on the following slides.

2024 Residential IECC Interim Progress Indicator

Energy and Cost Saving Results

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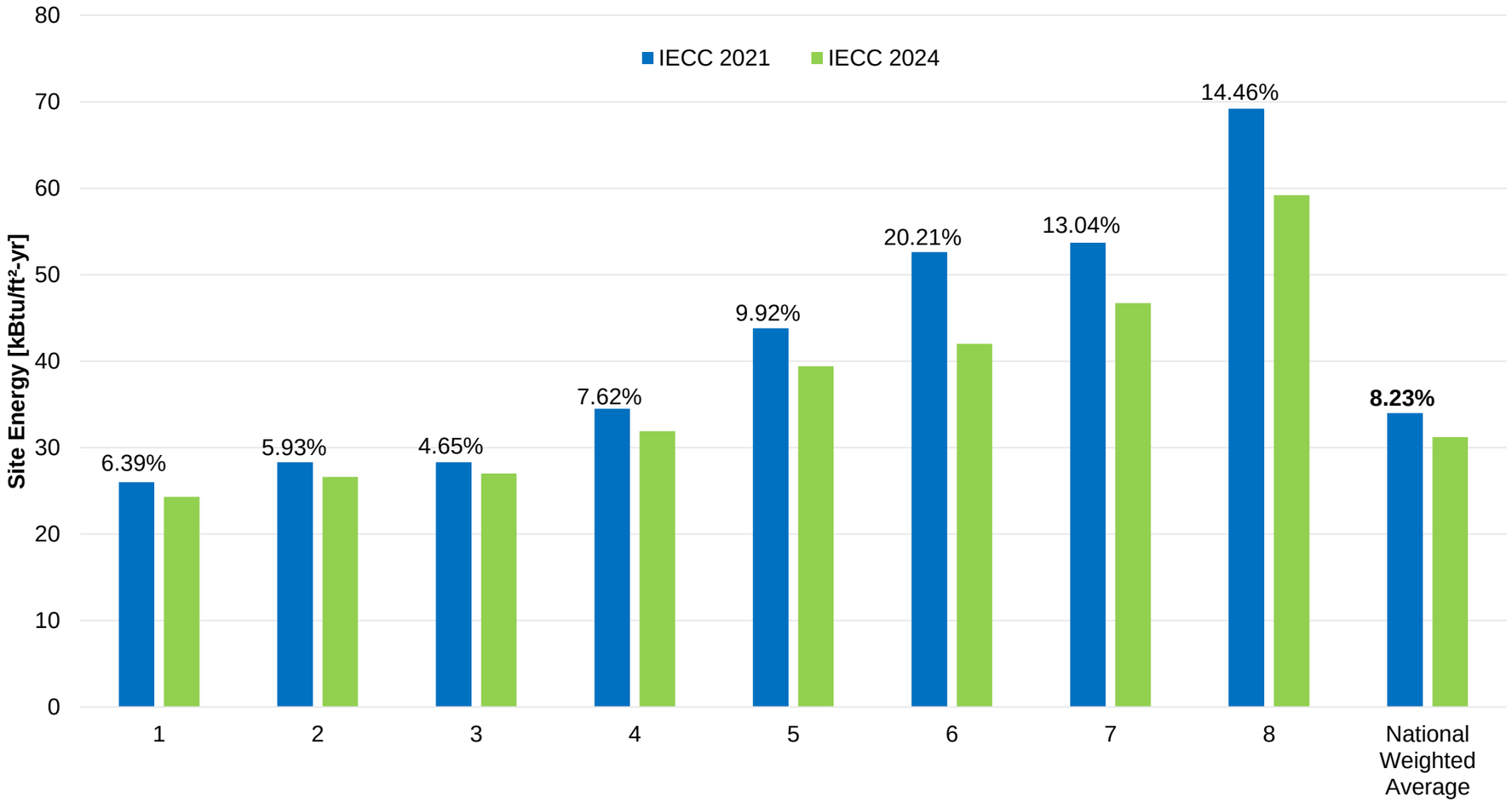
Summary of Results

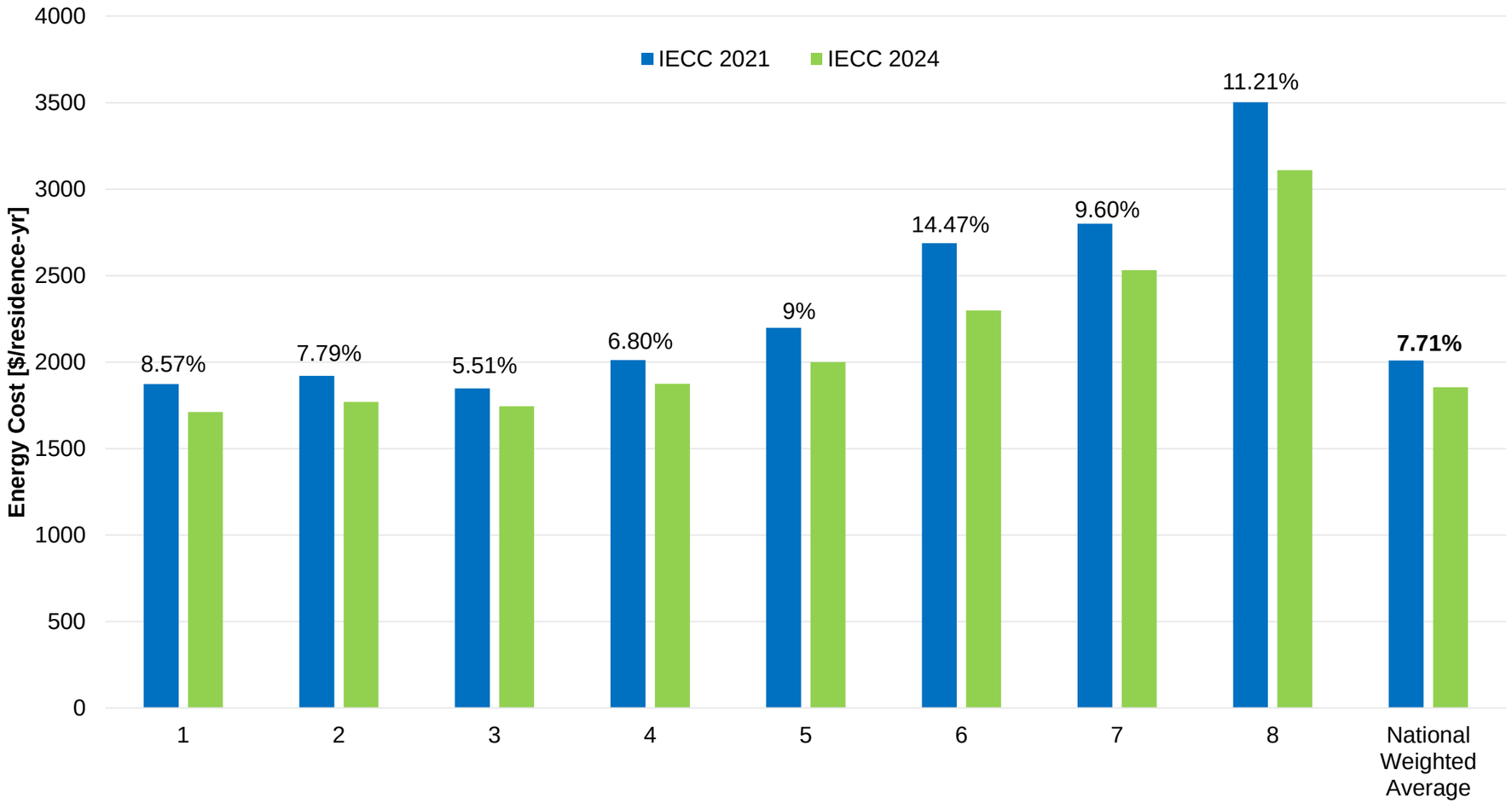
National Weighted Average		Site Energy [kBtu/ft²-yr] Energy Cost [$/residence-yr] Emissions [tons/kft²-yr]		% Savings
		IECC 2021	IECC 2024	
Whole Building	Site Energy	34	31.2	8.23%
	Energy Cost	2,009	1,854	7.71%
	Emissions	10.79	9.95	7.72%

Results do not include REPI-89 (pipe insulation)

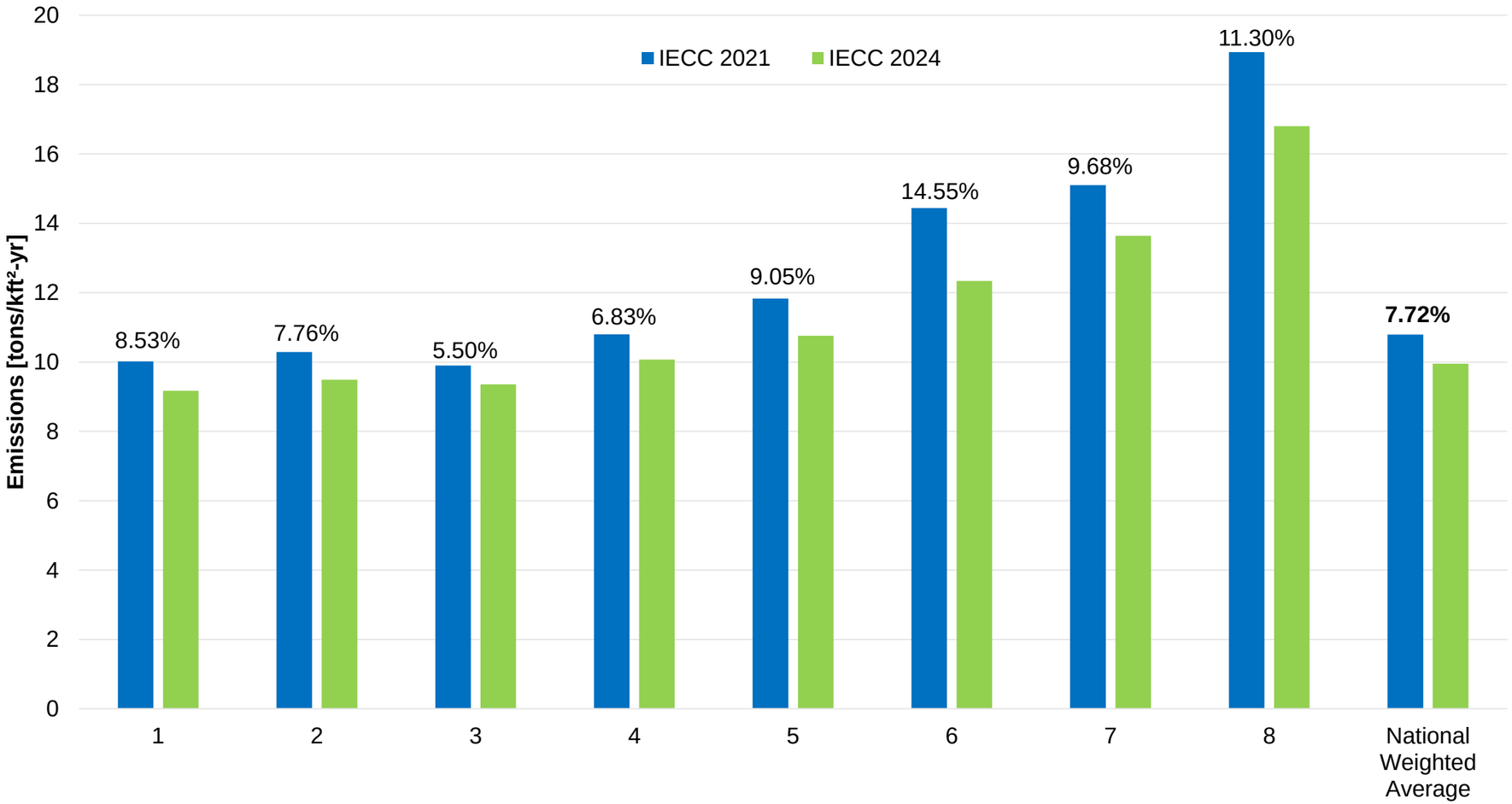
Whole Building Site Energy Savings by Climate Zone: 2021 to 2024



Whole Building Site Energy Cost Savings by Climate Zone: 2021 to 2024



Whole Building Site Energy Emissions Savings by Climate Zone: 2021 to 2024



Net Savings Summary by Climate Zone

Climate Zones	Site EUI (kBtu/ft²-yr)		Site EUI Savings (%)	ECI ($/residence-yr)		ECI Savings (%)	Emissions (ton/kft²-yr)		Emission Savings (%)
	2021 IECC	2024 IECC		2021 IECC	2024 IECC		2021 IECC	2024 IECC	
1	26	24.3	6.39%	$1,873	$1,712	8.57%	10.02	9.17	8.53%
2	28.3	26.6	5.93%	$1,920	$1,770	7.79%	10.29	9.49	7.76%
3	28.3	27	4.65%	$1,847	$1,745	5.51%	9.90	9.36	5.50%
4	34.5	31.9	7.62%	$2,011	$1,874	6.80%	10.80	10.07	6.83%
5	43.8	39.4	9.92%	$2,198	$2,000	9.00%	11.83	10.76	9.05%
6	52.6	42	20.21%	$2,687	$2,299	14.47%	14.44	12.34	14.55%
7	53.7	46.7	13.04%	$2,800	$2,531	9.60%	15.10	13.64	9.68%
8	69.2	59.2	14.46%	$3,502	$3,109	11.21%	18.94	16.80	11.30%
National Weighted Average	**34**	**31.2**	**8.23%**	**$2,009**	**$1,854**	**7.71%**	**10.79**	**9.95**	**7.72%**

Discussion on Specific Proposals

- Efficiency Decrease
- Trade-offs
- EV Charging
- Decarbonization – DR, Solar, Electric, Energy Storage

Ceiling Insulation (REPI-033) – Efficiency Decrease

Ceiling insulation levels from climate zones 2 through 8 have been reset to 2018 IECC levels

Table R402.1.3 Insulation Minimum R-Values and Fenestration Requirements by Component

	0	1	2	3	4 except Marine	5 and Marine 4	6	7 and 8
2018 IECC Ceiling R-Value	30	30	38	38	49	49	49	49
2021 IECC Ceiling R-Value	30	30	49	49	60	60	60	60
2024 IECC Ceiling R-Value	30	30	38	38	49	49	49	49

Relative Energy/Cost Savings of 2024 IECC compared to the 2021 IECC by Climate Zone (percent)

Climate Zone	Weight (%)	Site EUI (%)	Source EUI (%)	Energy Cost (%)	CO_2 Emissions (%)
1	4.3	0	0	0	0
2	22.43	-0.42	-0.36	-0.34	-0.34
3	29.04	-0.56	-0.45	-0.42	-0.43
4	19.49	-0.35	-0.26	-0.24	-0.24
5	19.51	-0.44	-0.32	-0.29	-0.29
6	4.68	-0.43	-0.34	-0.31	-0.31
7	0.53	-0.49	-0.39	-0.37	-0.37
8	0.02	-0.51	-0.43	-0.40	-0.41
National	**100**	**-0.43**	**-0.34**	**-0.32**	**-0.32**

R405 Reference Home (REPI-122)

Performance Path – Not Captured in Progress Indicator

- R405 Performance Compliance path in 2024 IECC allows performance credit for HVAC efficiency and duct location
- New compliance factors attempt to account for additional efficiency requirements as well as adjustments in reference home HVAC efficiency and duct location
- Potential for envelope efficiency trade-offs with high efficiency HVAC and ducts in conditioned space

2021 IECC R405 Reference Home

- Envelope Backstop: 2009 IECC (2009 IECC climate zones)
- HVAC & SWH efficiency: Same efficiency as proposed home
- Duct Location: Same location as proposed home

2024 IECC R405 Reference Home

- Envelope Backstop: 1.08 or 1.15 x UA of standard reference design
- HVAC & SWH efficiency: Federal minimum efficiency level (10 CFR 430.32)
- Duct Location: Based on stories and foundation type (attic, crawlspace, or conditioned space)
- Compliance Factors: Fossil fuel heating – 80%, Electric heating – 85% of standard reference design annual energy costs

R405 Reference Home (REPI-122)
Performance Path – Climate Zone 5 Analysis

How much could "free ridership" weaken efficiency?

Potential maximum value of high-efficiency HVAC equipment and ducts in conditioned space

- High-efficiency equipment (CEE Tier 2) = 7% annual energy use or $164/yr
- Ducts in conditioned space = 10% annual energy use or $236/yr

Annual energy use reduction in first year 17% (7,800 Btu/sf); Annual energy cost reduction in first year $400

Do the proposed multipliers sufficiently offset the effects of free-ridership?

Home with top-tier HVAC and minimum envelope, plus new multipliers (gas=80%, electric=85%)

- 2024 IECC R405 (as proposed) vs. 2021 IECC R405 baseline fails by 15% (i.e., requires additional 15% in efficiency)

Multipliers appear to sufficiently offset the potential effects of free-ridership due to equipment and ducts

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What are the life-cycle impacts (beyond first-year savings)?

Homes that would have installed minimum efficiency equipment and ducts outside conditioned space

- ➢ Maximum life-cycle energy savings of 216,700 Btu/sf = PV benefit of $8,000

Homes that would have installed high-efficiency equipment and ducts within conditioned space

- ➢ Maximum life-cycle energy increase of 61,100 Btu/sf = PV loss of $1,675

High Range of Potential Lifetime Impacts to Homeowner = $6,325 net benefit to $1675 net loss

EV Charging Infrastructure (RECPI-006, 007)

Decarbonization – Not Captured in Progress Indicator

Required number of EV capable spaces, EV ready spaces, and EV power supply equipment spaces based on residential building type

- Support of the electric vehicle market aids decarbonization efforts
- Based on average U.S. emissions for electricity generation, EVs save nearly 70% of the annual CO2e emitted by combustion-engine vehicles.

Savings Examples	Occupancy Group	Number of Total Parking Spaces	EV Supply Equipment (EVSE) Installed Spaces	Carbon Emissions Reduction (lb. CO2e year)
Single Family Home	R	2	1	6,532
Multifamily Building	R-2	69	14 (20%)	90,145

- Savings are based on annual combustion vehicle emissions of 11,435 lb CO2e and electric vehicle emissions of 3,596 lb CO2e, resulting in an annual savings of 7,839 lb CO2e/year.
- The carbon emission calculation assumes 12,000 miles traveled per year, 25.7 miles/gallon, 0.35 kWh/mile, 24.6 lb CO2e/gal, 0.866 lb CO2e/kWh, which is based on eGrid 2020 published data for U.S. average equaling 822.6 CO2e lb/MWH plus 5.3% to account for transmission and distribution losses.

Demand Response Proposals
Supports Decarbonization – Not Captured in Progress Indicator

- Grid-Integrated Thermostat (REPI-070)
  - Incremental cost of upgrading to a smart thermostat with DR controls between $100 and $200
  - Connected thermostat (CT) market has seen tremendously growth with continued innovation - CPUC data shows 325,000 smart thermostats installed from 2018 to 2019[1]
  - Approximately 15 million smart thermostats in the US at end of 2021
- Grid-Integrated Water Heating (REPI-090)
  - Grid connected heat pump water heaters reduced evening peak load power 90% compared to controlled electric resistance water heaters[2]
  - Translates to potential $7.8 billion in annual savings in water heating operating costs ($182 per household)[3]
  - IRA offers up to $1,750 rebate for a heat pump water heater
- DOE GEB study identified 15.6 GW dispatchable peak-reduction capability from demand-flexibility-only programs by 2030, 6.3 GW for residential GEBs and 9.3 GW for commercial GEBs[4]

1. https://www.energy.gov/eere/articles/connected-thermostats-offer-gateway-increasing-energy-savings
2. https://www.bpa.gov/EE/Technology/demand-response/Documents/20181118_CTA-2045_Final_Report.pdf
3. https://www.energy.gov/sites/prod/files/2014/01/f7/case_study_hpwh_northeast.pdf
4. DOE: A National Roadmap for Grid-Interactive Efficient Buildings – Building Technologies Office

Readiness Proposals
Supports Decarbonization – Not Captured in Progress Indicator

- Solar Ready Requirements (REPI-007)
  - Assures that homeowners are capable of cost-effectively installing renewable energy
  - NREL Solar Ready Buildings Planning Guide shows a solar ready home can save 60% on future PV systems: $1,720 vs $4,373[1]
  - IRA carries a solar tax credit for up to 30% of solar energy equipment can incentivize PV installations

- Electric Ready Requirements (REPI-111)
  - Retrofit electrical costs are over four times the cost with new construction: $500 vs. $2,100.
  - Potentially an estimated 48 million households may require a panel upgrade to fully electrify.

- Electric Energy Storage (ESS) Ready (REPI-115)
  - ESS readiness costs from $200-$250 per dwelling unit
  - Reduces cost for future electric storage, provides around the clock power, avoidance of higher peak rates, and provides energy self-sufficiency

✓ IRA high efficiency electric home rebate program offers rebates up to $14,000 or 100% of cost of qualified electrification projects for low-income families

1. Solar Ready Planning Guide – NREL Technical Report NREL/TP-7A40-51296

Performance Envelope UA Backstop (REPI-118)
Indirect energy impact

Sets R405 and R406 envelope backstop to a UA methodology

- 2021 IECC R405 envelope backstop is 2009 IECC
- 2024 IECC R405 envelope backstop is 1.08 or 1.15 x UA of standard reference home
- New envelope backstop (dark orange) lands between 2009 and 2012 IECC (lighter orange), representing a slight increase in efficiency

		Developed using PNNL SF Prototypes									
		2021 IECC UA	2018 IECC UA	2015 IECC UA	2012 IECC UA	2009 IECC UA	2021 IECC 1.15 X UA	2021 IECC 1.10 X UA	2021 IECC 1.08 X UA	2021 IECC 1.05 X UA	2021 IECC 1.02 X UA
Heated Basement	CZ 1	839.5	839.5	839.5	835.4	1112.9	965.4	923.5	906.7	881.5	856.3
Unheated Basement	CZ 1	489.5	489.5	489.5	485.4	762.9	562.9	538.5	528.7	514.0	499.3
Crawlspace	CZ 1	489.5	489.5	489.5	485.4	762.9	562.9	538.5	528.7	514.0	499.3
Slab	CZ 1	498.3	498.3	498.3	494.2	771.7	573.0	548.1	538.2	523.2	508.3
Heated Basement	CZ 2	816.6	821.3	821.3	817.2	922.3	939.1	898.3	881.9	857.4	837.7
Unheated Basement	CZ 2	439.2	443.9	443.9	439.8	544.9	505.1	483.1	474.3	461.2	452.8
Crawlspace	CZ 2	439.2	443.9	443.9	439.8	544.9	505.1	483.1	474.3	461.2	452.8
Slab	CZ 2	448.0	452.7	452.7	448.6	553.7	515.2	492.8	483.8	470.4	461.8
Heated Basement	CZ 3	409.5	422.1	434.0	427.9	544.5	470.9	450.5	442.3	430.0	430.5
Unheated Basement	CZ 3	330.2	342.8	354.7	348.6	465.2	379.7	363.2	356.6	346.7	349.7
Crawlspace	CZ 3	330.2	342.8	354.7	348.6	465.2	379.7	363.2	356.6	346.7	349.7
Slab	CZ 3	339.9	371.8	383.7	377.6	494.2	390.9	373.9	367.1	356.9	379.2
Heated Basement	CZ 4	338.4	379.5	391.4	385.3	441.1	389.2	372.2	365.5	355.3	387.1
Unheated Basement	CZ 4	297.0	338.1	350.0	343.9	399.7	341.6	326.7	320.8	311.9	344.9
Crawlspace	CZ 4	297.0	338.1	350.0	343.9	399.7	341.6	326.7	320.8	311.9	344.9
Slab	CZ 4	300.3	347.8	359.7	353.6	409.4	345.3	330.3	324.3	315.3	354.8
Heated Basement	CZ 5	327.8	361.0	368.9	362.8	390.0	377.0	360.6	354.0	344.2	368.2
Unheated Basement	CZ 5	280.4	313.6	321.5	315.4	332.0	322.5	308.4	302.8	294.4	319.9
Crawlspace	CZ 5	280.4	313.6	321.5	315.4	332.0	322.5	308.4	302.8	294.4	319.9
Slab	CZ 5	300.3	339.9	347.8	341.7	358.3	345.3	330.3	324.3	315.3	346.7
Heated Basement	CZ 6	327.8	330.2	338.1	344.3	374.7	377.0	360.6	354.0	344.2	336.8
Unheated Basement	CZ 6	280.4	282.8	290.7	296.9	327.3	322.5	308.4	302.8	294.4	288.5
Crawlspace	CZ 6	280.4	282.8	290.7	296.9	327.3	322.5	308.4	302.8	294.4	288.5
Slab	CZ 6	300.3	302.7	310.6	316.8	347.2	345.3	330.3	324.3	315.3	308.8
Heated Basement	CZ 7&8	300.4	302.8	310.7	316.9	347.3	345.5	330.4	324.4	315.4	308.9
Unheated Basement	CZ 7&8	274.5	276.9	284.8	291.0	321.4	315.7	302.0	296.5	288.2	282.4
Crawlspace	CZ 7&8	274.5	276.9	284.8	291.0	321.4	315.7	302.0	296.5	288.2	282.4
Slab	CZ 7&8	300.3	302.7	310.6	316.8	347.2	345.3	330.3	324.3	315.3	308.8

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Thank you