SCEP

STATE & COMMUNITY ENERGY PROGRAMS

DE-FOA-0003056: Inflation Reduction Act of 2022 (IRA) Assistance For The Adoption Of The Latest And Zero Building Energy Codes

Equivalence Methodology Overview

February 1, 2024
IRA Section 50131
Adoption of the Latest and Zero Building Energy Codes

Agenda

1. FOA Overview
2. Equivalence: What & Why
    - What is equivalence and why is it important?
        - 5-min Q&A
    - Equivalence examples
        - 5-min Q&A
    - What resources can help me determine equivalence and what needs to be submitted?
3. Open Q&A

Reference Slides: How it works – walking through the calculation

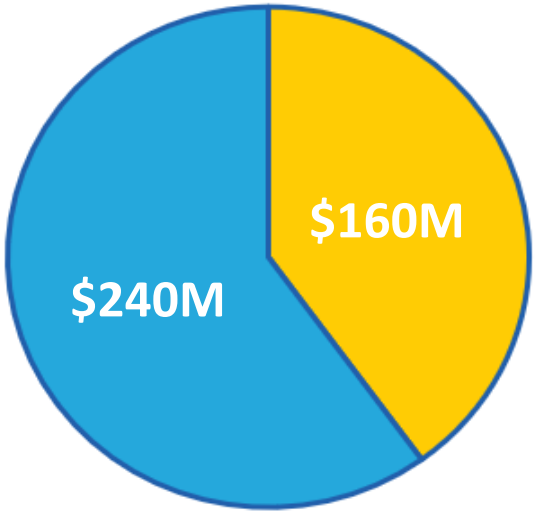
- New Construction & Major Renovations
- Existing Buildings

Overview of Funding Breakdown by Mechanism / Timing

Reminder: Applicant must have code/standard adoption authority

Formula – **$400M Total**

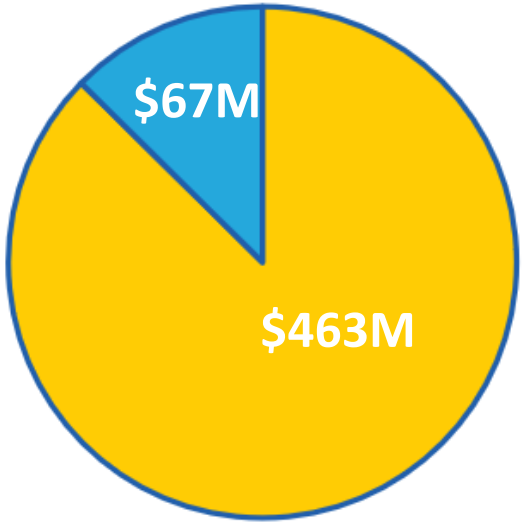
Eligible Entities: States (and partnerships with States)
Released: September 19, 2023



Streamlined process for motivated States

Competitive FOA – **$530M Total**

Eligible Entities: States, and localities with code adoption authority
Released: December 18, 2023



Equivalence

- Latest Model Energy Codes or Equivalent
- Zero Energy Codes or Equivalent

FOA Topic Areas & Equivalence-based Subtopic Areas

Topic Area 1: Adoption and Implementation of Qualifying Building Energy Codes by Certain Units of Local Government *(No calculation required)*

- *Subtopic A: LMC; Subtopic B: ZEC*

Topic Area 2: Adoption of the Latest Model Energy Codes or Zero Energy Codes with Combinations of Strengthening and Weakening Amendments by States and Certain Units of Local Government

- *Subtopics A & B: LMC Equivalence; Subtopics C & D: ZEC Equivalence*

Topic Area 3: Adoption of Innovative Building Energy Code Approaches by States and Certain Units of Local Government

- *Subtopic A: LMC Equivalence; Subtopic B: ZEC Equivalence*

What is equivalence?

Applicants must propose to adopt the statute-specified codes or **modified traditional or innovative codes with *equivalent or greater energy savings***.

Codes are often amended and adapted to meet specific and unique needs in various states and localities or incorporate other priorities (e.g.: EV-readiness, resilience, etc.)

- The proposed code, taken with all amendments and changes, needs to be **net neutral or deliver additional energy savings per the requirements in the IRA**

Why does equivalence matter?

Proposals that do not meet statutory "equivalence" will be deemed ineligible and will not be awarded a grant.

Equivalent to what?

I am submitting a proposal to adopt and implement a custom or innovative code. I need to demonstrate equivalent or greater energy savings vs…what?

			Commercial	Residential
Latest Model Codes	TA2 Subtopics A & B	Custom Codes	**ASHRAE 90.1-2019**	**2021 IECC Residential**
	TA3 Subtopic A	Innovative Approaches (BPS)		
Zero Energy Codes	TA2 Subtopics C & D	Custom Codes	**2021 IECC Appendix CC**	**2021 IECC Appendix RC**
	TA3 Subtopic B	Innovative Approaches (BPS)		

Equivalent to what? (Note: examples are illustrative)

Example 1:

I am a state that wants to adopt a new residential code that looks a lot like the 2021 IECC but has a few amendments. Some of these are strengthening, but some are weakening, too. Where do I apply?

Topic Area 2

Subtopic Area B

Equivalent Statute-Specified Code:

2021 IECC Residential

Example 2:

I am a city that wants to adopt a building performance standard. It deals with a lot of existing commercial and multifamily buildings since we don't have much new construction and is a key piece of reaching our net zero energy goal by 2050.

Topic Area 3

Subtopic Area B

Equivalent Statute-Specified Code:

2021 IECC Appendix CC

Equivalent to what? (Note: examples are illustrative)

Example 3:

I am a city with the authority to adopt building energy codes that wants to adopt and implement a new commercial code. We are planning to adopt ASHRAE 90.1-2019 / 2021 IECC Commercial with a few amendments to increase efficiency and add EV-readiness. Where do I apply?

Topic Area 1

Subtopic Area A

Equivalent Statute-Specified Code:

ASHRAE 90.1-2019

Example 4:

I am a territory that wants to adopt a custom residential code to meet our unique needs for resilience, climactic conditions, and affordability. We started with the 2024 IECC, but we believe it could save as much as a zero energy code for our jurisdiction.

Topic Area 2

Subtopic Area C

Equivalent Statute-Specified Code:

2021 IECC Appendix RC

New Construction Equivalence, Simplified (Illustrative Example)

A jurisdiction wants to adopt a new commercial code…

Applying for LMC equivalence

Current Code

ASHRAE 90.1-2013

EUI = X

Qualified Code

ASHRAE 90.1-2019

EUI = Y

Construction Projection

1000 new construction starts over next 30 years

"Equivalent" Savings Threshold

$$(1000 * x) - (1000 * y) = latest\ model\ code\ savings$$

Custom Commercial Code

EUI = Z

Is my proposed code equivalent?

$$(1000 * x) - (1000 * z) \geq (1000 * x) - (1000 * y)$$

BPS Equivalence, Simplified (Illustrative Example):

A jurisdiction wants to adopt a BPS as an innovative code

Applying for ZEC equivalence

Current Code

ASHRAE 90.1-2013

EUI = X

Qualified Code

2021 IECC Appendix CC

EUI = Y
(efficiency backstop)

Construction Projection

1000 new construction starts over next 30 years

Existing Buildings

25,000 existing buildings covered over 30 years

"Equivalent" Savings Threshold

$$(1000 * x) - (1000 * y) = zero\ energy\ code\ savings$$

Commercial & Multifamily BPS

Baseline EUI = z_0
Target EUI = z_1

Is my proposed code equivalent?

$$(25{,}000 * z_0) - (25{,}000 * z_1) \geq (1000 * x) - (1000 * y)$$

and

Renewable procurement requirements are *at least as stringent* as those in Appendix CC

What kind of help is there?

All calculators & templates are posted on Infrastructure Exchange with the FOA!

- **Topic Area 1**
  - There is a checklist! No equivalence *calculation* required.
- **Topic Area 2**
  - There is a calculator! Just provide the weighted site EUI of your proposed code (PCEP) from Slide 17 or Section 4.2 in the methodology.
  - **You can request support from DOE** – provide inputs identified in the FOA along with your full application and DOE conducts the calculation for you.
- **Topic Area 3**
  - If you are proposing a commercial or multifamily BPS, you *must* use the TA3 calculator provided with the FOA.
  - For other innovative approaches, follow resources for Topic Area 2, including **how to request support from DOE**.

Full Application Equivalence Requirements

			Calculator?	DOE Assistance?
Latest Model Codes	TA2 Subtopics A & B	Custom Codes	TA2 Calculator	Yes
	TA3 Subtopic A	Innovative Approaches (BPS)	TA2 or TA3 Calculator	Yes*
Zero Energy Codes	TA2 Subtopics C & D	Custom Codes	TA2 Calculator	Yes
	TA3 Subtopic B	Innovative Approaches (BPS)	TA2 or TA3 Calculator	Yes*

*DOE assistance for Topic Area 3 is available for all proposals *except* for commercial and multifamily BPS proposals which must use the TA3 Calculator.

If you believe you will require assistance from DOE in conducting the equivalence calculation as part of the application eligibility review process, **please indicate this in your concept paper.**

More information is available in ***Section IV(D)(vi)*** *of the FOA.*

When do I need to determine equivalence?

Concept Paper (February 9th)

- Applicants must select a topic area and subtopic area for their proposal
  - The subtopic area *may change* between the concept paper and the full application
- Applicants should indicate if they believe they will need DOE assistance in conducting their equivalence determination.
- Equivalence calculations are ***not required*** for the concept paper

Full Application (April 30th)

- Equivalence determination is ***required***.
- Applicants must submit the completed calculations in line with **Section IV(D)(vi)** of the FOA

OR

Submit the required information to leverage DOE assistance in conducting an equivalence determination per **Section IV(D)(vi)** of the FOA.

Deadlines & Feedback

Concept Papers (No Equiv Calc)	February 9, 2024 (5pm ET)
Full Applications (Equiv Calc Due)	April 30, 2024 (5pm ET)

Submit additional questions to IRACodes@hq.doe.gov

Answers are posted to Infrastructure Exchange through the FAQ process described in the FOA.

Reference Slides: Equivalence Methodology

Document and Calculation Overviews

Equivalence Methodology Document Overview

- **Section 1: Introduction**
- **Section 2: Determining Equivalence**
  - Outlines requirements for equivalence calculations and submission materials by topic and subtopic area
- **Section 3: Equivalency Calculation Requirements**
  - Outlines modeling software requirements
  - Provides data sources required & referenced in later sections
- **Section 4: Custom or Innovative New Construction and Major Renovation Codes**
- **Section 5: Innovative Building Energy Code Approaches for Existing Buildings**

Download the Equivalence Methodology Document here.

Section 4

Equivalence for New Construction and Major Renovations

Energyville, USA – Background

Energyville wants to adopt a new residential building energy code to create more efficient, affordable, and resilient new homes during a construction boom.

Energyville

Current Residential Code:

- 2012 IECC with Amendments

Proposed Code:

- 2021 IECC with Amendments

Equivalence Methodology:

- Section 4

Energyville, USA – Section 4.1

- Determine the Current Code Energy Performance (CCEP)
  - Open the "IRA Codes Equivalence Methodology Inputs" spreadsheet provided in Section 3.2.1(b) and locate the "Residential_EUI" tab. Select the State Baseline Code weighted site energy EUI figure for your state (Column C).
    - This value is normalized by floor area and no longer needs to be scaled by population.

B	C	D	E
	Weighted Site Energy (kBtu/ft2)		
State	State Baseline Code	2021 IECC	2021 IECC Appendix RC (without OPP)
Alabama	28.28	24.24	13.23
Alaska[1]	53.18	49.07	28.26
Arizona[2]	39.68	31.65	14.07
Arkansas	42.26	29.41	14.98
California	24.65	24.65	11.15
Colorado[2]	39.36	34.79	19.69
Connecticut	36.95	36.95	21.60
Delaware	29.89	26.43	15.67
District of Columbia	32.61	29.09	16.14
Florida	27.42	24.01	12.70
Georgia	29.00	24.40	13.69
Hawaii	32.30	29.02	12.56
Idaho	44.93	34.54	19.37
Illinois	45.27	38.69	22.83
Indiana	46.93	37.02	20.22
Iowa	42.87	36.43	22.10
Kansas[2]	37.10	32.57	17.13
Kentucky	40.30	28.88	15.90
Louisiana	30.54	28.60	13.58
Maine	46.12	43.03	23.09
Maryland	26.56	25.87	15.13
Massachusetts	39.66	37.95	22.50
Michigan	48.11	40.64	23.98

Residential_Bldg_Wts | Commercial_Bldg_Wts | **Residential_EUI** | Commercial_EUI | +

Energyville, USA – Section 4.2

- Calculating the proposed code energy performance (PCEP)
  - Use the Residential Prototype Building Models, provided in Section 3.2.1.c, to perform the EUI analysis for the various building combinations. Select the models that correspond to the appropriate version of code and climate zones for the proposal
    - In this case: 2021 IECC Prototypes for CZs 3A and 5B
    - Each of the prototypes covered by the proposed code (e.g.: single family slab basement w/ electric furnace, etc.), must be modeled to determine a Site EUI.

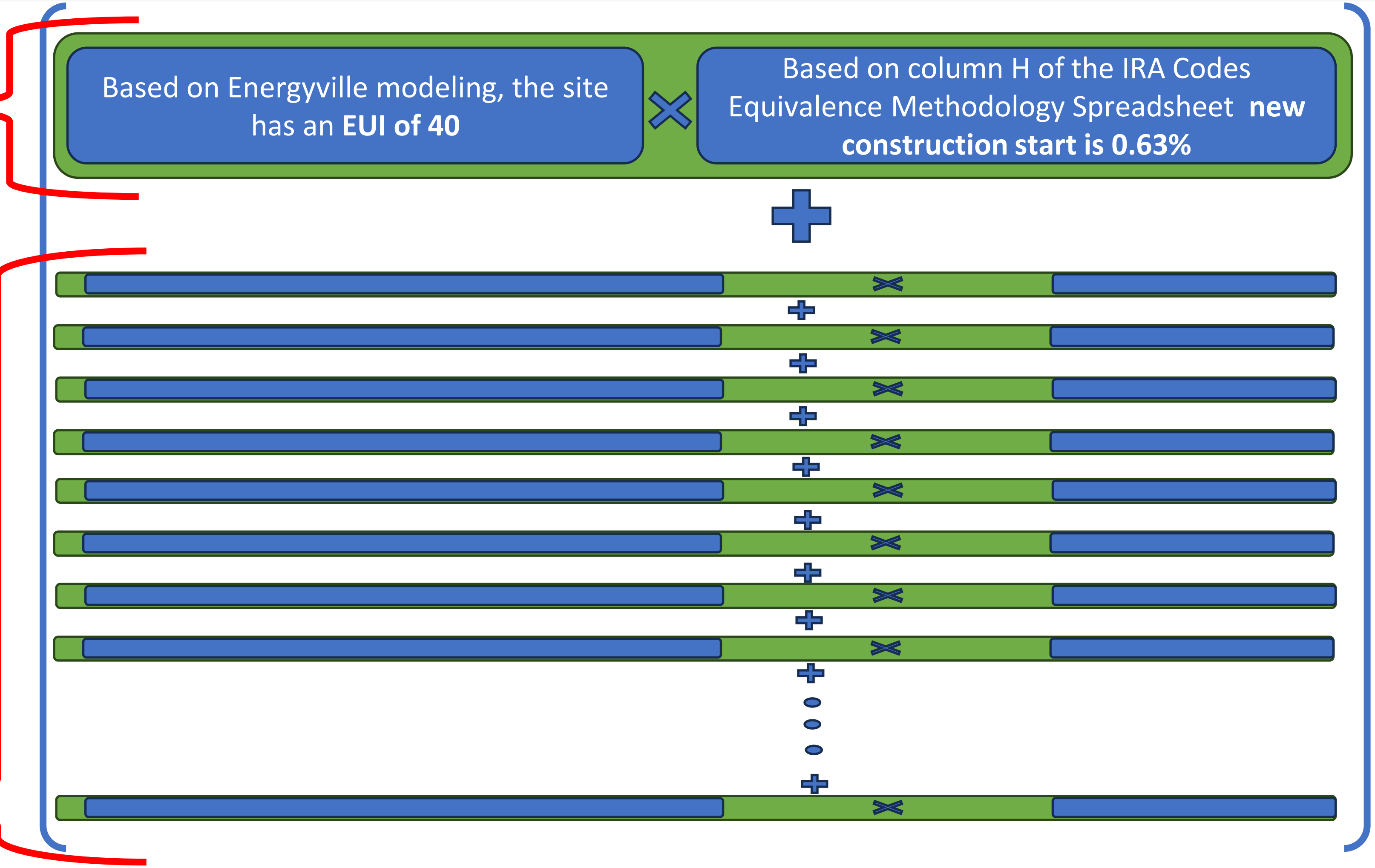
Climate Zone	Moisture Regime	Humidity Designation	Tropical Designation	Foundation Type	Heating System	Single Family	Multifamily
2	A	Warm-Humid	Not Tropical	Slab	Electric Furnace	0.19%	0.02%
2	A	Warm-Humid	Not Tropical	Crawlspace	Heat Pump	4.71%	0.63%
2	A	Warm-Humid	Not Tropical	Crawlspace	Oil Furnace	0.00%	0.00%
3	A	Not Warm-Humid	Not Tropical	Slab	Electric Furnace	0.63%	0.09%
3	A	Not Warm-Humid	Not Tropical	Slab	Gas Furnace	6.41%	0.86%

  - To calculate a weighted Site EUI, return to the IRA Codes Equivalence Methodology spreadsheet and locate the “Residential_Bldg_Wts” tab. Locate the appropriate rows that correspond to the prototypes modeled in your state and climate zone, and multiply the Site EUI by the % from the building type column for each prototype.
    - % represents portion of square footage by building type for new construction starts

Energyville, USA – Section 4.2

Prototype 1: Per the Residential_Bldg_Wts tab of the IRA Codes Equivalence Methodology Spreadsheet, looking at Single family homes in climate zone 3A with slab basement and electric furnace

Proposed Code Energy Performance =



All other Prototypes: Use modeling software, per the requirements in Section 3.1, to calculate the EUI of the different climates, foundation types and heating equipment. Multiply each prototype EUI by the corresponding % and sum up all the different types. The sum of the % should equal 1.

PCEP = **45 kBtu/sf**

Energyville, USA – Section 4.2

- Qualified code energy performance (QCEP)
  - Energy performance of the corresponding statute-specified code
    - 2021 IECC in this case
  - Use the values in Column D of the IRA Codes Equivalence Methodology Spreadsheet in Section 3.2.1(b).

Qualified Code Energy Performance

B	C	D	E
	Weighted Site Energy (kBtu/ft2)		
State	State Baseline Code	2021 IECC	2021 IECC Appendix RC (without OPP)
Alabama	28.28	24.24	13.23
Alaska[1]	53.18	49.07	28.26
Arizona[2]	39.68	31.65	14.07
Arkansas	42.26	29.41	14.98
California	24.65	24.65	11.15
Colorado[2]	39.36	34.79	19.69
Connecticut	36.95	36.95	21.60
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Hawaii	32.30	29.02	12.56
Idaho	44.93	34.54	19.37
Illinois	45.27	38.69	22.83
Indiana	46.93	37.02	20.22
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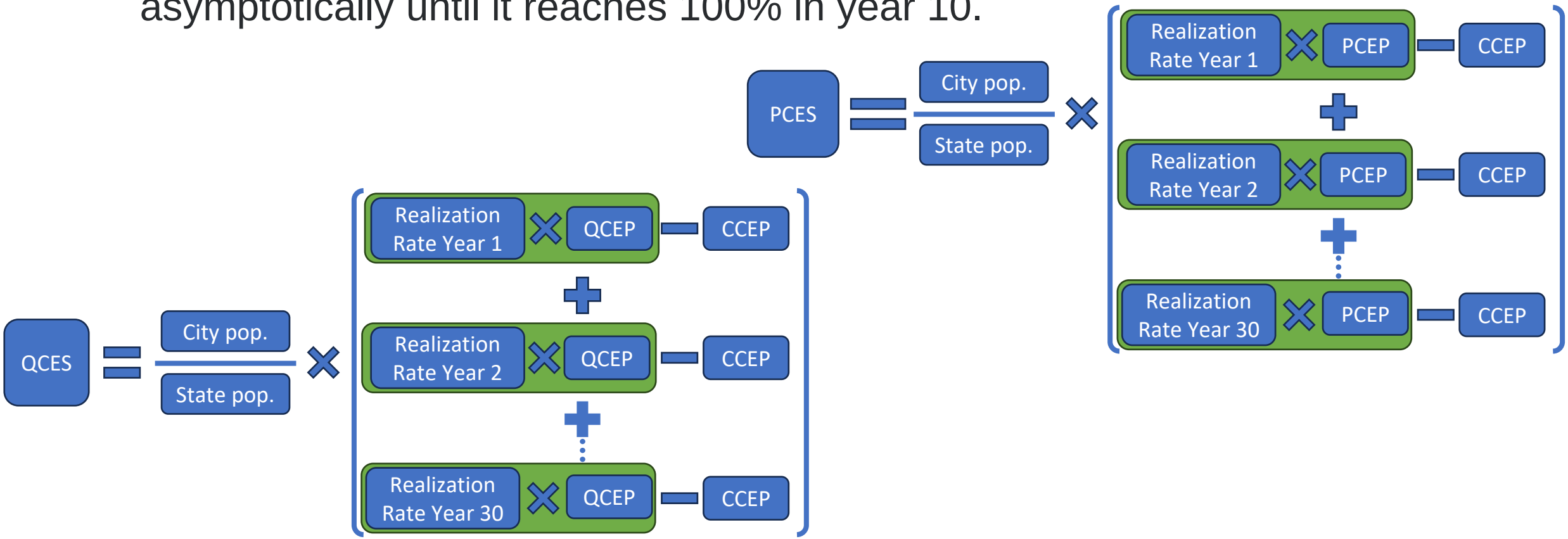
Louisiana	30.54	28.60	13.58
Maine	46.12	43.03	23.09
Maryland	26.56	25.87	15.13
Massachusetts	39.66	37.95	22.50
Michigan	48.11	40.64	23.98
Minnesota	44.27	39.97	23.74
Mississippi[1]	28.48	25.16	13.76
Missouri[2]	36.48	32.16	17.09
Montana	42.05	38.01	20.91

Residential_Bldg_Wts | Commercial_Bldg_Wts | Residential_EUI | Commercial_EUI

Energyville, USA – Section 4.3

- Calculating qualified code energy savings (QCES) and proposed code energy savings (PCES) – Section 4.2.2 and 4.2.3
  - Residential code savings realization rate: 80% in year 1, increasing asymptotically until it reaches 100% in year 10.



Energyville, USA – Section 4.4

- Calculating Equivalence
  - Ratio of proposed code energy savings (PCES) and qualified code energy savings (QCES)
  - Allowing a 1% variance as margin of error

$$\frac{\text{Proposed Code Energy Savings}}{\text{Qualified Code Energy Savings}} \geq 0.99$$

If the ratio is greater than or equal to 0.99, then Energyville's code proposal meets the equivalence requirement.

**Note: For ZEC equivalence, one additional step must be taken to compare RE generation procurement factors. This process is explained in the methodology but not shown here.

Using the Topic Area 2 Calculator

- Applicable for any new construction and major renovation code proposals for LMC or ZEC (backstop) equivalence.
- Users will need to calculate the PCEP based on Sections 4.1 and 4.2 to use the calculator or may request DOE assistance.

PROGRAM INPUTS FOR NEW CONSTRUCTION:

Location Information	
Program area	City or county
State	Energy State
City or county name (if not statewide)	Energyville
City or county population (if not statewide)	1,000,000
Code Information	
IRA 50131 Specified Code for Comparison	LMC: ASHRAE 90.1-2019 (com) and/or 2021 IECC (res)
Proposed Code Residential EUI, kBtu/sf	32.0
Proposed Code Commercial EUI, kBtu/sf	
Building Type(s)	
Residential or Commercial	Residential

OUTPUTS:

Current code (residential): 2012 IECC with amendments
Current code (commercial): 2012 IECC and 90.1-2010

Site Energy Savings (30-yr cumulative, TBtu)

	Commercial	Residential
IRA-Specified Code	0.0	31.2
Applicant's Proposed Code	0.0	39.9
Proposed/Specified	#DIV/0!	1.28

Index >0.99 is considered equivalent

Section 5

Equivalence for Existing Buildings

State of Codetopia – Background

Codetopia wants to have a more efficient building stock and reduce GHG emission by adopting a Building Performance Standard.

Current Commercial Code:

- 2012 IECC & ASHRAE 90.1-2010

Proposed Code:

- Innovative building energy code for existing buildings to reduce site energy by 35%

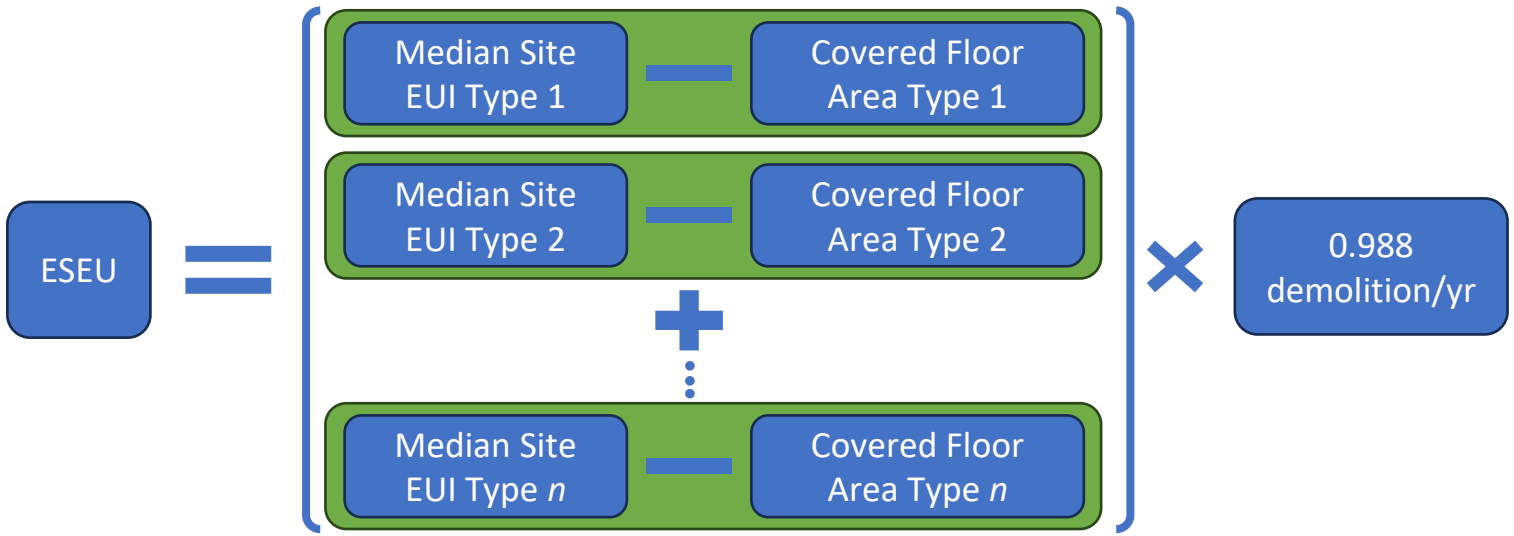
Equivalence Methodology:

- Section 5

Codetopia

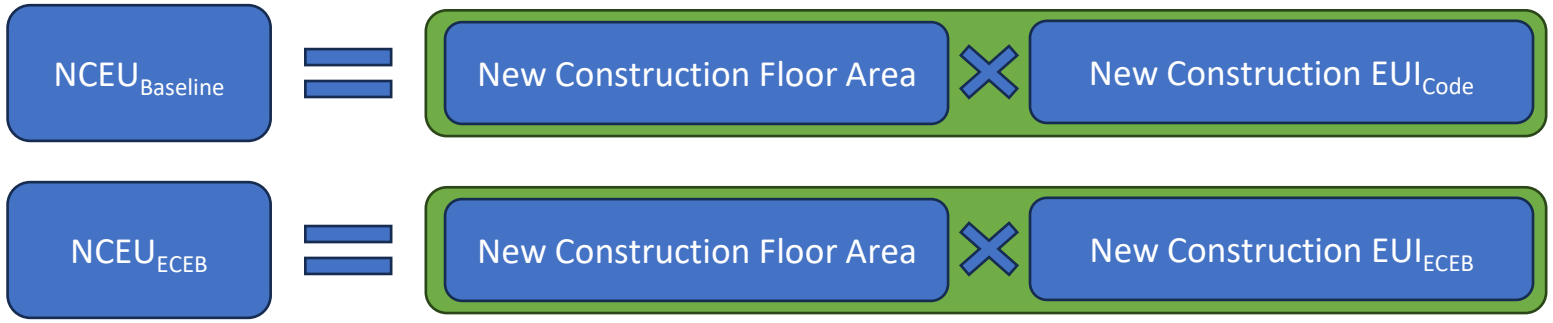
Codetopia – Section 5.1

- Calculate the energy use of the existing building stock (ESEU)
  - Identify the existing building types that will be covered by the proposal (e.g.: large offices, medium multifamily, quick service restaurants, etc.) and determine the median site EUI by type.
    - Site EUI can be calculated by building type based on Sections 5.1.2 and 5.1.3
    - Floor area can be determined by leveraging ResStock and ComStock, or by leveraging data from a preexisting benchmarking policy (must be provided with calculation)
  - ESEU over 30 years:



Codetopia – Section 5.2

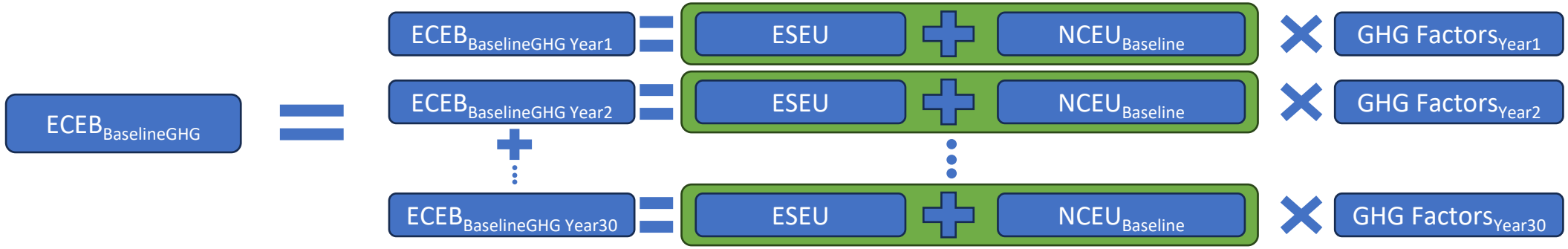
- New Construction Energy Use (NCEU)
  - Calculate the energy use of new buildings as they join the existing stock.
    - Only new construction site energy use that is *higher* than the proposed outcome-based targets will be included.
  - NCEU can be calculated using the guidance provided in Section 4 of the Equivalence Methodology. Appropriate prototype models for versions of code, and projected performance of those codes, can be found in the DOE BECP Impact Analysis, linked in Section 5.2.1.



Codetopia – Section 5.3

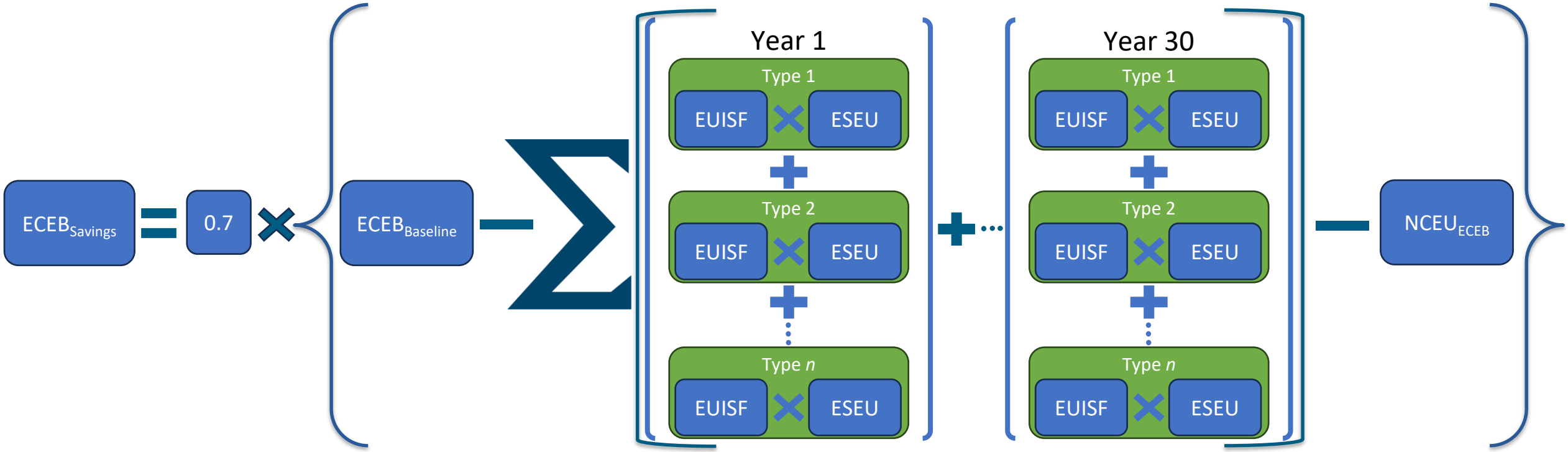
- Calculating savings from an energy code for existing buildings (ECEB)
  - First, baseline energy use must be determined. Add the new construction energy use projection to the energy use of the current existing stock calculated in Section 5.1

  - If the proposed approach uses GHG savings targets (GHGST) instead of energy savings targets, baseline emissions performance must be calculated. Annualized GHG factors are provided in Section 3.2.



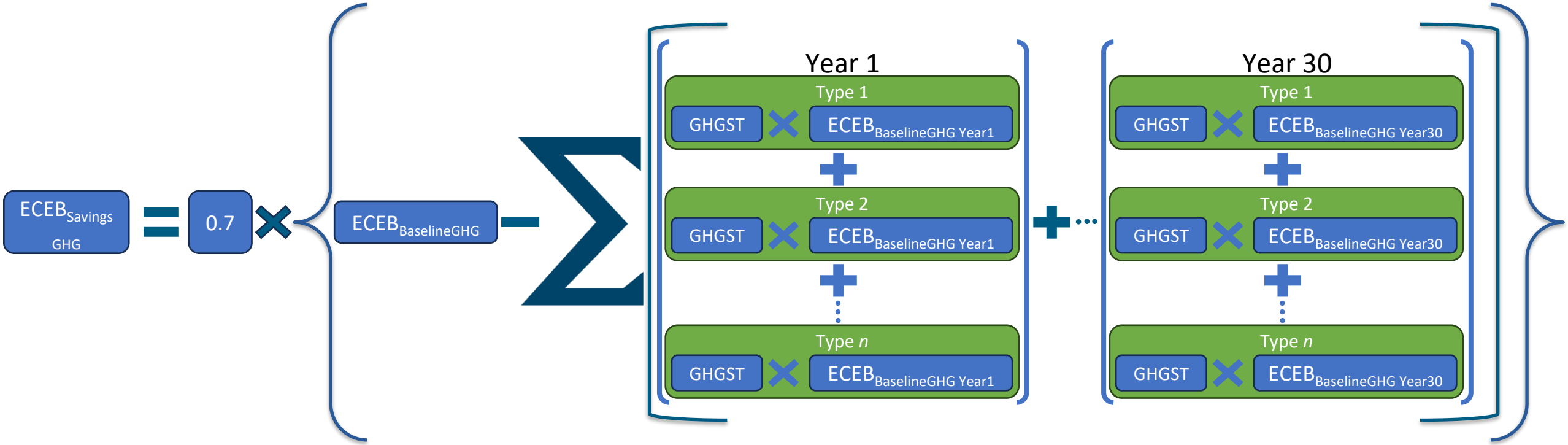
Codetopia – Section 5.3 (Energy)

- Calculating 30-year savings from an energy code for existing buildings (ECEB)
  - To calculate savings from the ECEB baseline, we need proposed savings factors. ECEB targets are often expressed as a site EUI % reduction (EUISF)
  - A 70% realization rate will be applied to the savings delivered by buildings meeting their performance targets in the proposed code



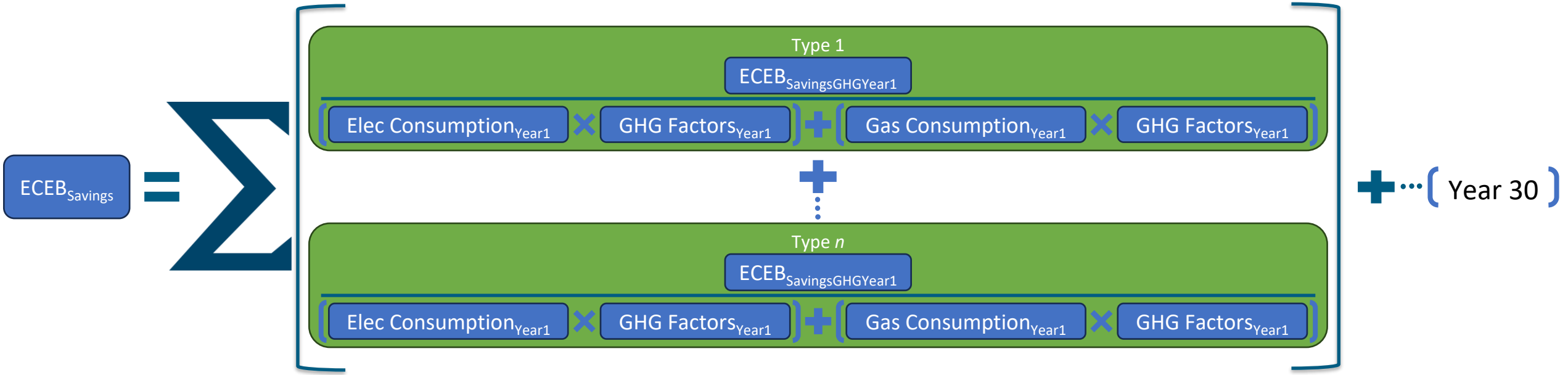
Codetopia – Section 5.3.1 (Emissions)

- Calculating 30-year savings from an energy code for existing buildings (ECEB) using outcome-based emissions targets, expressed as a % reduction (GHGST)
  - Like with energy-based targets, 70% realization rate will be applied to the calculation
  - NCEU is not considered in this scenario due to uncertainties in projecting energy source mix



Codetopia – Section 5.3.1 (Emissions…continued)

- Calculating 30-year savings from an energy code for existing buildings (ECEB)
  - GHG savings must be converted to energy savings for the proposed code
  - Conversion will use annual electricity and gas consumption across the building stock with corresponding emissions factors (e.g.: fuel mix for small offices, high rise multifamily, etc.)



Codetopia – Section 5.4

- Calculating Equivalence
  - Ratio of savings from the energy code for existing buildings ($ECEB_{Savings}$) and qualified code energy savings (QCES)
  - Allowing a 1% variance as margin of error

$$\frac{ECEB_{Savings}}{\text{Qualified Code Energy Savings}} \geq 0.99$$

If this ratio is greater than or equal to 0.99, the energy code for existing buildings meets the equivalence requirement.

**Note: For ZEC equivalence, one additional step must be taken to compare RE generation procurement factors. This process is explained in the methodology but not shown here.

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