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Vermont Building Energy Code Stakeholder RBES Meeting

April 6, 2022
1:00 – 3:00

ENERGY FUTURES GROUP
Cx associates LLC
Guidehouse
nbi new buildings institute

Agenda

1. Introductions
2. Background on RBES
3. Code Update Process Overview and Timeframe
4. Multifamily
5. Code Compliance and Enforcement
6. Goals and EUI Targets and Initial Modeling Results
7. RBES Update Summary
8. RBES Code Update Recommendations
9. Other Recommendations

Code Team: Who

- Lead State Agency
  - Public Service Department
    - Kelly Launder: Assistant Director
    - Keith Levenson: Energy Program Specialist
    - Barry Murphy: EM&V Program Manager
- Code Update Lead and Residential Code
  - Energy Futures Group
  - Liz Bourguet & Richard Faesy
- Commercial Code Update
  - Guidehouse
    - Keith Downes & Andrew Volent
  - Cx Associates
    - Eveline Killian
- National Insights
  - New Building Institute
    - Jim Edelson, Diana Burk & Sean Denniston

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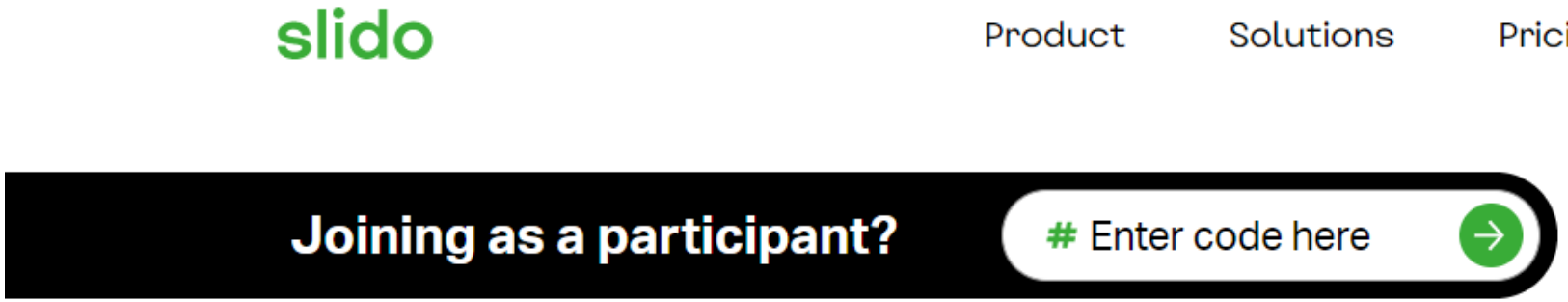
SLIDO Polling Info

- Throughout our discussion, we will be asking you to respond to poll questions
- Before we get started, please go to https://www.sli.do/
- Enter **971815** into the field at the top of the website



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Background on Vermont Residential Building Energy Codes (RBES)

- Minimum standard of energy efficiency for new and renovated residential buildings three stories or less
  - Initially passed by the Vermont legislature in May 1997
  - Updates in 2006, 2011, 2015, and 2020
- Updates are designed to provide reductions in energy use and emissions over the life of a building

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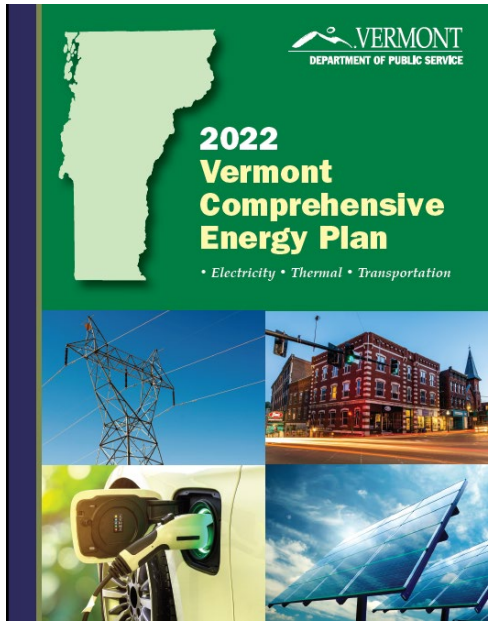
2022 Vermont Comprehensive Energy Plan Recommendations for RBES & CBES

- Energy code updates should put Vermont on a path so that all newly constructed buildings are net-zero ready by 2030.
- Consider both societal and customer cost effectiveness in analysis of code updates.
- The Legislature should authorize the Department to adopt the CBES stretch code by 2023 and authorize municipalities to adopt it.
- The Legislature should pass a builder registry requirement, with a goal that 100% of builders are registered with VT OPR and aware of the building energy standards and training opportunities by 2025.
- Consider requiring that all new constructed homes have a 200-amp service.
- Municipalities should consider requiring permitting and certificate of occupancy and provide information on the RBES and CBES when permits are being applied for.
- Municipalities should consider hiring a code official to review construction documents, receive RBES and CBES certificates, and enforce the building energy standards.
- Municipalities should consider adopting beyond base code standards and adopt the stretch code versus other standards, to maintain consistency across the state.



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Code Compliance and Enforcement

- We recognize that it's an issue for residential buildings
  - Lack of compliance undermines the objective of the building energy standards, particularly in the residential sector
  - Not only for new construction but also existing buildings
- This is an issue outside of code update process
- Talk with your legislator about adopting some of the recommendations included in the Comprehensive Energy Plan

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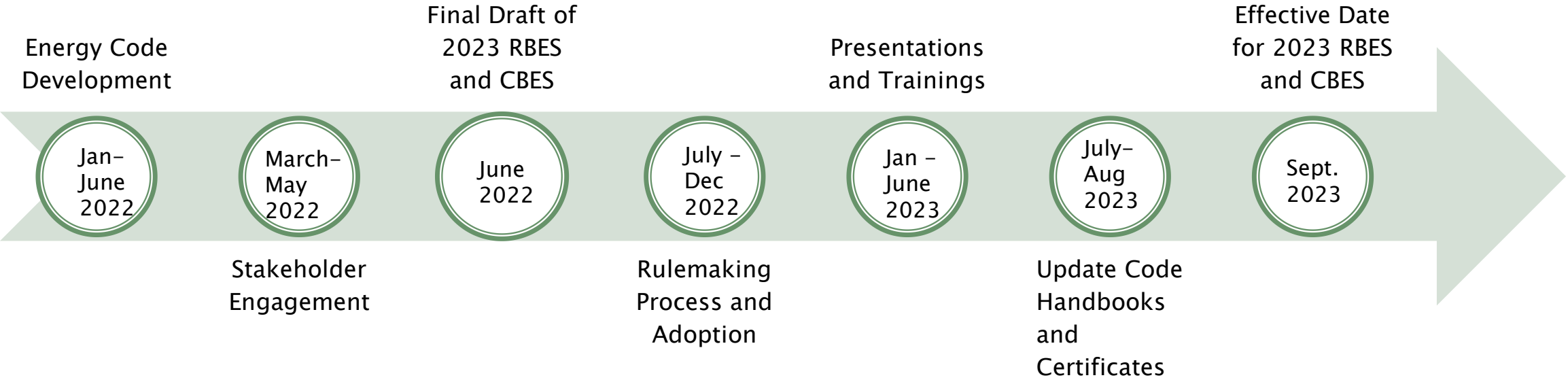
Timeline of 2023 Vermont Energy Code Update Process



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Multifamily Buildings

- Per the enabling legislation, residential portions of mixed-use buildings three stories or less must comply with RBES
- Multifamily buildings four stories or greater must comply with CBES
- Suggested approach in 2023 code update is to align language in RBES and CBES for MF buildings of all heights

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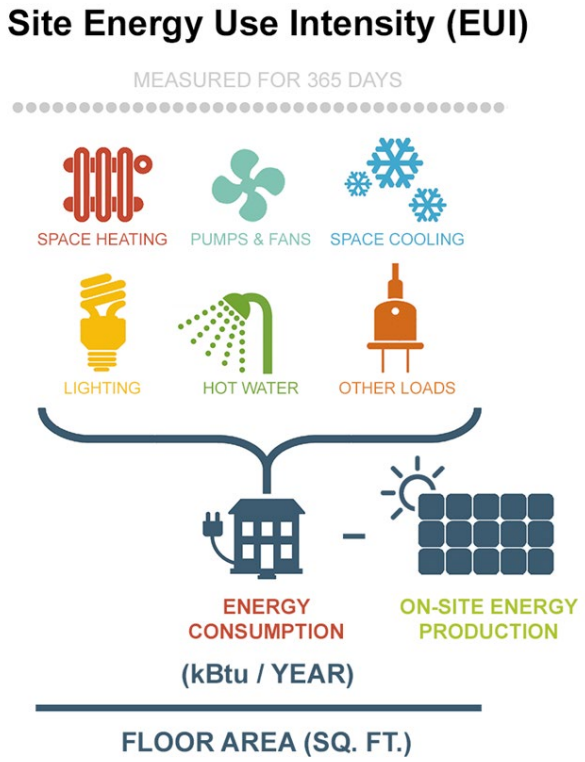
Goals and EUI Targets

- A net zero ready building is “a highly efficient and cost-effective building, designed and constructed so that renewable energy could offset all or most of its annual energy consumption” (VT 2022 CEP)
- The 2022 Comprehensive Energy Plan sets a target to achieve net-zero ready construction for all newly constructed buildings by 2030
- EUIs = Energy Use Intensity. Metric of energy performance
  - Total energy use per building square foot, used to compare and evaluate energy data
  - Energy performance modeling to EUI goals



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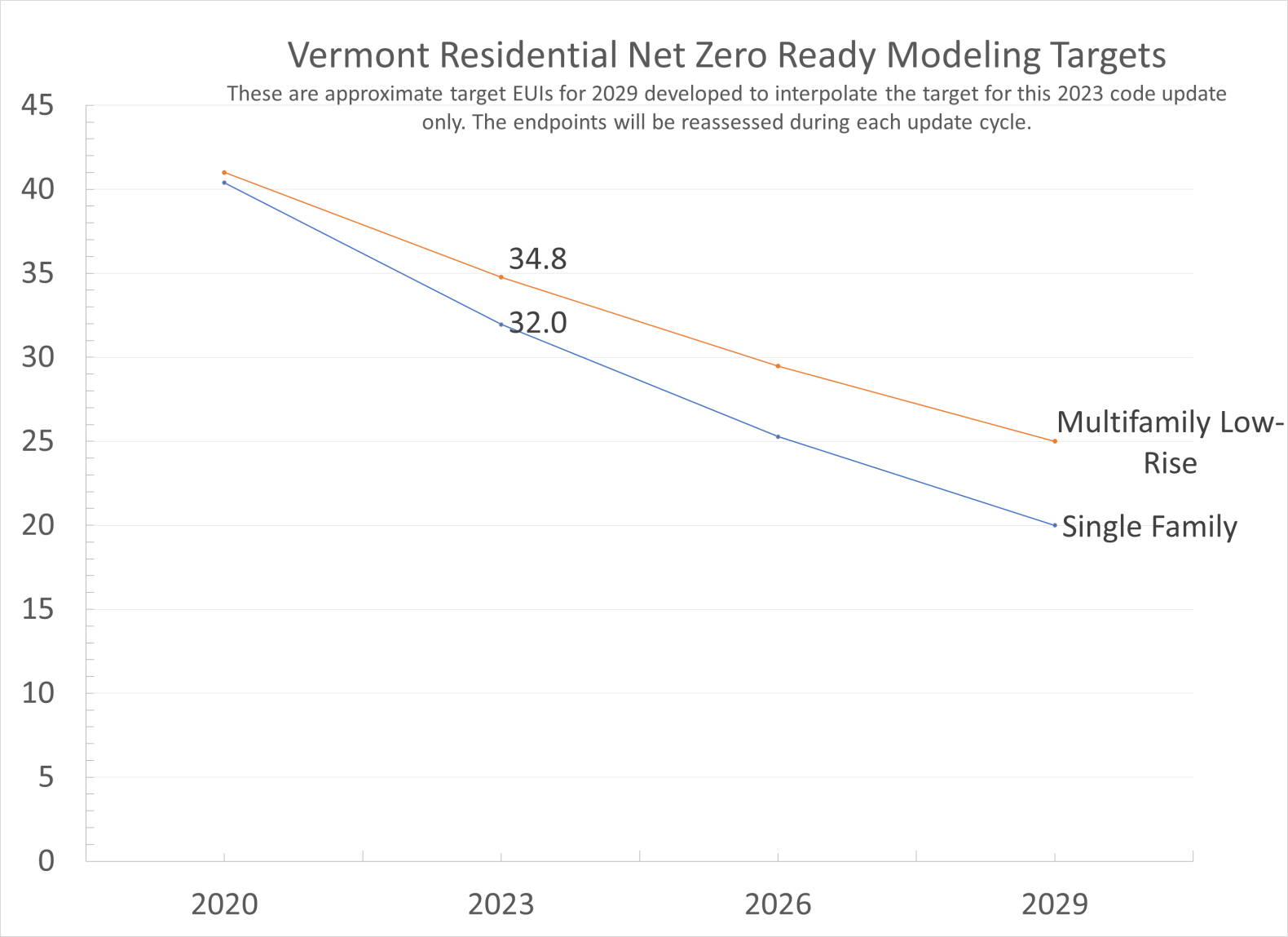
RBES EUI Modeling Targets



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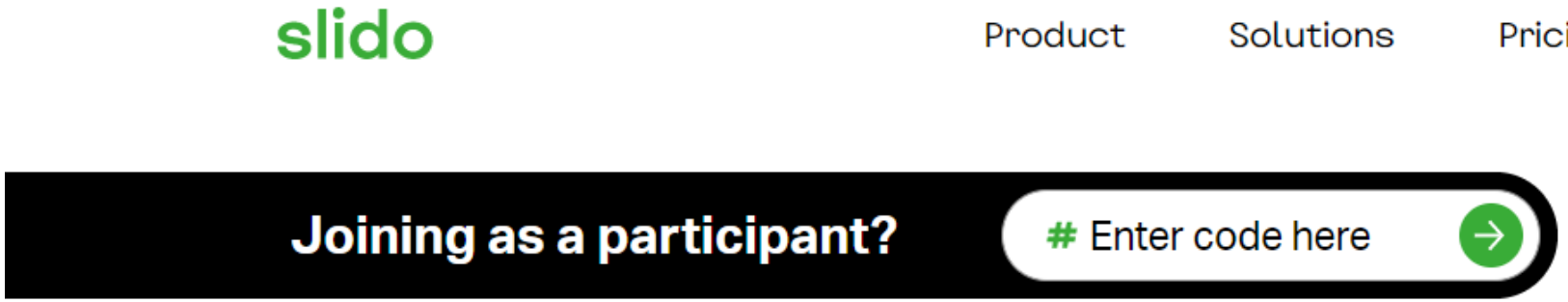

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Poll #1: 2030 Goal

- Do you agree with the 2030 “net zero ready” goal?
  - Yes
  - No
  - Maybe
  - Write comments in the chat

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Poll #2: 2023 Target

- What should the EUI target be for 2023 RBES?
  - 2020 RBES (EUI 40)
  - A little bit better than 2020 RBES
  - One-third of the way to the 2030 goal
  - Two-thirds of the way to the 2030 goal
  - Net-zero ready (i.e., around Passive House levels) (EUI 20)
  - Other (put comments in the chat)

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Review Polling Results

- 2030 RBES target
- 2023 RBES target

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Code Recommendations

RBES Recommended Updates Categories

- Building Envelope
- Mechanical Systems
- Electric/Solar
- Implementation/Administration
- Embodied Carbon Accounting

- 25 specific recommendations
  - See Advisory Committee slides on the PSD website for details

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Building Envelope Recommendations

- Increase insulation levels (R-Values)
- Require continuous insulation (remove cavity-only wall insulation with thermal bridging)
- Improve windows (require ENERGY STAR – U.27)
- Decrease air leakage rate (change leakage rate to 2 ACH50 from 3)
- Simplify and clarify sub-slab insulation requirements
- Offer a Passive House alternative compliance path

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Mechanical Systems Recommendations

- Require heat/energy recovery balanced ventilation systems instead of exhaust-only systems
- Require dampers on mechanical ventilation systems
- Specify modulating and variable speed equipment sizing limits and not just equipment capacity size limits
- Install all ducts and air handling units in conditioned space only and not in unconditioned spaces
- Provide make-up air for multifamily common laundry rooms

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Electric/Solar Recommendations

- Install electric vehicle (EV) changing “ready” components (electrical conduit, space on elec panel)
- Ensure that electric panel is ready for “all-electric” house
- Require “solar ready zone” and components (conduit to solar PV location, electric panel space, roof load documentation)
- Include options for electric grid resilience including hybrid heating system for peak electric grid times
- Reference the CBES lighting requirements for parking and exterior spaces for MF buildings

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Implementation/Administration

2020 RBES		2023 Proposed	
Sq. Ft.	Points	Sq. Ft.	Points
MF<2,000	4	<1,000	~2
<2,000	5	1,000-2,500	~6
2,000-4,000	7	2,501-4,000	~8
>4,000	10	>4,000	~12

- Adjust Points thresholds: See table
- Implement window-to-wall ratio requirements to limit windows
- Change air leakage measurement units from air-changes per hour ACH50 to CFM50/sq. ft. of exterior shell area (ESA) to align with CBES
- Require specific points for Additions and Alterations
- Tighten envelope backstop for U-Factor Alternative and UA Envelope compliance paths

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Embodied Carbon Accounting

Simple cost-effective insulation choices can significantly lower a building's embodied carbon emissions (kg CO2e), often equivalent to 5-20 years of operational carbon emissions

Recommendations for integrating into Energy Code:

- Keep it simple
- Use established methods (don't reinvent wheel)
- Make it optional, but reward effort
- Focus only on material choices directly associated with Energy Code

Recommendation

- Simple table, simple calculation to determine key metric: Global Warming Potential (GWP)/square footage (kg CO2e/sq.ft)
- Points:
  - 1 pt – do it — No effort other than taking time to calculate
  - 2 pt – result is less than 0.5 — Moderate effort needed to achieve
  - 3 pt – result is less than 0 — Deep effort needed to achieve

Calculation

Assembly	Material	R-value		Sq ft (gross)		Multiplier (from table)		Result (kg CO2e)
Foundation, horizontal (under slab)			X		X		=	
Foundation, vertical			X		X		=	
Above grade walls, cavity			X		X 0.8 X		=	
Above grade walls, continuous			X		X		=	
Roof, flat			X		X		=	
Roof, sloped, cavity			X		X 0.8 X		=	
Roof, sloped, continuous					X			

Material	GWP per 1m^2 RSI-1, kgCO2e	Factor
Straw - panel	-10.88	**-0.178**
Wood fiber - board	-7.13	**-0.117**
HempCrete - block	-5.67	**-0.093**
Cellulose - densepack, 3.55 pcf	-2.16	**-0.035**
Wood fiber - batt	-1.96	**-0.032**
Cellulose - blown/loosefill, 1.29 pcf	-0.83	**-0.014**
Fiberglass - batt	0.68	**0.011**
Fiberglass - blown/loosefill	1.30	**0.021**
Phenolic foam - board	1.54	**0.025**
SPF - open cell	1.59	**0.026**
Fiberglass - blown/spray	1.64	**0.027**
Polyiso - board, foil faced	2.32	**0.038**
EPS board, Type I - 10psi	2.63	**0.043**
Polyiso - board, GRF facers (roof)	2.63	**0.043**
Mineral wool - batt	3.25	**0.053**
EPS board, Type IX - 25psi	3.49	**0.057**
Cellular glass - aggregate	3.93	**0.064**
SPF - closed cell HFO	4.00	**0.065**
Mineral wool - board high density	4.06	**0.066**
SPF - roofing HFO	4.74	**0.078**
Mineral wool - blown	5.18	**0.085**
Fiberglass - board	7.37	**0.120**
XPS - board, 15psi HFO/HFC	7.41	**0.121**
XPS - board, 25psi HFO/HFC	8.83	**0.145**
XPS - board, 40psi HFO/HFC	10.26	**0.168**
XPS - board, 60psi HFO/HFC	12.55	**0.205**
SPF - closed cell HFC	14.86	**0.243**
XPS - board, 100psi HFO/HFC	17.10	**0.280**
SPF - roofing HFC	19.33	**0.316**
SPF - 2K-LP HFC	25.46	**0.416**
XPS - board, 15psi HFC	39.04	**0.639**
XPS - board, 25psi HFC	46.51	**0.761**
XPS - board, 40psi HFC	54.04	**0.884**
XPS - board, 60psi HFC	66.06	**1.080**
XPS - board, 100psi HFC	90.05	**1.473**

Kg CO_2e/sq.ft.

Values are from https://www.efficiencyvermont.com/news-blog/whitepapers/the-high-greenhouse-as-price-tag-on-residential-building-materials

Example: Single family home, 25’x40’ footprint, basement plus 2 stories (3000 sf)

Assembly	Material	R-value		Sq ft (gross)		Multiplier (from table)		Result (kg CO2e)
Foundation, horizontal (under slab)	EPS Type IX	10	X	1000	X	0.057	=	570
Foundation, vertical	Polyiso	20	X	1040	X	0.038	=	790
Above grade walls, cavity	FG batts	21	X	2340	X 0.8 X	0.011	=	432
Above grade walls, continuous	Polyiso	12	X	2340	X	0.038	=	1067
Roof, flat	Cellulose	60	X	1000	X	-0.014	=	-840
Roof, sloped, cavity			X		X 0.8 X		=	
Roof, sloped, continuous					X			

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2019 (divided by 3000) =
0.67 kg CO_2e/sq.ft.

This building would get 1 point (for just doing the calculation).
There are various ways it could achieve 2 points. For example replacing FG batts with dense-pack cellulose.

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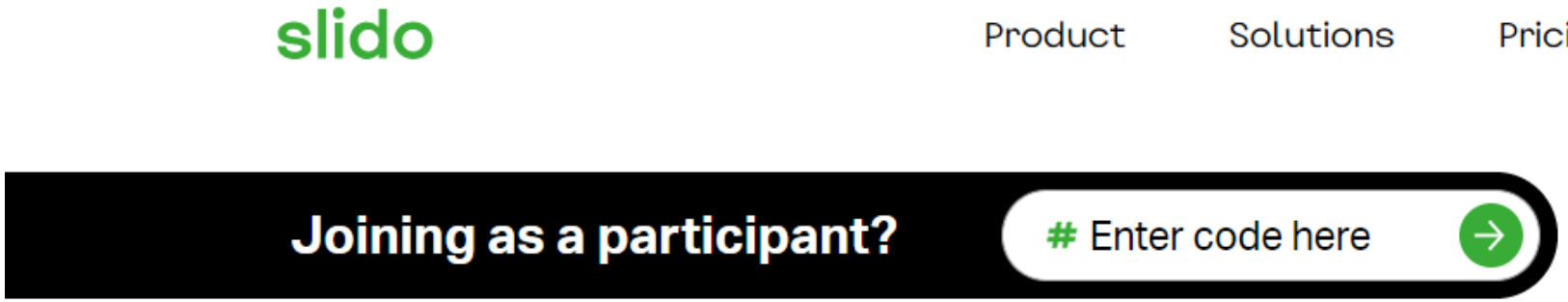

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Poll #3: Decision-Making for Recommendations

- What factors would be most important in deciding to implement these recommendations?
  - Cost
  - Energy Savings
  - Greenhouse Gas Savings
  - Cost-effectiveness (i.e., cost/savings or positive cash flow)
  - Availability of products, materials or qualified contractors
  - Ease of implementation
  - Other (put comments in the chat)

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Discussion of Poll Results and Q&A

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Energy Code Update Information & Comments

- **BUILDING ENERGY STANDARDS**
  - https://publicservice.vermont.gov/content/building-energy-standards
- **BUILDING ENERGY STANDARDS UPDATE**
  - https://publicservice.vermont.gov/content/building-energy-standards-update
- **ENERGY CODE UPDATE COMMENTS**
  - https://publicservice.vermont.gov/content/energy-code-update-comments

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Thank you for your time and input!

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