

Did You Hear Energy Intensity was Flirting with Carbon Intensity?

Maximizing the Decarbonization Potential of Energy Efficiency Programs

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What is Embodied Carbon in the built environment?



Carbon Emissions in Building: 'Upfront' Embodied Carbon and Operational Carbon



'Upfront' Embodied Carbon

Manufacture, transport and installation of construction materials

Operational Carbon Building energy consumption



Image source: Skanska USA



What are possible unintended carbon emission impacts associated with energy efficiency programs?





Our focus: Embodied Carbon in building insulation materials

Relevant program types: new construction, retrofit or renovation programs that incentivize building envelope improvements

Sectors: All existing and new buildings in the built environment





- Literature Review: Scanned existing literature on embodied carbon in construction materials, with emphasis on insulation materials
- Database Review: Scanned publicly available embodied carbon databases
- Interviews: Conducted ten interviews with embodied carbon industry experts
- Potential Analysis: Estimated impact of embodied carbon in insulation types and levels associated with baseline single-family construction practices in three states in the Northeast





What changes have occurred in building shell performance?

- Generally, R-values have been improving in baseline homes over time.
- Likely due to energy code updates and changing building practices. Some of which likely come from program influences.



How have insulation materials changed over time?



- Increased building shell efficiency is driven by a change in insulation materials
- Application of spray foams has increased in baseline homes



Batt Insulation Spray Foams Foam Board Blown Insulation



- Generally, materials that are more efficient by volume have higher GWP.
- Some materials, typically biogenic materials, can sequester carbon.



Source: Magwood et al., 2021



What are the estimated changes in embodied carbon



 Increases in efficiency and changes in materials used, especially spray foams and foam boards, have increased the embodied carbon content of insulation in new homes.





What does this change mean?



Change in Embodied Carbon for new baseline residential homes between 2015 and 2019 from insulation materials







Can programs adapt to achieve better outcomes?



Practical Considerations for Quantifying embodied carbon in Participating NMR Projects

- How to address data collection needs (who and how)?
- How to quantify?
 - Quantifying ECE is complex, but limiting scope (A1-A3, A5 phases with insulation focus) simplifies the process
- Leverage existing tools and data collection activities
 - HERS ratings, existing energy modeling software (all volumetric data needed for insulation)
 - Programs already use HERS raters to verify program eligibility
 - Combine with publicly available EPDs





Elephants in the Room: Regulatory Frameworks and Funding

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- Programs lack space (regulatory/funding/cost-effectiveness) to innovate for decarbonization
- Will emerging decarbonization policies open paths for regulatory shift?
- How to fund?















Alignment with decarbonization goals







Can programs with POTENTIAL to further decarbonize the building sector afford not to?



Thank You

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