

INVITATION TO SUBMIT A RESEARCH PROPOSAL ON AN ASHRAE RESEARCH PROJECT

1988-SP, Whole-Life Carbon Gap Analysis

Attached is a Request-for-Proposal (RFP) for a project dealing with a subject in which you, or your institution have expressed interest. Should you decide not to submit a proposal, please circulate it to any colleague who might have interest in this subject.

Sponsoring Committee: Center of Excellence for Building Decarbonization

Co-sponsored by: TC 2.08, Building Environmental Impacts and Sustainability; TC 4.04, Building Materials and Building Envelope Performance; TC 4.07, Energy Calculations; TC 6.07, Solar and Other Renewable Energies & TC 7.06, Building Energy Performance

Budget Range: \$80,000 may be more or less as determined by value of proposal and competing proposals.

Scheduled Project Start Date: **September 1, 2025**, or later.

All proposals must be received at ASHRAE Headquarters by 8:00 AM, EDT, July 18th, 2025. NO EXCEPTIONS, NO EXTENSIONS. Electronic copies must be sent to rp bids@ashrae.org. Electronic signatures must be scanned and added to the file before submitting. The submission title line should read: 1988-SP, "Whole-Life Carbon Gap Analysis", and "*Bidding Institutions Name*" (electronic pdf format, ASHRAE's server will accept up to 10MB)

If you have questions concerning the Project, we suggest you contact one of the individuals listed below:

For Technical Matters

Technical Contact

Lisa Ng

Phone: 301-975-4853

E-mail: lisa.ng@nist.gov

For Administrative or Procedural Matters:

Manager of Special Projects

Derrick Nesfield

ASHRAE, Inc.

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Peachtree Corners, GA 30092

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Contractors intending to submit a proposal should notify, by mail or e-mail, the Manager of Special Projects by July 1st, 2025, in order that any late or additional information on the RFP may be furnished to them prior to the bid due date.

All proposals must be submitted electronically. Electronic submissions require a PDF file containing the complete proposal preceded by signed copies of the two forms listed below in the order listed below. **ALL electronic proposals are to be sent to rp bids@ashrae.org.**

All other correspondence must be sent to dnesfield@ashrae.org. In all cases, the proposal must be submitted to ASHRAE by 8:00 AM, EDT, July 18th, 2025. NO EXCEPTIONS, NO EXTENSIONS.

The following forms (Application for Grant of Funds and the Additional Information form have been combined) must accompany the proposal:

- (1) ASHRAE Application for Grant of Funds (electronic signature required) and
- (2) Additional Information for Contractors (electronic signature required) ASHRAE Application for Grant of Funds (signed) and

ASHRAE reserves the right to reject any or all bids.

State of the Art (Background)

ASHRAE defines the following: whole-life carbon (WLC) emissions as the total greenhouse gas emissions, including operational carbon emissions and embodied carbon emissions over the life cycle of an asset (i.e., building). Greenhouse gases (GHG) are gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapor (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄), and ozone (O₃) are the primary GHGs in the Earth's atmosphere. Moreover, there are a number of entirely human-made GHGs in the atmosphere, such as the halocarbons and other chlorine- and bromine-containing substances, dealt with under the Montreal Protocol. Besides CO₂, N₂O and CH₄, the Kyoto Protocol deals with the GHGs sulphur hexafluoride (SF₆), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). Decarbonization is the process of removing or reducing greenhouse gases.

For all new and existing buildings to achieve significant carbon reduction by 2030 and net-zero carbon emissions by 2050, a comprehensive approach to whole-life carbon (WLC) assessment is essential. Keep in mind that ASHRAE defines WLC emissions, as noted above, as total GHG emissions.

ASHRAE has made great strides in supporting more robust WLC assessment: ASHRAE 240P "Evaluating Greenhouse Gas (GHG) and Carbon Emissions in Building Design, Construction and Operation" is being developed to provide a methodology to quantify the embodied and operational GHG emissions associated with buildings and their sites as well as minimum requirements for documentation of life cycle GHG emissions. In addition, ASHRAE 242P "Standard Method for Calculation of Building Operational Greenhouse Gas Emissions" is being developed to provide a consistent procedure and data for the calculation of GHG and carbon emissions from the operation of new and existing buildings.

Several other ASHRAE and industry publications provide additional relevant guidance such as the ASHRAE Whole Life Carbon Guide for Building Systems, ASHRAE Whole Life Carbon Calculation Guide for Building Systems, and Royal Institution of Chartered Surveyors (RICS) Whole Life Carbon Assessment for the Built Environment. While these provide a strong foundation for standardizing whole-life calculations, uniformly operationalizing this with existing tools remains a challenge. Existing commercial software tools do conduct extensive operational carbon and embodied carbon analyses, but these efforts have historically been isolated and introduced in standalone tools, separated from commonly used building simulation and design tools.

Furthermore, standardized data is needed to support relevant WLC calculations particularly for building components such as mechanical electrical and plumbing (MEP). As an example, ASHRAE RP-1929 "Evaluation of building life cycle analysis tools incorporating embodied carbon" has identified that Environmental Product Declarations (EPDs) are lacking standardized descriptions for determining embodied carbon – for MEP components in general, and for North America specifically. Defining Product Category Rules (PCRs) for MEP would enable the publishing of EPDs for North American MEP products, rather than trying to fit within PCRs developed for other markets. In the European Union, the relevant regulatory framework (BPIE 2025) is evolving with several instruments, which navigate towards mandatory environmental product information. For example, the revised Energy Performance of Buildings Directive (EPBD Directive EU/2024/1275)(EU 2024a) that mandates a life cycle assessment for new buildings calculating a numeric indicator for each life-cycle stage expressed as kgCO₂eq/m² of useful floor area that is disclosed in the energy performance certificate of the building, in line with the Level(s) common EU framework and in accordance with EN 15978:2011 Sustainability of construction works. Assessment of environmental performance of buildings - Calculation method (EN 2011). In addition, the new EU rules for the Construction Product Regulation (EU 2024b; EU 2025) introduce digital product passports that will provide all information on construction products that will also enable reliable calculations of the carbon footprint of buildings. However, data availability is very limited in many parts of the world, since EPDs are not mandatory by law and national data is scarce. Standardized data is also needed to support WLC calculations that include the indoor environmental quality (IEQ) impact on the built environment. Work is beginning at the National Institute of Standards and Technology (NIST) to incorporate IEQ metrics into the existing Building Industry Reporting and Design for Sustainability Neutral Environmental Software Tool (BIRDS NEST) platform (Kneifel et al. 2017).

ASHRAE members and other professionals turn to ASHRAE looking for resources, tools, and guidance on how to adapt or generate the necessary data, and for practical data and simulation tools, that can be used or integrated in

their design and construction practices. Thus, it is imperative that ASHRAE gains a comprehensive understanding of the existing and upcoming standards, guidelines, datasets and tools for WLC analyses, so that ASHRAE can identify the investments it makes next to best enable robust WLC analyses for practitioners.

Justification and Value to ASHRAE

According to the ASHRAE Position Document on Building Decarbonization (ASHRAE 2022), by 2030, the global built environment must halve its 2015 GHG emissions, including at least a 40% reduction in new construction embodied carbon. By 2050, at the latest, all new and existing assets must be net zero GHG emissions across the whole life cycle. Achieving this goal requires a comprehensive approach to understanding and mitigating WLC emissions. This will encompass both embodied emissions generated during the extraction, production, and construction of building materials, and operational emissions produced during the building's use phase for all energy carriers and all end-uses, such as heating, cooling, and lighting, equipment and appliances. Embodied carbon accounts for up to 50% of a building's total emissions for new high-performance buildings, making buildings a critical target for decarbonization. Thus, this project is needed in order for ASHRAE to make decisions on appropriate future investments to fill the gaps in WLC analyses that will serve its mission and members throughout the world, the building design and construction professionals and the market at-large.

Objectives

Overall, this project aims to identify the resources (standards, guidelines, datasets and tools) to standardize building WLC (embodied and operational) analyses for practitioners and to identify the need, and prospective, for the development of a unified environment for evaluating and optimizing operational and embodied carbon throughout a building's lifecycle. The project shall be limited to WLC of the building and does not include the site. The project shall be focused on meeting the needs of practitioners.

The objectives of this project are to:

1. Identify existing authoritative standards, guidelines, datasets, tools, and other resources used in WLC analyses. This may include conducting interviews with industry and other experts in WLC to supplement published and publicly available resources. Information shared during interviews will remain confidential and used only for the purposes of this project.
2. Conduct gap analysis on a prioritized list of authoritative resources identified, focused on the resources that do or would provide the largest impact to practitioners. Deliver interim analyses for: (1) standards and guides (2) datasets (3) tools beyond RP-1929, and (4) other resources, if identified by or with the Project Monitoring Subcommittee (PMS) and the ASHRAE Center for Excellence for Building Decarbonization (CEBD), while maintaining progress towards project objectives and maintaining the expected timeline.
3. Prepare reports that summarize the results of the gap analysis and provide specific and financially substantiated and prioritized recommendations on what and how ASHRAE expertise can best be used to help close gaps or facilitate future work in this area with a long-term goal of robust WLC analyses.
4. Ensure that the timeline is met in order to meet current and emerging needs in a timely fashion that has the largest impact on practitioners.

Scope:

1. The contractor shall demonstrate that they have an established network to convene a broad project team and should include a proposed list in the proposal. If the contractor has or plans to seek collaborators (funded or voluntary), those collaborators should be identified in the proposal. If the contract has or plans to support this project with independent funding, that should be identified in the proposal. A list of ASHRAE and non-ASHRAE affiliated experts who have interest in supporting the contractor as volunteers has been provided in "Other Information".
2. To meet Objective #1, the contractor shall lead the identification of authoritative standards, guidelines, datasets, tools, and other resources used in WLC analyses by practitioners in collaboration with the PMS and CEBD. The contractor shall propose a methodology for conducting the gap analysis, including but limited to how to determine if a resource is authoritative or informational; defining the scope of the gap analysis as it relates to

the life cycle stages defined in EN15978:2011 (EN 2011); and how to identify the areas of greatest need or largest impact to practitioners to pursue for detailed gap analyses. Any on-going and related ASHRAE funded research (e.g., ASHRAE RP-1929 Evaluation of building life cycle analysis tools incorporating embodied carbon and CEBD projects) must be consulted so that efforts are not duplicative (see list projects and their point of contacts in “Other Information”). The contractor is expected to supplement its expertise and publicly available information by conducting interviews with relevant WLC experts in order to capture ongoing efforts that have not yet been published while this project is underway. The contractor will assure interviewees that information shared will remain confidential and used only for the purposes of this project. The contractor shall ensure that the scope of the project coverage is focused on the largest impacts to practitioners to ensure on-time project completion. The contractor shall collaborate with the PMS and CEBD to identify the area(s) that have the highest relevance, importance and/or impact to the WLC practitioner community and use this information to prioritize the detailed gap analysis.

3. To meet Objective #2, the contractor with their team shall conduct gap analyses on the prioritized list of authoritative resources identified in Objective #1. The contractor shall deliver an interim report with the gap analyses, as agreed upon with the PMS and CEBD, for: (1) standards and guides (2) datasets (3) tools beyond what is being evaluated in RP-1929, and (4) other resources, if identified. The interim report shall include all the raw data, annotated bibliography-references and all related information that will be collected during the course of the work, such as interview questions and responses.
4. To meet Objective #3, the contractor shall prepare a final report summarizing the results from the gap analyses and include specific, financially substantiated and prioritized recommendations to ASHRAE for developing missing resources or contributing to collaborations with other entities in this area towards a long term goal of robust whole-life analyses.
5. To meet Objective #4, the contractor shall meet monthly with the PMS and CEBD to provide updates on milestone progress, project schedule, and to exchange feedback on the next steps for the project in order to ensure that the timeline is met.

Deliverables:

Interim report that will provide an overview of the implemented process to identify and collect information, the gap analysis, along with an annotated bibliography-references and all related information that was collected during the course of the work, such as interview questions and responses.

Progress, Financial and Final Reports, Technical Paper(s), and Data shall constitute the deliverables (“Deliverables”) under this Agreement and shall be provided as follows:

a. Progress and Financial Reports

Progress and Financial Reports, in a form approved by the Society, shall be made to the Society through its Manager of Special Projects at quarterly intervals; specifically on or before each January 1, April 1, June 10, and October 1 of the contract period.

The following deliverables shall be provided to the Project Monitoring Subcommittee (PMS) as described in the Scope/Technical Approach section above, as they are available:

Furthermore, the Institution’s Principal Investigator, subject to the Society’s approval, shall, during the period of performance and after the Final Report has been submitted, report in person to the sponsoring Technical Committee/Task Group (TC/TG) at the annual and winter meetings, and be available to answer such questions regarding the research as may arise.

b. Final Report

A written report, design guide, or manual, (collectively, “Final Report”), in a form approved by the Society, shall be prepared by the Institution and submitted to the Society’s Manager of Research and Technical Services by the end of the Agreement term, containing complete details of all research carried out under this Agreement,

including a summary of the control strategy and savings guidelines. Unless otherwise specified, the final draft report shall be furnished, electronically for review by the Society's Project Monitoring Subcommittee (PMS).

The report shall include specific and prioritized recommendations for future work to best address the identified gaps either within the Society or in collaboration with other properly identified entities, including a description of the key work and objectives, the timeline and budget first estimates. If needed, update the annotated bibliography-references and any new information.

Tabulated values for all measurements shall be provided as an appendix to the final report (for measurements which are adjusted by correction factors, also tabulate the corrected results and clearly show the method used for correction).

Following approval by the PMS and the TC/TG, in their sole discretion, final copies of the Final Report will be furnished by the Institution as follows:

- An executive summary in a form suitable for wide distribution to the industry and to the public.
- Two copies; one in PDF format and one in Microsoft Word.

c. *Science & Technology for the Built Environment* or ASHRAE Transactions Technical Papers

One or more papers shall be submitted first to the ASHRAE Manager of Research and Technical Services (MORTS) and then to the "ASHRAE Manuscript Central" website-based manuscript review system in a form and containing such information as designated by the Society suitable for publication. Papers specified as deliverables should be submitted as either Research Papers for HVAC&R Research or Technical Paper(s) for ASHRAE Transactions. Research papers contain generalized results of long-term archival value, whereas technical papers are appropriate for applied research of shorter-term value, ASHRAE Conference papers are not acceptable as deliverables from ASHRAE research projects. The paper(s) shall conform to the instructions posted in "Manuscript Central" for an ASHRAE Transactions Technical or HVAC&R Research papers. The paper title shall contain the research project number (1988-SP) at the end of the title in parentheses, e.g., (1988-SP).

All papers or articles prepared in connection with an ASHRAE research project, which are being submitted for inclusion in any ASHRAE publication, shall be submitted through the Manager of Research and Technical Services first and not to the publication's editor or Program Committee.

d. Data

Data is defined in General Condition VI, "DATA"

e. Project Synopsis

A written synopsis totaling approximately 100 words in length and written for a broad technical audience, which documents 1. Main findings of research project, 2. Why findings are significant, and 3. How the findings benefit ASHRAE membership and/or society in general shall be submitted to the Manager of Research and Technical Services by the end of the Agreement term for publication in ASHRAE Insights

The Society may request the Institution submit a technical article suitable for publication in the Society's ASHRAE JOURNAL. This is considered a voluntary submission and not a Deliverable. Technical articles shall be prepared using dual units; e.g., rational inch-pound with equivalent SI units shown parenthetically. SI usage shall be in accordance with IEEE/ASTM Standard SI-10.

Level of Effort

This contract will provide funding to a principal project manager (PM) and an assistant project manager. The PM and assistant PM shall have monthly check-ins with the PMS and CEBD to provide updates. Involvement of the RP-1929 team (and other representatives from related and funded ASHRAE projects) should be included in order to

avoid duplicative efforts in this project with on-going projects. The total duration of the research project is expected to be 12 months. Estimated cost of \$80,000.

No.	Proposal Review Criterion	Weighting Factor
1	Understanding of the work statement	15%
2	Quality of proposed personnel: project manager and assistant project manager; proposed team and collaborators	25%
3	Proposed methodology	20%
4	Probability of meeting objectives in scheduled time frame	25%
5	Demonstrated performance with related projects or subject matter	10%
6	Ability to convene a multidisciplinary team to achieve objectives	5%

Project Milestones:

No.	Major Project Completion Milestone	Deadline Month
1	Convene team and establish connections with RP-1929 and other related ASHRAE work	1
2	Objective #1: Define gap analysis methodology and identify authoritative standards, guidelines, datasets, tools, and other resources used in WLC analyses	2
3	Objective #2: Identify the area(s) that have the highest impact to the WLC practitioner community and will be pursued for further detailed gap analysis in collaboration with PMS and CEBD	3
4	Objective #2: Deliver interim gap analysis reports	6
5	Objective #2: Completion of gap analyses	9
6	Objective #3: Final report (including raw data and results in dual units) and synopsis to CEBD and co-sponsoring TCs as agreed-upon by CEBD and TCs	12
7	Objective #4: Monthly check-ins between contractor and PMS and CEBD	Monthly

Other Information to Bidders (Optional):

Experts to consider for project team

First Last Name	Affiliation	Practitioner, academia, or local/state/federal government	Email
Chris Lee			chris.lee@adaptis.ai
Liam Buckley			liam.buckley@iesve.com
Manoj Kumar Singh			manoj.singh@snu.edu.in

List of on-going and related approved ASHRAE projects

ASHRAE RP-1929 Evaluation of building life cycle analysis tools incorporating embodied carbon has identified that Environmental Product Declarations (EPDs) are lacking standardized descriptions for determining embodied

carbon – for MEP components in general (massive need), and for North America more specifically. Having Product Category Rules (PCRs) for MEP would make it easier to publish EPDs for North American MEP products, rather than trying to fit within European-focused PCRs. The project has begun to catalog and evaluate building LCA tools and related literature that incorporates LCC with the goal of providing ASHRAE an assessment of the “state-of-the-art,” and gap analysis that can be fulfilled by ASHRAE for ASHRAE members utility. Recommendations for potential improvements and identification of future research and development needs will be formulated. This review and evaluation effort will summarize building LCA and LCC studies and programs that are focused on methods and models of building life cycle analysis. Some of these categories of evaluation include, but are not limited to, software robustness, accuracy, usability, compatibility, adaptability, customization, availability, cost effectiveness, and flexibility. Timeline: 24 months (June 2024-August 2026) **POC: Jaya Mukhopadhyay at jaya.mukhopadhyay@montana.edu.**

The ASHRAE approved projects are:

- Whole Life Carbon Benchmarking
- Update Equipment Lifespan Tables
- Standardizing Whole Life Carbon Calculations for Building Systems

Resources

List of existing resources for review

- [ASHRAE 228](#) Standard Method of Evaluating Zero Net Energy and Zero Net Carbon Building Performance
- [ASHRAE 240P](#) Quantification of Life Cycle Greenhouse Gas Emissions of Buildings
- [ASHRAE 242P](#) Standard Method for Calculation of Building Operational Greenhouse Gas Emissions
- [RICS Whole Life Carbon Assessment for the Built Environment](#)
- [MEP2040 Embodied Carbon](#)
- [Workshop on Decarbonization: A Gap Analysis of LCA Standards for Industry](#)

International Energy Agency's [EPC Annex 89](#) project in which a large group of scholars and professionals from multiple countries are investigating tools, regulations, policies, etc. for whole-life cycle carbon emissions of buildings.

List of tools for review

The latest version of any software included in the analysis should be the latest version

Operational Carbon Modeling Tools	Carbon tools	LCA tools
California Simulation Engine (CSE)	- One Click LCA Planetary (To be evaluated under RP-1929 as well as Madaster)	- One Click LCA Expert Pack
CBECC by NORESKO/Carrier	- EC3	- TallyLCA
cove.tool	- TallyCAT	- Tekla Structures × OCLCA
DesignBuilder	- Tangible	- Tekla Structural Designer × OCLCA
		- eTool

EDSL TAS	- cove.tool	- RapidLCA
eQUEST	- EPIC	- Vizcab
EnergyPlus by DOE	- CarbonQuery	- Plant
EnergyPro by EnergySoft	- Preoptima	- Anavitor
ESP-r	- Verte	- Rhino × OCLCA
GBS/Insight 360 by Autodesk	- CIBSE TM65	- Grasshopper × OCLCA
HAP by Carrier	- IESVE	- Bentley × OCLCA
IDA ICE	- NABERS	- Athena
IESVE Software by IES Ltd.	- Carbon Designer 3D	- IESVE EnviroImpact
Sefaira by Trimble	- Build	- IESVE x OCLCA
Simergy by Digital Alchemy	- Trimble Connect × OCLCA	- ArchiCAD × OCLCA
Trace by Trane	- Autodesk BIM360	- Allplan × OCLCA
TRNSYS by TESS	-NRMCA Concrete Carbon Calculator	- Nooco
ZeroGuide	ZeroGuide	- OCLCA × Autocase, Civil3D, Navisworks, Revit, Takeoff, Designbuilder, Procore, SAP, Solibri and Strusoft
		Adaptis

References

- 1) ANSI/ASHRAE (2023). ANSI/ASHRAE Standard 228-2023 – Standard Method of Evaluating Zero Net Energy and Zero Net Carbon Building Performance.
- 2) ASHRAE (2022). ASHRAE Position Document on Building Decarbonization. Available here https://www.ashrae.org/file%20library/about/ashrae_building_decarbonization_pd_2022.pdf.
- 3) ASHRAE (2024). Center for Excellence for Building Decarbonization (CEBD), est. Available here <https://www.ashrae.org/about/cebd-center-of-excellence-for-building-decarbonization>.
- 4) ASHRAE/ICC (2024). ASHRAE/ICC Standard 240P – Evaluating Greenhouse Gas (GHG) and Carbon Emissions in Building Design, Construction and Operation.
- 5) ASHRAE/ICC (2024). ASHRAE/ICC Standard 242P – Standard Method for Calculation of Building Operational Greenhouse Gas Emissions.
- 6) ASHRAE (n.d.). Whole Life Carbon Guide for Building Systems. More information here <https://www.ashrae.org/about/cebd-upcoming-guides#additionalguides>
- 7) ASHRAE (n.d.). ASHRAE Research Project (RP)-1929 Evaluation of building life cycle analysis tools incorporating embodied carbon.
- 8) BPIE (2025). Environmental Product Declarations for Construction Products: An Overview of Availability, Costs, and Trends in Germany. Buildings Performance Institute Europe, Stuttgart/Berlin. <https://www.bpie.eu/publication/environmental-product-declarations-for-construction-products-an-overview-of-availability-costs-and-trends-in-germany/>
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- 11) EU (2024a). Energy Performance of Buildings Directive. European Commission, Brussels, Belgium. Available here https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en
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- 13) EU (2025). New EU rules on the safety and sustainability of construction products mark a new step for the sector's competitiveness. Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs, Brussels, Belgium. Available here https://single-market-economy.ec.europa.eu/news/new-eu-rules-safety-and-sustainability-construction-products-mark-new-step-sectors-competitiveness-2025-01-07_en
- 14) IEA (2023). EA EBC - Annex 89 - Ways to Implement Net-zero Whole Life Carbon Buildings. Available here <https://annex89.iea-ebc.org/>.
- 15) Kneifel, J. , O'Rear, E. , Grubb, S. , Lavappa, P. and Greig, A. (2017), Building Industry Reporting and Design for Sustainability (BIRDS) Neutral Environment Software Tool (NEST) Technical Manual, Technical Note (NIST TN), National Institute of Standards and Technology, Gaithersburg, MD, available here <https://doi.org/10.6028/NIST.TN.1976>.
- 16) Last, N. , Kneifel, J. , Costello, A. , Houska, C. and Morris, K. (2024). Workshop on Decarbonization: A Gap Analysis of LCA Standards for Industry. ASTM Specialty Reports, West Conshohocken, Pennsylvania. Available here <https://doi.org/10.1520/workshop-on-decarbonization-gap-analysis-of-lca>, https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=957956
- 17) MEP 2040. <https://www.mep2040.org/>
- 18) RICS (2024). Royal Institution of Chartered Surveyors (RICS) Whole Life Carbon Assessment for the Built Environment, version 3. Available here <https://www.rics.org/profession-standards/rics-standards-and-guidance/sector-standards/construction-standards/whole-life-carbon-assessment>.