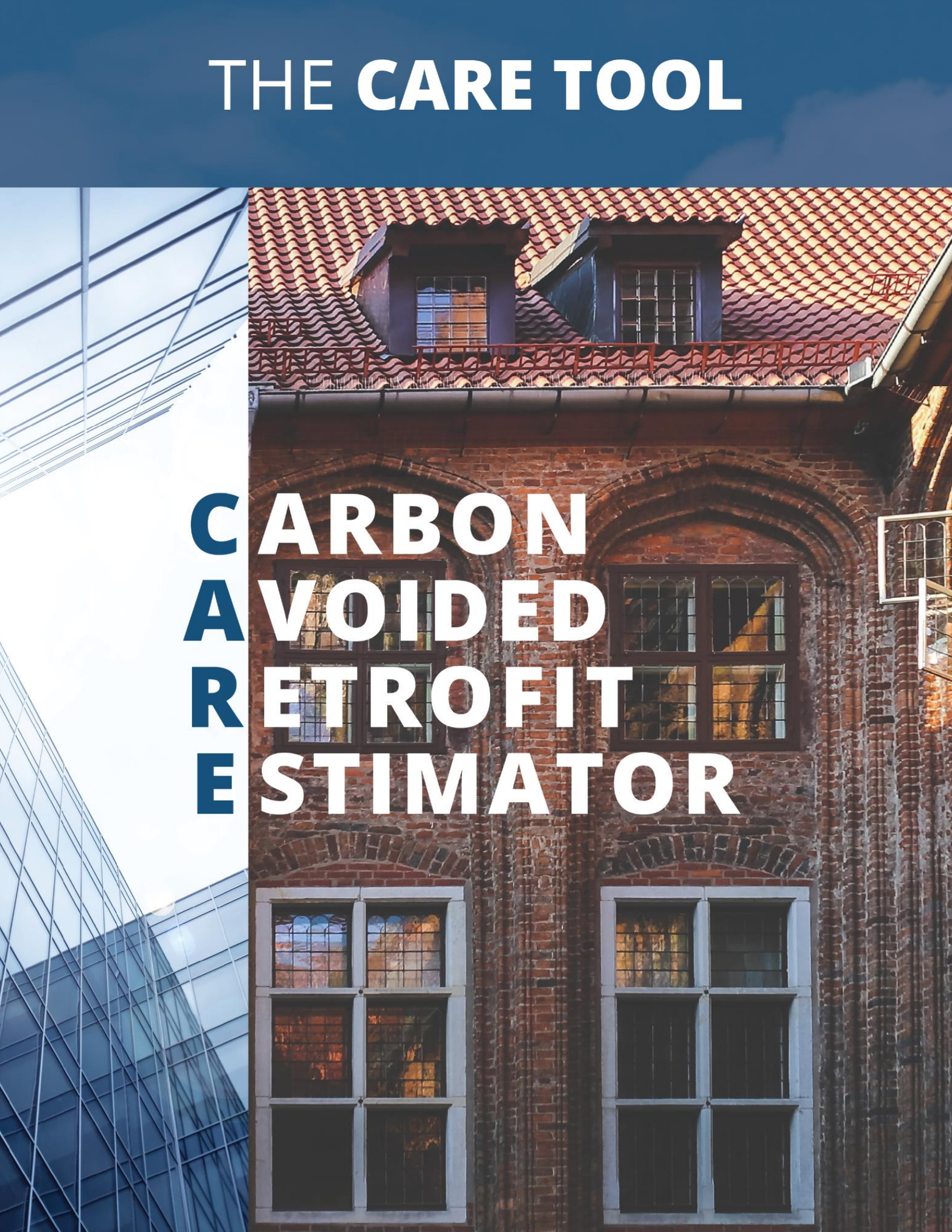# THE **CARE TOOL**

CARBON
AVOIDED
RETROFIT
ESTIMATOR

CARE Tool: Carbon Avoided Retrofit Estimator

Final Report for ONEder Grant

January 2023

The CARE Tool is an Architecture 2030 project.

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TABLE OF CONTENTS

ABSTRACT

LEVERAGING EXISTING BUILDINGS
In this critical decade for climate action, the existing built environment is a key asset to achieving substantial, near-term carbon reductions. Leveraging the buildings we already have avoids embodied emissions from new construction, reduces operational emissions from existing buildings, and provides social and economic co-benefits.

Reusing our existing building stock can help us avoid significant environmentally-costly new emissions, while also providing opportunities to reduce building operating emissions through energy upgrades. It's estimated that reusing and retrofitting existing buildings can save between 50-75% of the embodied carbon that would be expended by constructing new similar buildings. This is particularly relevant in the global north, where we have a lot of existing buildings available to reuse as well as a significant number of underutilized buildings. Reusing these buildings reduces the need for new construction and future embodied carbon emissions and improving the operational performance of our current building stock lowers its current operating emissions.

The benefits of reusing and improving existing buildings doesn't end with reduced carbon emissions. The built environment consumes vast amounts of natural resources that come with significant environmental impacts. Reusing and improving buildings requires far fewer resources than new construction. Building reuse also supports and revitalizes existing neighborhoods, and can create local jobs, strengthen community control, build financial equity, and increase neighborhood resilience. Investment in communities that have been subjected to historic discrimination and economic "redlining" has the potential to bring sustainable and equitable climate solutions that also have meaningful economic outcomes for the most impacted communities. To make this potential a reality, decisions must be made by, and benefits accrued to, those impacted or affected by the improvements.

In most cases, the greenest building is the one that already exists, but that wisdom has not been proven with comprehensive data. This means that the carbon benefits of reusing existing buildings are rarely incorporated in climate action plans, carbon tracking, or design decision-making, a critical missed opportunity for the preservation, planning, design, and policymaking communities to quantify their impact potential and make the strongest case for building reuse. The Carbon Avoided: Retrofit Estimator (CARE) Tool provides decision-makers with this capability, by offering high-level total carbon projections for reusing and upgrading existing buildings compared to replacing them with new construction.

ONEder GRANT BACKGROUND

One Workplace has provided generous support during two critical development phases of the <u>CARE Tool.</u> The first ONEder grant in 2020, came in the early stages of the tool's development when it was still known as the <u>2 Build or not 2 Build Carbon Calculator.</u> In that first phase we established an advisory committee, defined the project's goals and methodologies, set up focus groups, and gathered operational and embodied carbon data. We developed the original Excel tool, simplifying and adding features and redesigned the excel interface, and shared this version with contributors and people who have been following the tool's development.

In the final report for the first grant, we outlined a series of next steps: Collect, analyze and validate embodied carbon data; verify operational emissions data for different building types; develop additional features to make the tool more flexible and reflective of typical new building and renovation scenarios; convert the tool into a open access, web based tool; and publicize and promote the Tool with building owners, developers, the A&E community, and the historic preservation community.

In 2022 we were awarded a second ONEder Grant and were able to continue to develop and refine the Tool. In November 2022 we released an online, open access Beta version of the tool at the [Peer to Pier](#) event during the GreenBuild conference in San Francisco.

FINAL REPORT

In this report, the CARE team will outline the activities supported by the ONEder Grant. Two significant changes occurred in 2022: the name was changed and the management of the CARE Tool was taken over by Architecture 2030.

The name change occurred at the end of 2021. The working title for the tool had been the 2Build or not 2Build Carbon Calculator, which was a descriptive title, but it didn't call out the avoided carbon benefits of reuse. The team wanted to make it clear that this is an estimating tool not a precise calculation tool, and the acronym putting the focus on caring for the buildings we already have supports the overarching goals of the tool. In the Fall of 2021, the name was changed to the CARE Tool – Carbon Avoided Retrofit Estimator.

In the Spring of 2022, Architecture 2030 officially adopted the tool and took over managing the CARE Tool. Erin McDade, Senior Program Director for Architecture 2030 had been on the development team since the beginning, but having Architecture 2030 officially adopt the tool and take over its management allowed the development team to leverage their networks and reputation in the field of zero carbon architecture to make additional connections, promote the tool, and seek additional funding. The development team of Larry Strain, Erin McDade and Lori Ferriss remains the same, and adding Architecture 2030 and their extensive networks has helped guide, promote, and accelerate the tool's continued development.

The CARE team completed the activities outlined in the project grant proposal and accomplished all of the next steps listed at the end of our 2020 ONEder grant report. These are summarized below:

PROJECT ACTIVITIES AND OUTPUTS:

1. CARE Tool Online Interface Development
2. CARE Tool Retrofit Data Validation
3. CARE Tool Launch and Promotion

CARE TOOL ONLINE INTERFACE DEVELOPMENT

Tool

During this grant period, the free, open source, online CARE Tool was successfully developed and launched as both a web- and mobile-friendly app. In collaboration with the CARE team's software developers, the CARE Team designed a user-friendly application interface in which users enter high-level information about a building project in four tabs: General Information, Existing Building, Building Reuse, and New Building. Inputs include basic information about existing building location, size, use type, and structural system, the selection of potential upgrades to the existing building, and proposed characteristics of the new building. The CARE Tool automatically calculates the operational and embodied carbon emissions of each scenario: the existing building, the retrofit, and the new building. Results are visualized in charts and tables to the right of the inputs, and automatically update as inputs are added or adjusted for real-time feedback. Outputs for each scenario are visualized as both total operational and embodied emissions for a user-defined period of time, as well as total cumulative emissions over time. Together these results help users determine whether it makes more carbon sense to renovate their existing building or tear it down and build new, and helps designers, developers, planners, and policymakers quantify and value the climate benefits of our existing building stock.

Significant upgrades from the Excel version of the CARE Tool were implemented in the web application:

- An API connection to the Zero Tool, which is the operational energy and emissions baseline-setting standard for stakeholders striving to meet 2030 Challenge targets.
- The ability to visualize the impacts of building electrification and of the addition of on- or off-site renewable energy, for both reuse and new construction.
- Significant refinement of the inputs and data assumptions for building interventions affecting embodied carbon (see CARE Tool Retrofit Data Validation and Alignment for more details).

Website

In addition to CARE Tool application development, the CARE Team worked with a web designer to build out caretool.org, and is populating content for the following pages:
- About
- FAQ
- Case Studies
- CARE in the News
- Data and Methodology
- User Guide

The CARE team also added a User Feedback form to the website and is currently compiling feedback to inform future tool upgrades and enhancements.

CARE TOOL DATA VALIDATION AND ALIGNMENT

Prior to the launch of the online tool, a data validation exercise was undertaken to assure data quality, maximize compatibility with complimentary tools, and review nomenclature and user inputs using the following process:

Survey
A survey was issued to diverse stakeholder groups including architects, preservation and sustainability specialists, structural engineers, contractors, and owners to solicit feedback on the applicability and usability of the tool. Information from over 60 respondents was analyzed to inform revisions to user inputs within CARE to ensure that the tool represents a comprehensive range of building types, geographies, and approaches to reuse.

Literature Review
Additional literature review and interviews with professionals were conducted to fill gaps in data through peer reviewed studies and expert advice. This particularly supported the development of more user options for preservation and repair treatments of existing buildings, as well as structural upgrade options.

Alignment
Metrics and user selection options within CARE were aligned with the EPIC Tool, a free, online early carbon modeling tool that focuses on design decisions primarily for new construction. This alignment allows the two tools to act as a complementary pair, contributing to the development of a cohesive set of tools that are simultaneously in development across the industry. The CARE tool also referenced envelope and facade data from Kalidescope, an online tool developed by Payette Architects.

CARE TOOL LAUNCH AND PROMOTION

Soft Launch
The CARE team hosted a soft launch for the CARE Tool at the Peer to Pier event during Greenbuild, co-hosted by AIA COTE, AIA COTE San Francisco, EHDD, and Architecture 2030. The event was held at architecture firm EHDD's headquarters on Pier 1 in San Francisco, and included a dedicated room for CARE Tool demos. One monitor looped a CARE Tool slideshow which included high-level info about the tool, logos of tool supporters, a CARE case study, and a pre-recorded tool demo. On a second monitor CARE Tool team members

took turns offering live, interactive CARE demos with event attendees. The event lasted for approximately 3 hours with an estimated 300+ attendees, and the CARE demo room was full the entire time. The CARE team also passed out [CARE fliers](#) with information about the tool, the website url, and a QR code so attendees could demo the tool on their phones or later at their desks.

Since the CARE soft launch, multiple stakeholders have informed the CARE Team that they are using the tool on real-world projects, and the CARE team is collaborating with a few stakeholders to develop real-world case studies for publication on the CARE website.

Official Launch

The CARE Team and Architecture 2030 is planning an official launch of the tool in February 2023.

Promotion

The need for the CARE Tool is urgent. Thanks in part to our 2020 and 2022 ONEder grants, we were able to bring together stakeholder groups of industry and policy leaders. We received expressions of interest from architects and engineers, cities, historic preservation officers, and global NGOs. We currently have 438 subscribers to the BETA Version.
The BETA version of the CARE Tool was has been shared with:

- RMI 20 Cities
- C40 Cities
- GSA (General Services Administration)
- AIA - San Mateo, Santa Clara, AIA California COTE
- IBPSA (International Building Performance Simulation Association)
- National Trust
- Classes - University of Washington, University of Pennsylvania

In addition to funding from One Workplace we received funding from a Moe Family Fund Grant through the National Trust for Historic Preservation, and the 1772 Foundation. We have development and promotion support from industry partners including Zero Net Carbon Collaboration for Existing and Historic Buildings, Climate Heritage Network, Architecture 2030, and the Carbon Leadership Forum.

CARE in the News

Since the launch of CARE, the tool has been highlighted in various publications:

- [We Can't Build Our Way To Net Zero: Building Stewardship At Agnes Scott](#) published by [Drawdown Georgia](#)

- [Raze or Retrofit? CARE Tool Has the Answer](#) published by [BuildingGreen](#)
- [CarbonPositive: Carbon Intelligence for Reuse Decisions](#) published by [Architect Magazine](#)
- [We Can't Build Our Way To Net Zero](#) published by [Next City](#)

CONCLUSION

Meeting global climate targets will require a dramatic uptake in beneficial reuse across the globe. Until the development of the CARE Tool, stakeholders did not have a user-friendly way to quantify and demonstrate the impact potential and value of reuse, nor easily understand and compare the carbon impact of reuse vs new construction within key climate deadlines. The CARE tool enables this analysis to be completed quickly by a variety of stakeholders impacting the built environment, and gives users the ability to understand how individual building interventions, such as electrification or structural reuse, impact the total reuse and new construction emissions.

We are very grateful to the One Workplace for providing the resources we needed to launch this version of the CARE Tool. Architecture 2030 and the CARE team will continue to expand upon the capabilities and reach of the tool, as well as our larger initiative to support beneficial reuse as a critical climate solution.