

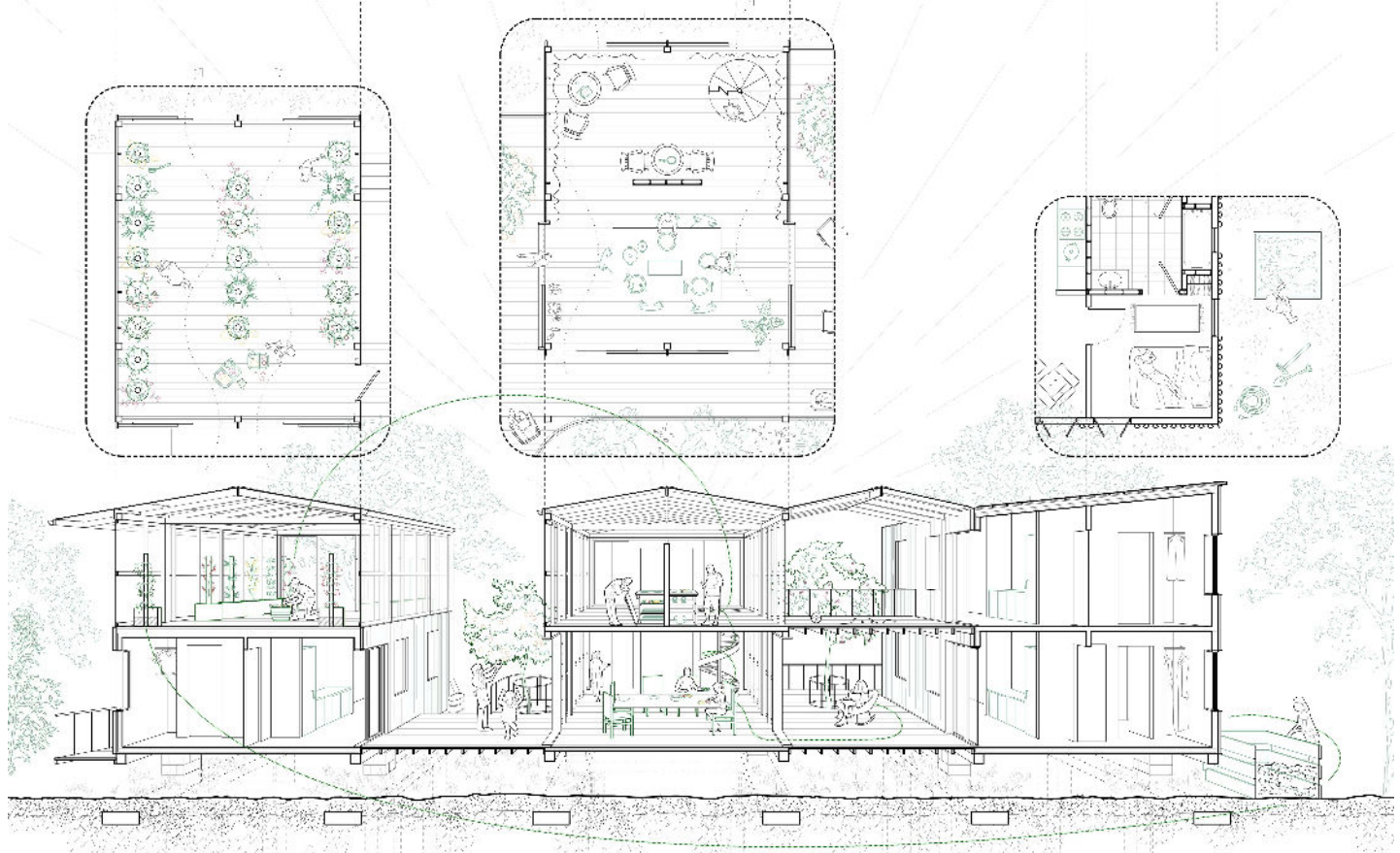
Carbon Budget Zero. Climate Positive

Iteration 1st **Reimagining an affordable neighborhood as a carbon bank**
Course Syllabus and Information

Instructor: **Assistant Professor Sonsoles Vela**

email: svela@tulane.edu

Credits: (6) semester credit hours | Meeting Place: Nochi Atrium. | Reg Meeting Time: MWF 1:00-5:00 PM



Research Studio: Carbon Budget Zero. Climate Positive Fall 24. Prof. Sonsoles Vela.

Strategic Approach _REIMAGINING our neighborhoods as a metabolic system, Circular processes. Undergraduate student: Sofia M Vladimir

01_CONTEXT

The built environment is a major contributor to global carbon emissions, with the construction industry accounting for 40% of emissions and 32% of natural resource consumption. This highlights the urgent need for change, especially as we approach the UN's 2030 targets. Housing is essential, yet it contributes 21% of global energy use and 17% of CO₂ emissions. With 3 billion people needing suitable housing by 2030, there is an opportunity to improve housing while minimizing environmental impact. Current environmental policies focus on energy efficiency but often overlook material efficiency and the carbon storage potential of various construction materials. The "Carbon Bank" concept aims to create low-carbon neighborhoods that sequester more carbon than they emit. This requires thoughtful site planning and leveraging natural landscapes to offset construction emissions. The industry often follows a linear "take, make, use, dispose" model, which hinders material reusability and fails to consider the total environmental impact of materials from extraction to construction. Addressing embodied emissions is crucial, making material selection and future reuse key to reducing the sector's carbon footprint.

02_COURSE DESCRIPTION:

The research studio sets out with a bold aim: to use embodied and operational carbon as design parameters in the new or stock-built environment through three iterations, paving the way for constructing buildings and cities with a zero-carbon footprint. This approach integrates carbon footprint as the primary performance measure and promises a sustainable future. The research studio is guided by a pivotal question: "How can a design be developed to achieve a zero-carbon budget?" This inquiry shapes the research agenda and envisions a future where carbon neutrality is the standard. The exploration is twofold, allowing for a comprehensive investigation of the topic. On one side, the studio focuses on operational carbon actions, examining both passive and active strategies along with renewable energy systems to enhance efficiency and reduce operational emissions. Conversely, the research delves into embodied carbon actions, emphasizing low-carbon materials and innovative methods that align with the natural carbon cycle. This involves reimagining design approaches by prioritizing the principles of reuse, reduction, and sequestration and considering materials as strategies for carbon storage while exploring alternatives to conventional building materials.

reliance on limited natural resources and fossil fuels while aiming to capture carbon in building layers. Ultimately, the project aspires to achieve carbon neutrality, hinging on a comprehensive understanding of the lifecycle of biobased and sink materials within the design process. The implementation phase relies heavily on Life Cycle Assessment (LCA) tools, which inform the design choices to lower both embodied and operational carbon emissions, reducing environmental impact from construction and facilitating paths toward carbon-neutral designs.

2.2 Work plan and implementation

Outline Calendar: The 16-week, 6-credit research studio is divided into the following modules/sections to build course concepts progressively:

Interaction #1: Hot Climate FL

Reimagining an affordable neighborhood as a carbon bank

MODULE 0. INTRO Strategies for Building Decarbonization

M0 Carbon exploration.

Considerations for Building Decarbonization
Introduction to Embodied and Operational Carbon
Measuring Embodied and Operational Carbon
Carbon Reduction Strategies

MODULE 1. Material Strategy Circular economy

M1 Material Exploration.

material pallet material, ID card,
material life cycle analysis. Product Stage A1-A3
case study and implementation

MODULE 2. Design Strategy Circular economy. Redefine affordable suburban housing.

M2.1 Urban Strategy.

Re-imagining zoning to formulate carbon-neutral neighborhoods. Carbon Sequestration and energy production on-site

M2.2 Design Exploration

Operational Carbon Strategies.

Embodies Carbon Strategies. Carbon sink layers
LCA Module D. Reuse-Recovery-Recycling potential
Emissions Calculations (embodied & operational)

M2.3 Design Implementation

Circular Economy: Beyond the Life span -disassembly
Measuring embodied carbon: LCA and GWP Analysis:
Tools for quantifying energy usage and carbon accounting
One Click LCA plugin & cloud.

Sefaira– app/climate studio: operational emissions -renewables
Visualization data: Carbon budget dashboard

Interaction #2 & 3. Cold Climate NY, Moderate Climate CA. Adaptive reuse transformations.

MODULE 0. INTRO Strategies for Building Decarbonization

M0 Carbon exploration.

MODULE 1. Material Strategy Circular economy

M1.1 Material Exploration.

M1.2 Material Sourcing /Production On-site – VS Off-site

MODULE 2. Design Strategy Circular economy. Redefine a new use for sheltering.

M2.1 Deconstruction, Salvage, and Reuse Policies

M2.2 Design Exploration

M2.3 Design Implementation

04_READINGS & SOURCES

Books and essays

Designing Zero Carbon Buildings. Embodied and Operational Emissions in Achieving True Zero, by Ljubomir Jankovic

Carbon: A Field Manual for Building Designers by Alan Organschi, Andrew Ruff, and Matti Kuittinen

Designing the Forest and other Mass Timber Futures by L.Wikstrom

Manual of Biogenic House Sections by Lewis Paul Lewis, Marc Tsurumaki, David J. Lewis (Authors)

Energy and Design: Making Architecture between Metrics and Narratives, Columbia University GSAPP, David Benjamin (eds.)

Renovating carbon: Re-imagining the carbon form, by Erik L'heureux and Giovanni Cossu

Ending Fossil Fuels: Why Net Zero is not enough' by Holly Jean Buck

Build Beyond Zero: New Ideas for Carbon-Smart Architecture by B. King and C. Magwood

The New Carbon Architecture: Building to Cool the Climate by B. King
Emerging Ecologies: Architecture and the Rise of Environmentalism by Carson Chan

Landscape Design for Carbon Sequestration Thesis. by Deanna Lynn

Digital sources

Architecture 2030. <https://www.architecture2030.org/>

2030 Palette <https://2030palette.org/>

Carbon Smart Materials Palette. <https://www.materialspalette.org/>

Carbon Leadership Forum <https://carbonleadershipforum.org/>

IStructE <https://www.istructe.org/>

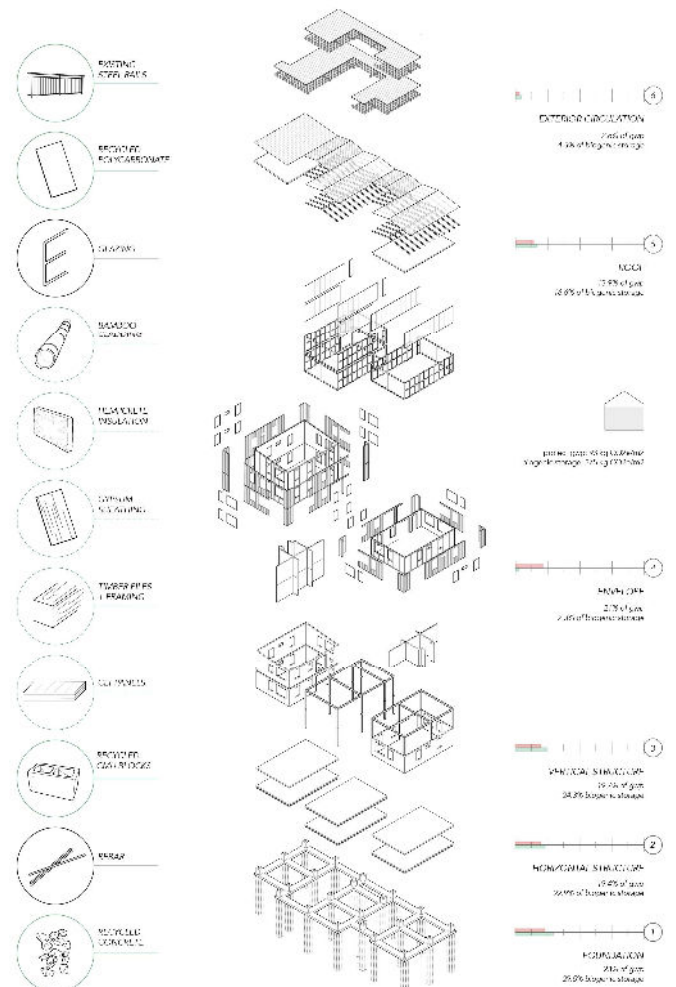
LETI <https://www.leti.uk/wlcwebinarseries>

Software tools

I tree & Pathfinder Software _ Sequestration on site.

Sefaira software Energy consumption & Operational emissions

One Click LCA plugin measures and reduces embodied carbon from pre-design to practical completion. Stages A1-A5, B1-B7, C1-C4, and D.



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EXPLORED AXONOMETRIC ASSEMBLY: LCA analysis.
Undergraduate student: Sofia M Vladimir