

**Truro DPW Project**  
**Scope of Services**  
**Embodied Carbon Life Cycle Assessment**

**DESIGNER SERVICES**

The following scope of services for a, embodied carbon Life Cycle Assessment (LCA) is based on on-going discussions with the Town regarding sustainability goals for the new Public Works Facility. LCAs calculate the embodied carbon associated with building materials during various stages of their lifespan including manufacturing, construction, use, demolition, and disposal (cradle-to-grave).

The scope of services and corresponding fees are intended to clarify the process and cost implications that are beyond the current contract. If the Town chooses to proceed with the additional service, the consultant will submit a formal proposal based on the preferred assessment scoping.

**Embodied Carbon Life Cycle Assessment (LCA)**

- 1.1 LCAs can include some or all of the following building materials and systems: foundation systems, framing systems, mechanical systems, products / appliances, and interior finishes.
- 1.2 LCAs include four major stages (Based on EN 15978:2011 and ISO 21930:2017):
  - a. Product Stage (A1-A3)
  - b. Construction Stage (A5-A6)
  - c. Use Stage (B1-B7)
    - i. Operational carbon stages are sometimes excluded from LCAs focused on embodied carbon (\*B6: Operational Energy Use and \*B7: Operational Water Use)
  - d. End of Life State (C1-C4)

Product Stage			Construction Stage		Use Stage					End-of-Life Stage			
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4
Raw Material Supply	Transport to Factory	Manufacturing	Transport to Site	Construction / Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Deconstruction / Demolition	Transport to Waste Processing/Disposal	Waste Processing	Disposal of Waste

### 1.3 LCAs are typically performed at two different levels: building-level or product/material-level.

#### a. Building-level LCAs (referred to as whole building LCAs (WBLCA)):

- i. Scoping: The consultant will define the LCA's functional description (project use type, technical requirement such as building and energy code, occupancy, etc.), the reference unit, the study period, and the system boundary. Scoping also defines the physical scope - some WBLCAs include structure only, or structure and envelope, while others may include a more complete assessment with structure, envelope, interiors, and mechanical, electrical, and plumbing (MEP) systems. The Town will identify their preferred physical scope for the assessment.
- ii. Inventory & Data Collection: The consultant will identify the types and quantities of material that are defined during the scoping phase. Detailed data is also gathered at this time including transportation travel distance. If MEP systems are defined in the scoping phase, energy use will also be modeled and inventoried. (Note: if an LCA is conducted during Design Development once a schematic cost estimate has been completed and MEP Narratives have been established, there could be efficiencies in using the bill of materials generated by and consistent with the estimator's quantities.)
- iii. Impact Assessment: the consultant will calculate the inventory by the environmental impact factors (associated with extraction, manufacturing, transportation, construction, end-of-life demolition/disposal) for each respective material. The analysis will also include operational carbon if MEP systems are included in the scope. This phase typically requires software tools to generate the total estimated embodied carbon.
- iv. Interpretation and Results: The consultant will review the analysis and summarize the results into an Embodied Carbon Report.

#### b. Product- or material-level LCAs:

- i. Scoping: The consultant will define the LCA's functional description, the reference unit, the study period, and the system boundary. The Town will identify the preferred physical scope for the assessment in terms of what material(s)/product(s) to assess.
- ii. Environmental Product Declarations (EPDs) Collection & Assessment: The consultant will focus on a specific material(s) or product(s) used in the construction of the facility and evaluate the embodied carbon across its entire life cycle. The assessment is primarily driven by looking at EPDs created by LCA practitioners and product manufacturers. EPDs are based on product LCAs covering the impacts of product extraction, transportation and

manufacturing (A1-A3). EPDs capture manufacturing and supply chain strategies that prioritize material and energy efficiency, and low-carbon energy sources. Comparing EPDs for multiple products is only accurate if the products are functionally equivalent, include the same life cycle stages, the use of one product versus another does not change other aspects of the design or assembly, and both use the same product category rule (PCR). (Note: not all manufacturers provide EPDs for their materials / products).

- iii. Interpretation and Results: The consultant will review the analysis and summarize the result. The review process will include providing insight into potential material substitutions to reduce embodied carbon (e.g., low-carbon concrete alternatives or recycled steel).

## **ASSUMPTIONS**

- This scope of work does not include consideration for third-party funding or third-party certification. If the Town wishes to pursue related incentives or certification programs, the scope and fee may need amending to match the verification criteria/requirements of those programs.
- Material quantities will be conducted in-house and may differ from those collected by the independent cost estimator for the schematic design cost estimate. This effort could be conducted during Design Development once a schematic cost estimate has been completed to ensure consistent quantities are being referred to.

## **SCHEDULE**

This scope of work identified above will be completed within one to two months once the preferred schematic floor plan is approved and depending on the level of analysis (whole building vs. product/material level).

## **FEE OF SERVICES**

The following is a summary of the proposed fees associated with the scope of services identified above. The total fee will not exceed the fee schedule below unless written authorization is granted by the Town.

TASK	FEE
Product- or Material-Level Life Cycle Assessment	\$9,000 per material/product
Whole Building Level Life Cycle Assessment *depending on the physical scope	\$25,000 - \$40,000*