

Life Cycle Assessment for CERN

Comparative Carbon Footprint of Underground Civil Engineering Facilities for Future Colliders

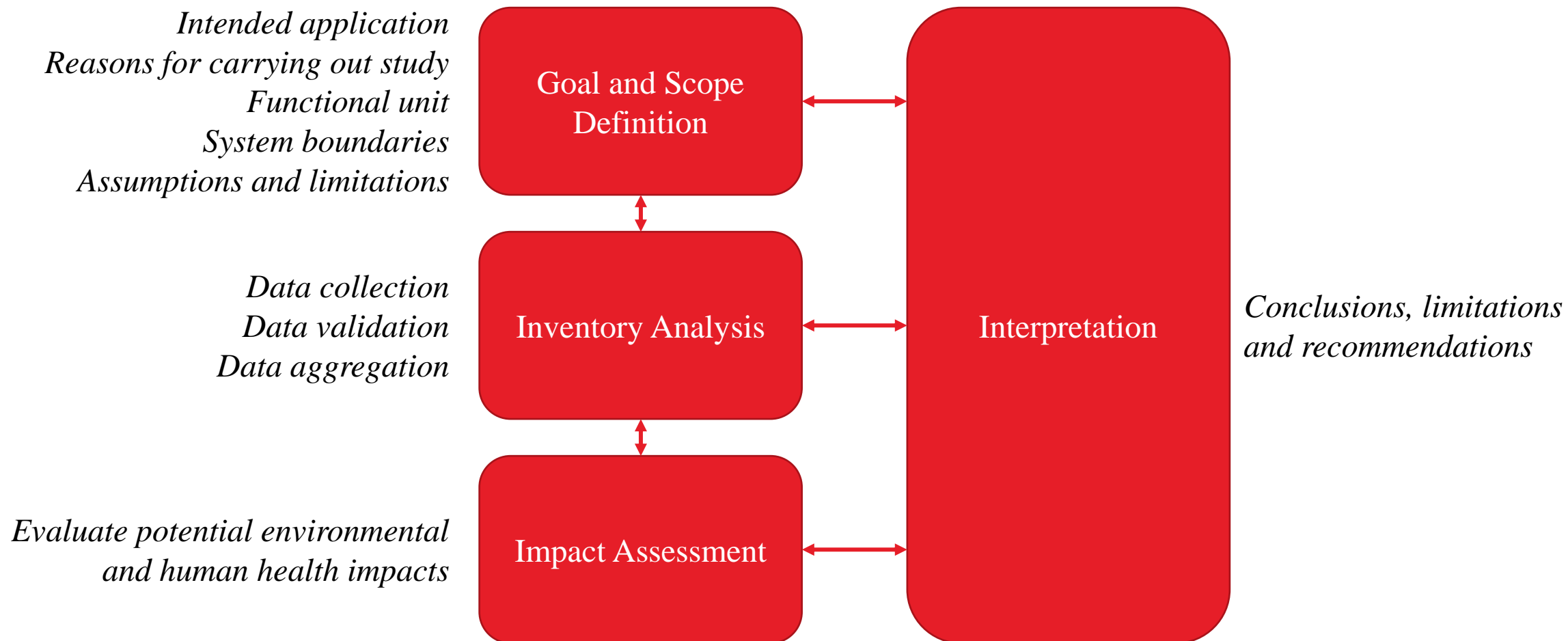
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17/11/2022

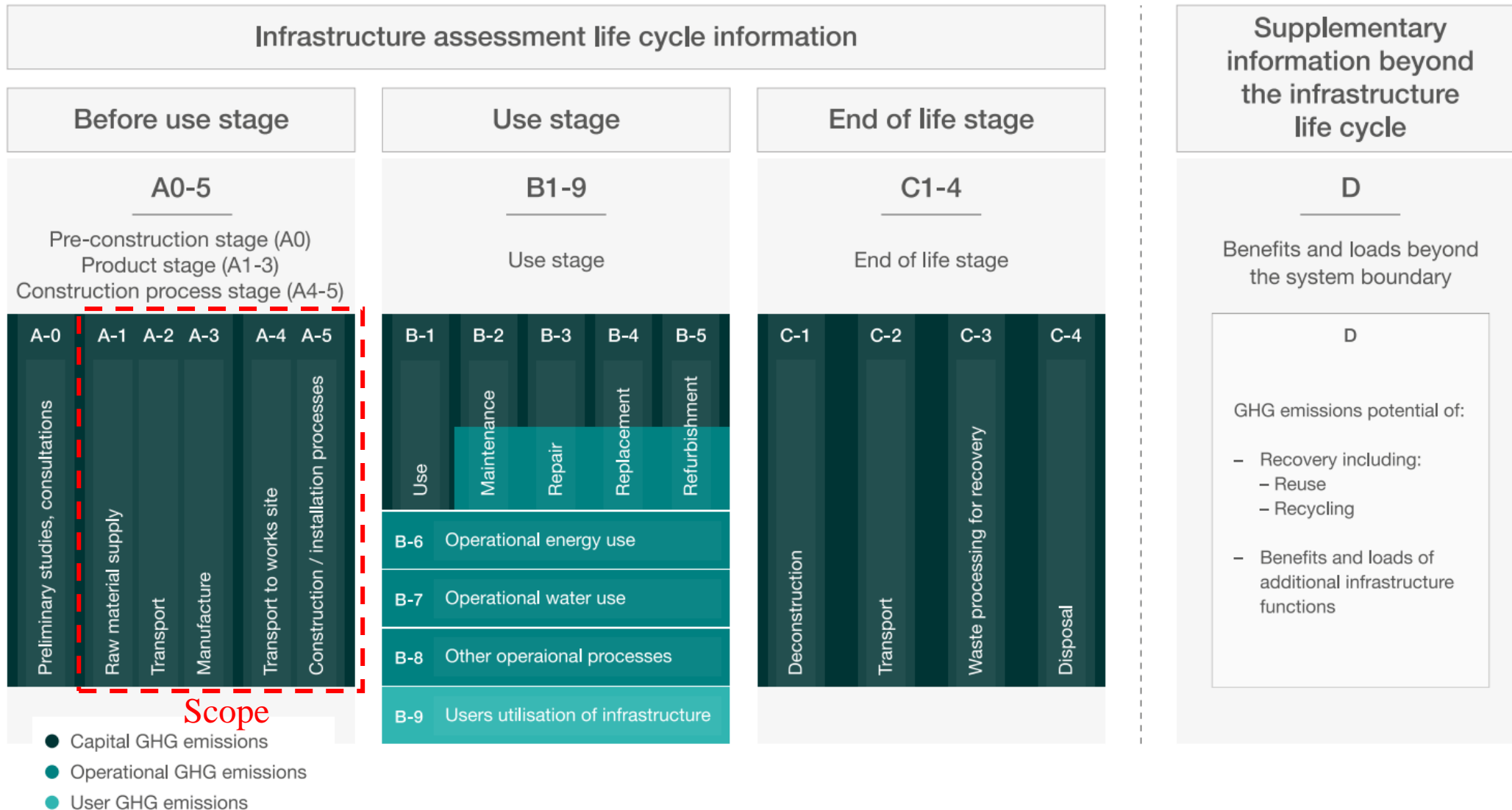
Agenda

- Scope of LCA
- Delivery programme
- Cost estimate for undertaking the study
- Discussion on details of CLIC and ILC
- Further questions/discussion/AOB

Life Cycle Assessment Framework



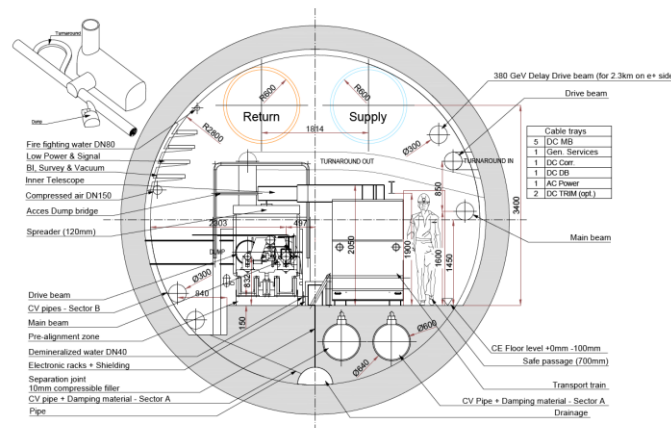
Life cycles commonly considered



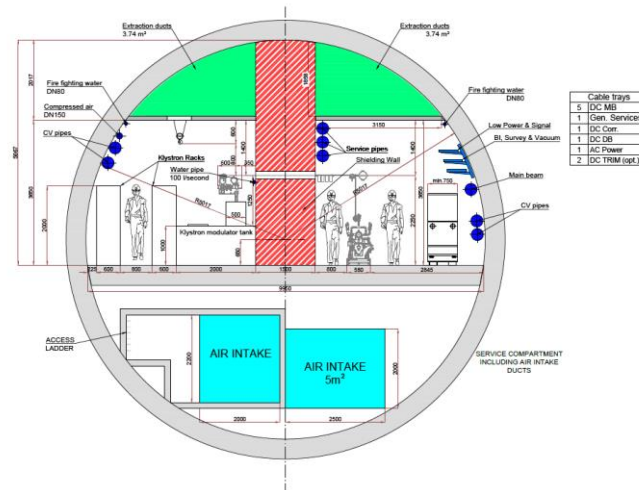
Goal and Scope

- Goal: Reduce embodied and construction environmental impacts
- LCA for 3 tunnel options (tunnels, caverns & access shafts)
- System boundaries: Embodied and construction.
Excluding operation, use and end of life.

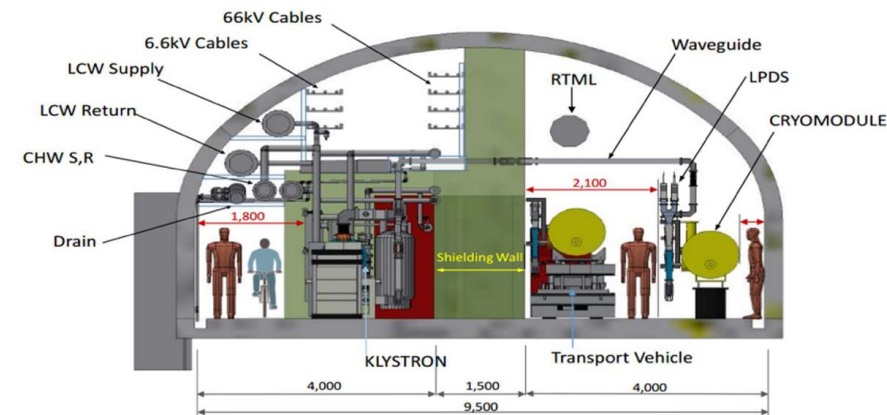
1. CLIC Drive Beam tunnel,
5.6m internal diameter



2. CLIC Klystron tunnel,
10m internal diameter



3. ILC Japan tunnel,
arched 9.5m span



Data for A1-A5 LCA

A1 - A3

- Cross section/BIM model for:
 - CLIC and ILC tunnel geometry and configuration (3 scoped)

- Available materials information / early stage assumptions

- Transport distances of construction materials

- Construction methods

- Materials/energy suppliers during construction/MEP products (if available)

A4 - A5

- Available environmental reports for recent CERN construction projects

Environmental Impact Categories

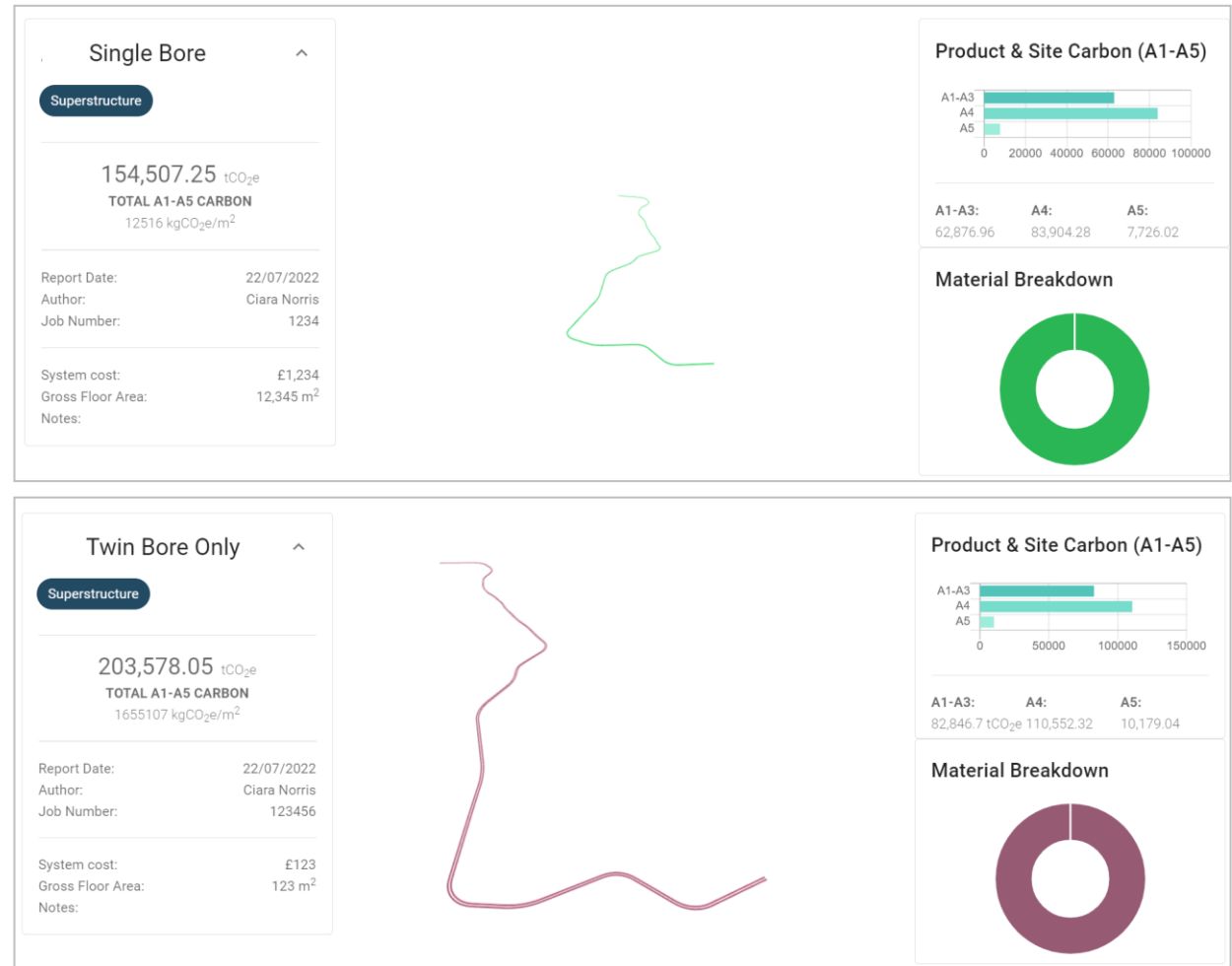
- Global warming potential (GWP)
- Acidification potential (AP)
- Eutrophication potential (EP)
- Ozone depletion potential (ODP)
- Photochemical ozone creation potential (POCP)/
Smog formation
- Abiotic depletion potential (ADP)/ Fossil fuel
depletion
- Particulate Matter emissions (PM_{2.5})
- Ecotoxicity (kg1,4)

CML methodology to
European standards &
TRACI methodology to
American standards
(different units used)

Used in TRACI
methodology only

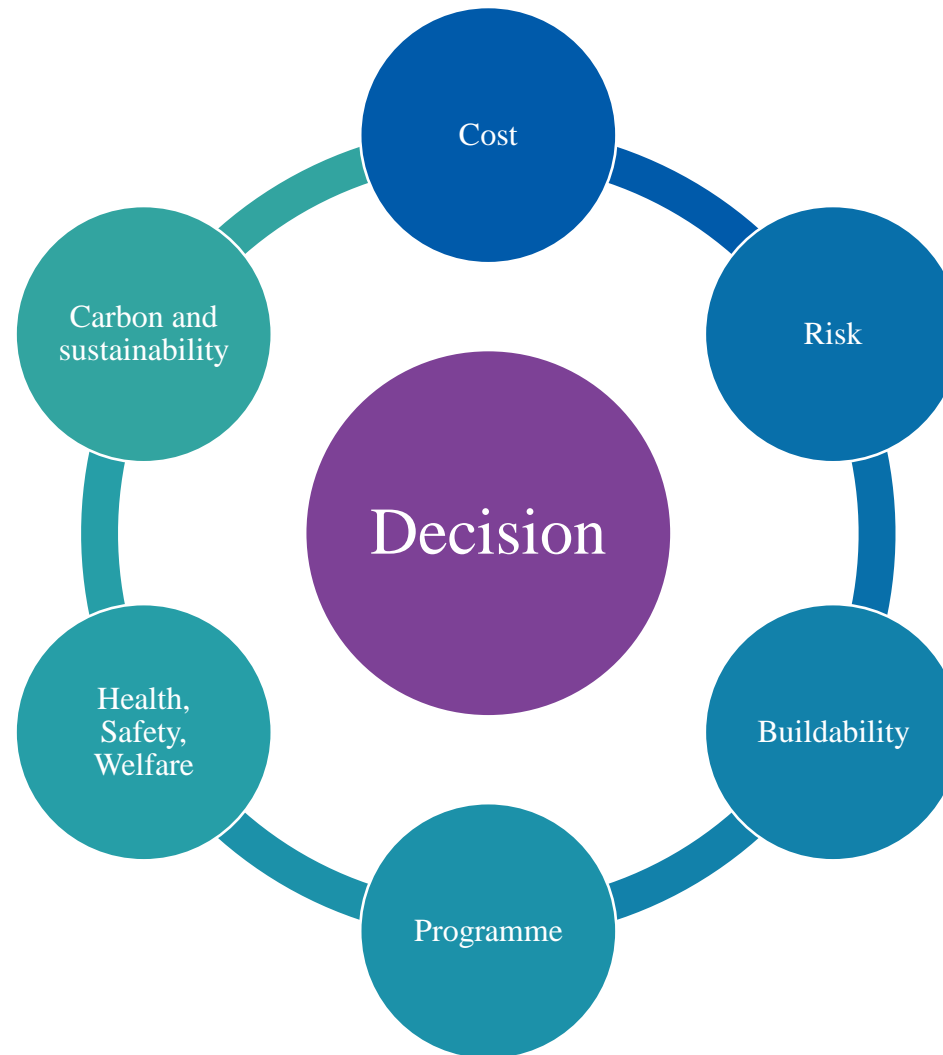
LCA Outcomes

- Insights, recommendations and graphical carbon hotspots for 3 tunnel options
- A1-A5 comparison between 3 tunnel options
(whole life carbon comparison possible with operational and user data)

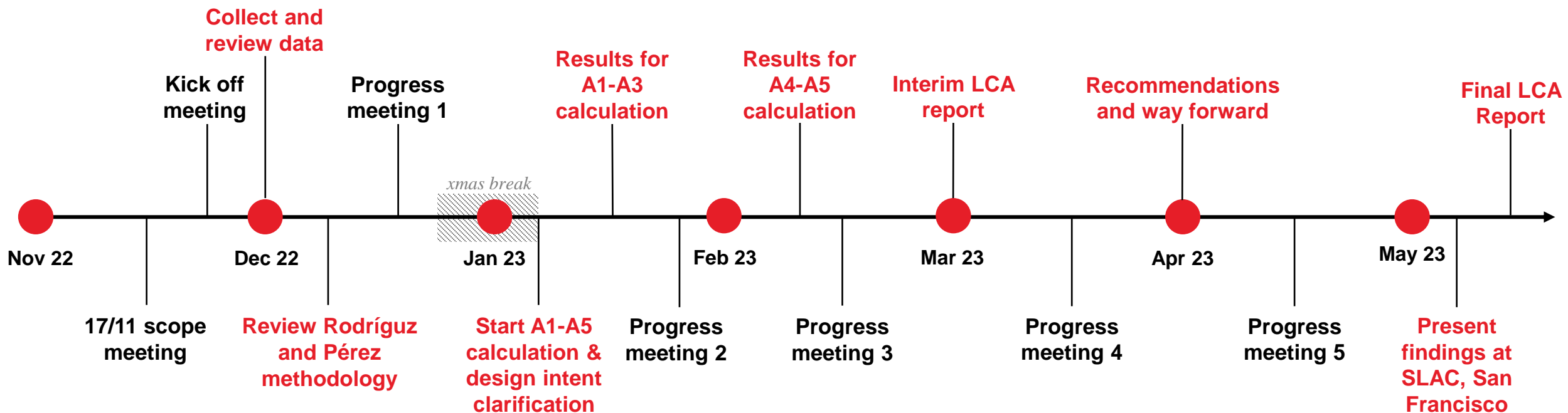


Ref: [a carbon tool \(act\)](#)
(Open source A1-A5 tool designed by Arup)

Including carbon in decision-making



Delivery Programme



Stage 1

- Desk study, data review
- Requirements review
- Design intent clarification

Stage 2

- Parametric modelling study
- LCA: A1 – A3 assessment and reporting
- LCA: A4 – A5 assessment and reporting

Stage 3

- Future considerations
- CERN/KEK wider net-zero targeting & engagement

Across Stages

- Online meetings & workshops
- SLAC workshop

ARUP