Pacific Northwest
NATIONAL LABORATORY

Lighting the path to data-driven green procurement & decarbonization

Life cycle tools for standardizing environmental labels

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PNNL Systems and Environmental Engineers

ICR23v: Innovations in Climate Resilience 2023

U.S. DEPARTMENT OF ENERGY BATTELLE

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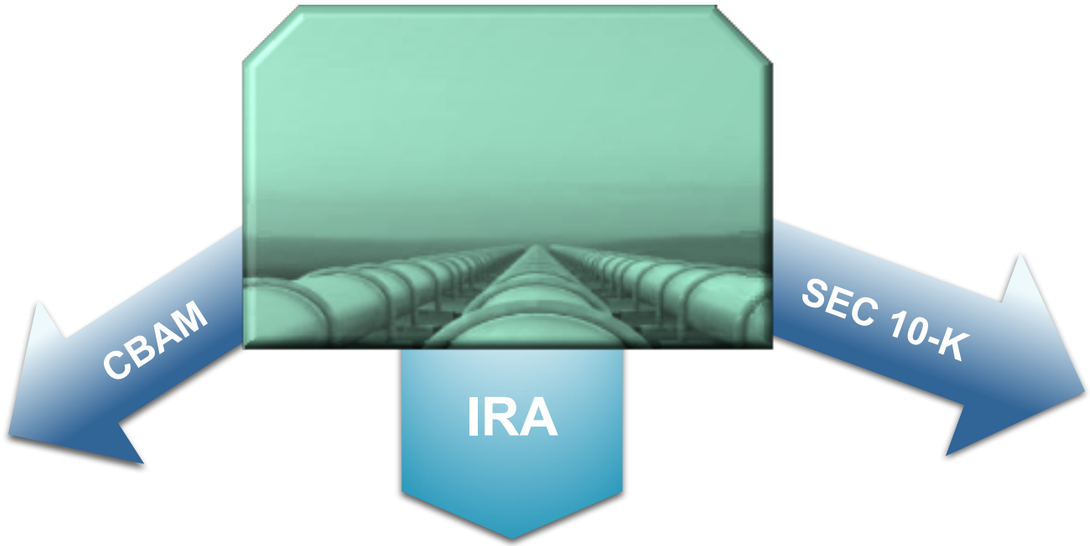
EO 14057: Federal Sustainability Plan

SEC. 101 – Policy ← Net-zero by 2050
SEC. 102 – Gov't-wide goals
SEC. 201 – Agency goals & targets ← Set targets for Scope 1, 2, & 3
SEC. 202 – Reducing agency GHGs ← Reduce Scope 1, 2, & 3
SEC. 203 – Transition to 100% C-Free electricity
SEC. 204 – Transition to 0-emissions fleet
SEC. 205 – Net 0-emissions buildings ← Net-zero by 2045, reduce Scope 1 & 2
SEC. 206 – Increasing energy & H2O efficiency ← GHG impacts per eProject Builder (ePB) calculator
SEC. 207 – Reducing waste & pollution
SEC. 208 – Sustainable acquisition & procurement
SEC. 301 – Federal supply chain sustainability
SEC. 302 – Supplier emission tracking ← 15 categories of Scope 3
SEC. 303 – Buy Clean Task Force
SEC. 401 – Training, educating Federal workforce
SEC. 402 – Incorporating environmental justice ← GHG reductions not to impose disproportionate burdens
SEC. 403 – Public, private, & non-profit engagement
SEC. 501/2 – Federal Chief Sustainability Officer duties
SEC. 503 – Agency planning & performance measurement
SEC. 504 – Chair of Council on Environmental Quality (CEQ)
SEC. 505 – Duties of Director Office Mgmt. & Budget (OMB)
SEC. 506 – Duties National Climate Advisor
SEC. 507 – Duties heads of agencies
SEC. 508 – Est. Federal Leaders Working Group
SEC. 509 – Gov't-wide support & collaboration ← Scope 1, 2, & 3 Target setting instructions
SEC. 510 – Additional guidance & instruction for agencies



Buy-Clean Specific

EPDs for procurement policies—embodied emissions & pollutants of construction materials

- Increase transparency in reporting & auditing EPDs
- Easing verification of EPDs
- Pilot programs incentivize GHG accounting
- Building supply chain green procurement
- Pilot can includes social cost of GHGs (SC-GHGs)

Per Implementing Instructions, Aug. 2022:
https://www.sustainability.gov/pdfs/EO_14057_Implementing_Instructions.pdf

Lifecycle Data Challenges & Opportunities

Data-Driven Buy Clean & Decarbonization

Data Challenges

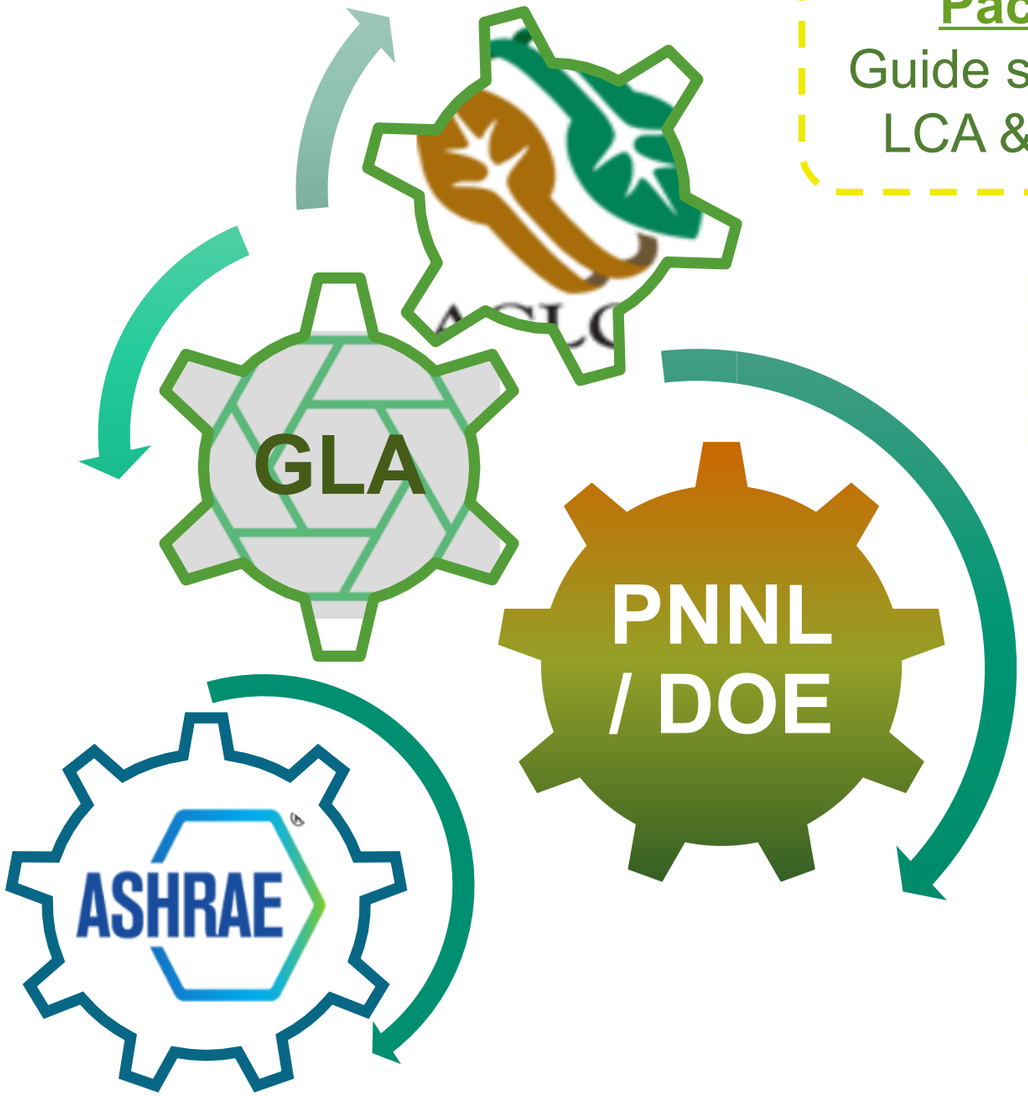
Lifecycle Phases?
Scope 1, 2, 3 ?

Lifecycle Impacts?
Carbon only ?
GHGs ?
Other emissions ?

Data Opportunities

Building Out Public Data
Standardization
Digitization
Live Hosting

Multi-party Engagement & Collaboration for More Transparent, Procurement, & Supply Chain Life Cycle & Embodied Carbon Data



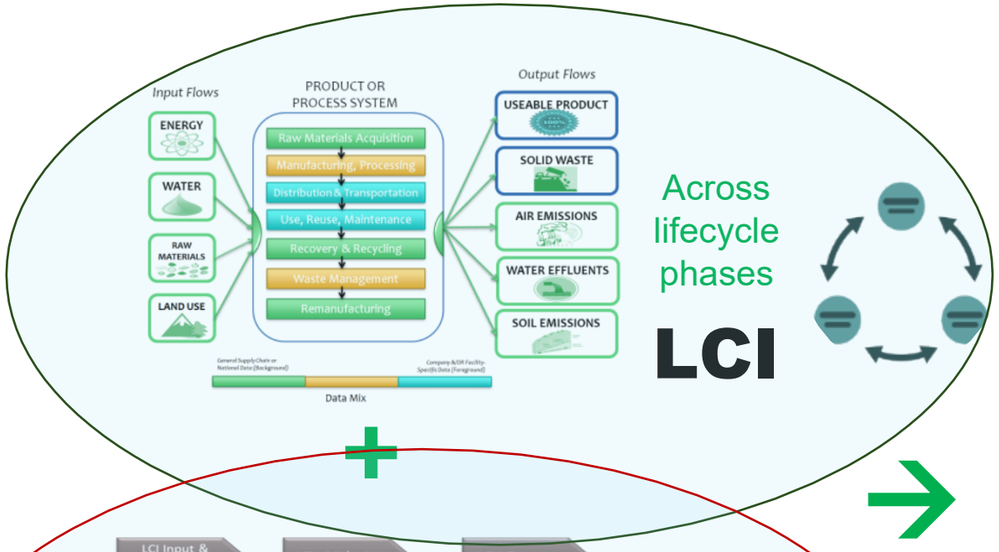
Pacific Northwest National Laboratory (PNNL):
Guide streamlining & standardizing lighting & MEP PCRs, LCA & EPD for improved transparency & comparability

American Center for Life Cycle Assessment (ACLCA):
PCR Open Standard for standardized, consistent, & reliable PCRs & EPDs

GreenLight Alliance (GLA):
Supporting international dialogue on transparency and standardization in the lighting industry

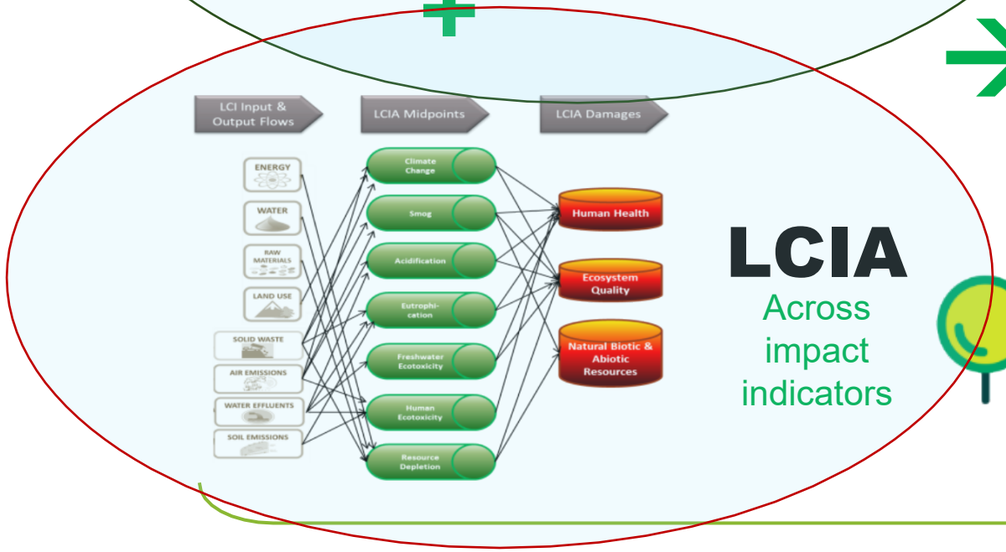
ASHRAE WHOLE BUILDING WG:
Developing a North American version of CIBSE TM65 embodied carbon estimation tool

LCI+LCIA → LCA per PCR → $LCA_{Summarized}$ ~ EPD



Across lifecycle phases

LCI



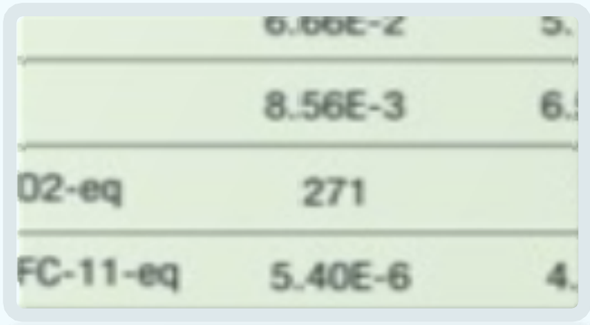
LCIA

Across impact indicators

LCA

~

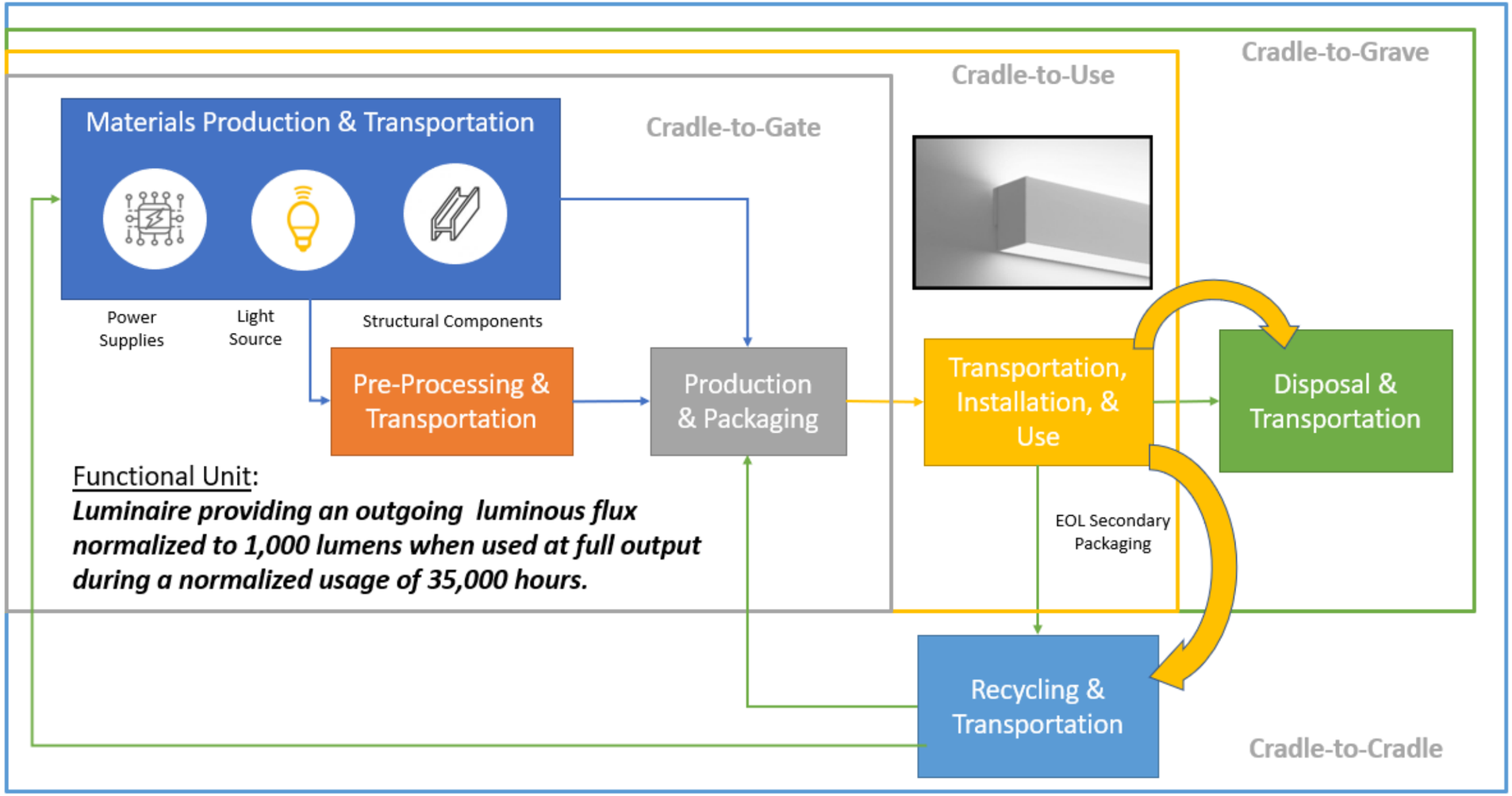
EPD



According to Relevant Product Category Rule (PCR)

LCA System Boundaries

Luminaires



Systems Boundary Diagram for Lighting in North America

Roadblocks Encountered for Lighting & Electrical Products LCA in North America

Lighting and electrical industry not yet fully adopted LCA process

The LCA/LCI/EPD/PCR process can be expensive and confusing

Not yet a North American PCR standard yet for transparent and comparable LCAs

Certain electronic components LCI/LCA data not yet collected or difficult to obtain

“Wild west” environment in drive for EPD development, creates lack of comparability

Lighting manufacturers typically produce product families with potentially1000s of variations, SKU combinations, frequently substitute components from multiple suppliers

Geographically Relevant & Dynamic PCR & Standardized, Model-Linked Data Collection Templates Streamline and Simplify Participation in the LCA/EPD Process

- Standardized LCI template has potential for significant adoption in the lighting and electrical equipment industries, and beyond
- Allows manufacturers to produce high-quality data sets and results that align with clean procurement regulations as well as other environmental reporting requirements
- Addresses embodied energy and carbon (among other indicators) in economically critical products and systems

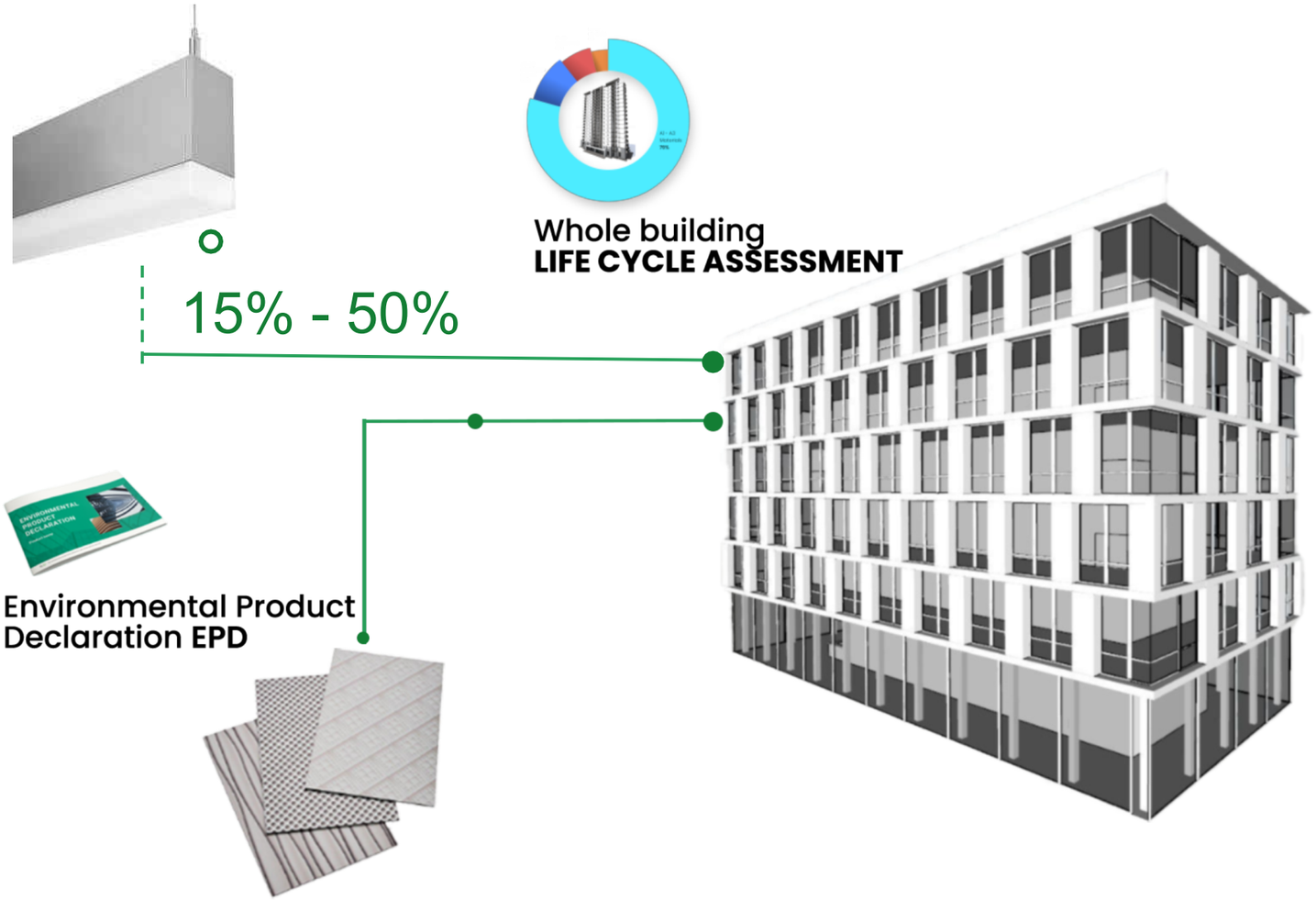
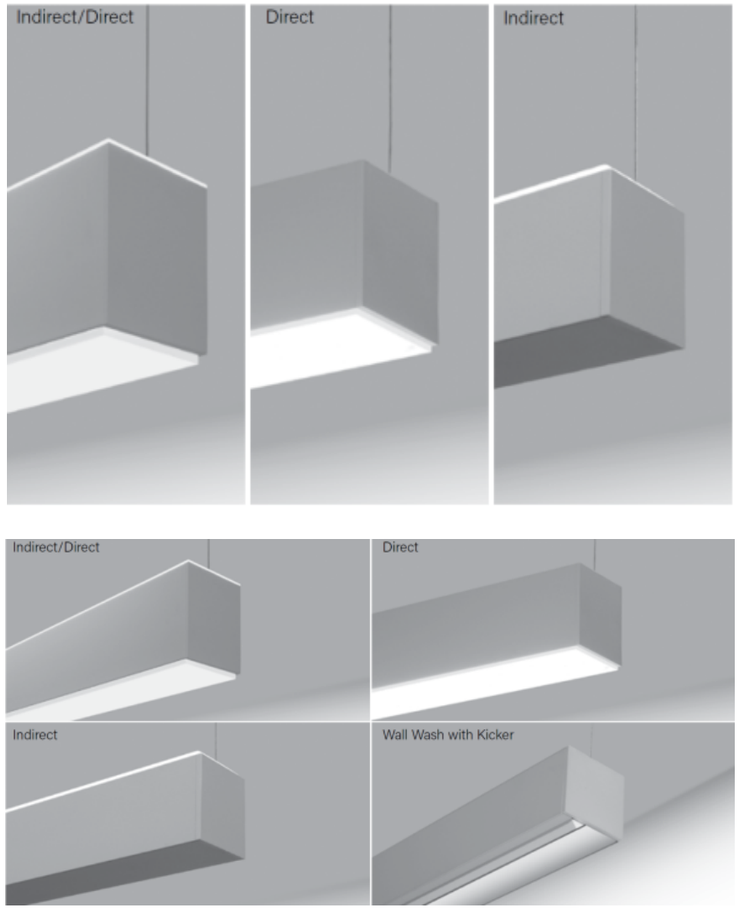


Image from https://www.oneclicklca.com/epds-for-building-lca/

‘Homogenous Family of Products’



EPD extrapolations when following are same:

- Type of materials & assembly processes: power equipment technology, printed circuit components, light source technology, and lighting management system technology
- Packaging materials & manufacturing processes: mass of packaging varies proportionally to luminaire mass, material repartition is same
- Logistics circuits such as transport modes/distances
- Installation and energy saving functions same
- Regulations for recycling (varies by geography)
- Product standards to which products subject
- Assigned product lifetime

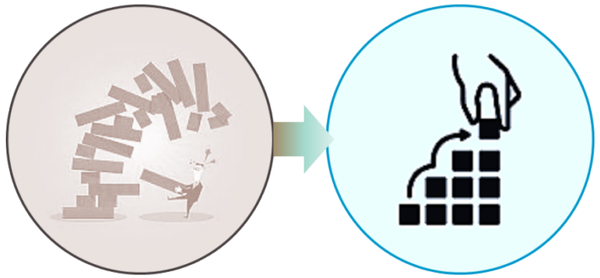
EPD RESULTS grouped for family based on:

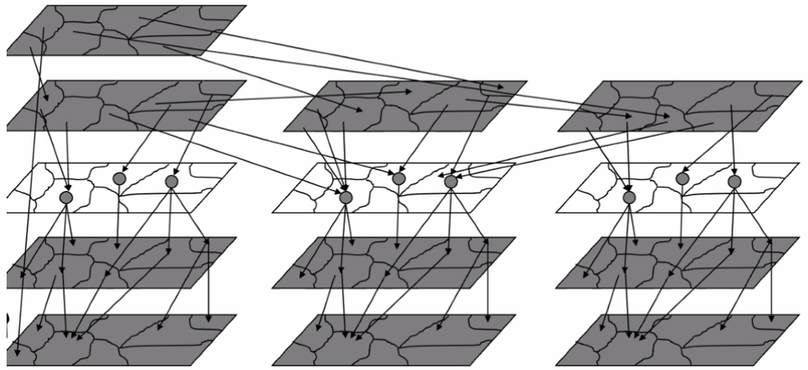
- Market share of products
- Per linear foot using coefficients

Lighting the path forward:
PCR Open Digitized Models & Templates as building blocks…

Rather than culling together disparately scoped LCA data from various background databases…

"Often, the best time to prepare data for reuse is when the data is being originally developed."





applied sciences

MDPI

Communication

The LCA Commons—How an Open-Source Repository for US Federal Life Cycle Assessment (LCA) Data Products Advances Inter-Agency Coordination

Ezra Kahn *, Erin Antognoli and Peter Arbuckle

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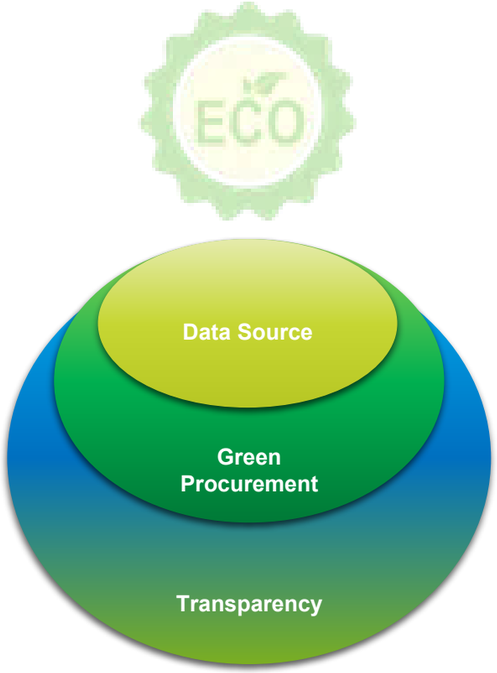
"The little data engine that could…"

ACLCA 2022 PCR Open Standard
Four Data Source Criteria in Checklist



- **Harmonize PCRs Methods, Allocation both Up & Down Supply Chain**
- **Specify which Unit Processes**
- **Data Quality Assessment**

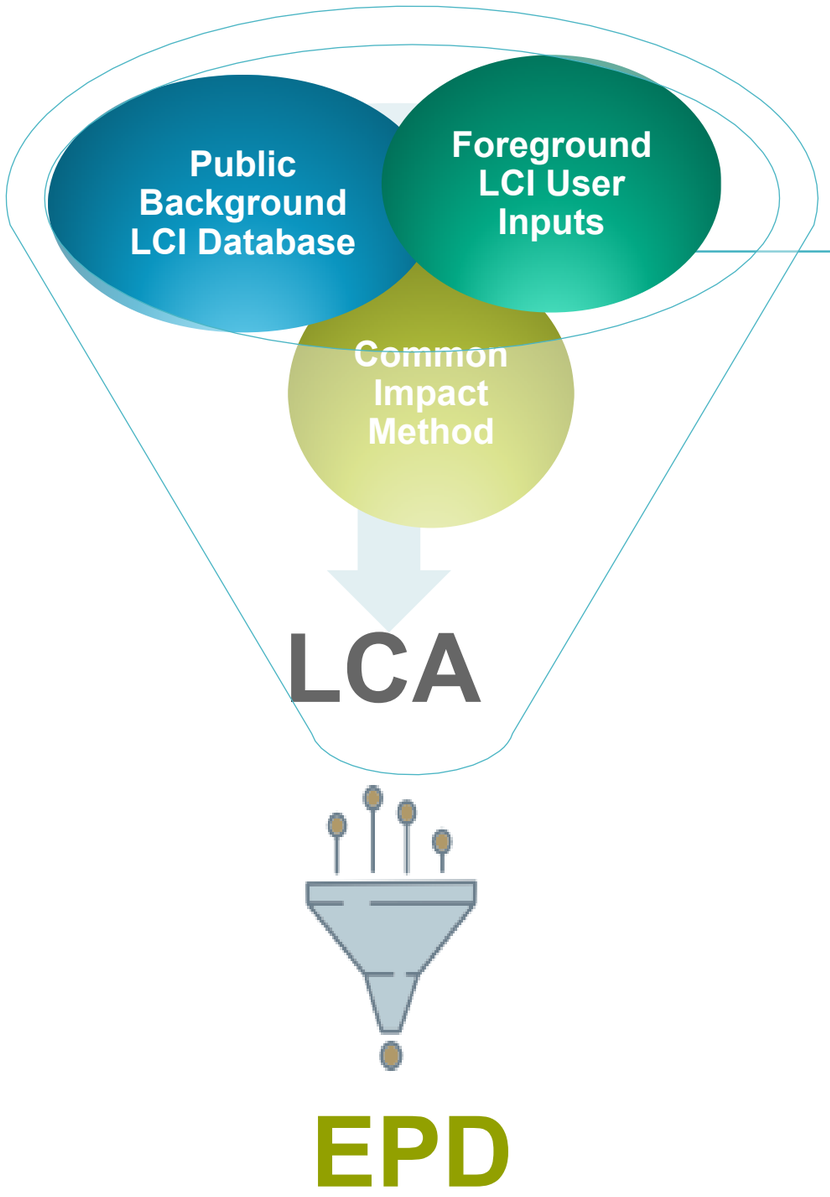
1. Program Operator (PO) checklist Version 1.0, May 25, 2022 | ACLCA PCR Guidance 2022

#	Criteria	ISO reference	Supporting documentation	EPD use
Ground rules				
☐ 5	PO **shall** evaluate upstream and downstream PCRs in the value chain to be considered for alignment. PO **shall** list relevant PCRs in the PCR. *Note: Also see Criterion 15 for the process of determining when a PCR may be updated.*	**14044** **14027 Clause 6.4.3** **This guidance**	**PCR supporting documentation:** • Identify existing upstream PCRs for the major inputs to the product(s) considered in the PCR. • Describe differences in allocation rules or other potential conflicts and how they were resolved. • Identify existing downstream PCRs that use products/materials from the PCR and how inconsistencies were resolved.	3 Data source

2. PCR Committee checklist Version 1.0, May 25, 2022 | ACLCA PCR Guidance 2022

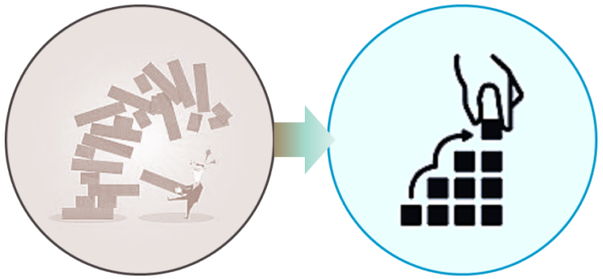
Ground rules				
☐ 8	PCR Committee **shall** ensure that all rules for LCA are specified and harmonized with upstream and downstream PCRs (if available) in conformance with relevant standards, including: specification of the functional unit, scope of the study, inventory collection, any allocation rules, impact assessment, and rules for additional information.	**14044** **14027 Clause 6.5.3**	**PCR:** • Draft PCR with list of specifications	3 Data source
System boundary				
☐ 13	PCR Committee **shall** determine the level of granularity of unit processes specified by the PCR to be included in the underlying LCA supporting the EPD and ensure that these are consistent with the study's goal of using well-identified and explained criteria.	**14044 4.2.3.3** **14027 Clause 6.5.3** **21930 Clause 7.1.9 for construction products & services**	**PCR:** • Draft PCR with list of all unit processes that include all service, material, and energy flows directly connected to the study project and its ability to perform its function.	3 Data source
Data compliance				
☐ 30	PCR Committee **shall** ensure that the PCR states data quality requirements for all data applicable for use in claims. These data **shall** be verified to be compliant with the established PCR data quality requirements and those for foreground (primary) and background (secondary) data. The PCR **shall** specify that a data quality assessment be performed on all collected foreground (primary) data and may provide templates to facilitate harmonized primary data collection, assessment, reporting, and verification. *Note: Refer to the 'Assessing Data Quality of Background Life Cycle Inventory Datasets' addendum.*	**This guidance**	**PCR:** • Data quality assessment criteria and/or template	3 Data source

Digitized, Open LCI Model-Linked Templates for PCRs



- Reflects ACLCA 2022 PCR Open Standard tiers; ease of verification for certification
- Toggle between NA & EU geographic regions, ISO standards & relevant impact assessment methods
- Connective tissue with activity and environmental flow mapping for matching public and private data inputs
- Streamlines data collection, ‘same shape’ modeling, impact assessment, verification & reporting
- Potential to implement privacy-preserving computation technology to produces industry average EPDs
- Easy data integration with upstream and downstream tools (e.g., ToxNot, EC3, SFTool, Eccomedes)

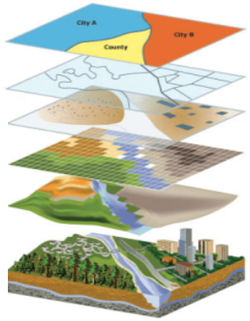
Lifecycle Footprint Cloud Solution
Open Distributed Network for Data Providers



Inventories

Digital Survey Interface
Standardized per Sector

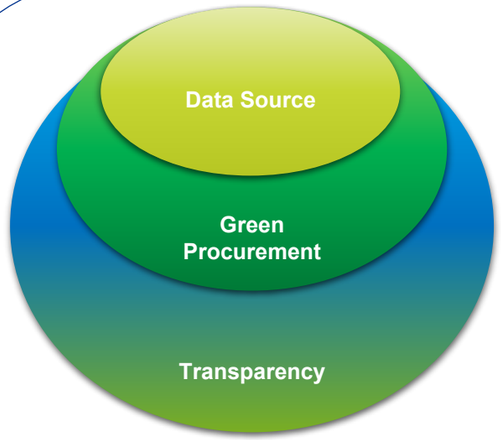
Private Data



Open Model Algorithms =
Connective Tissue Links
Private & Public Data

Plant/Company-Specific + Industry Average Declarations

Privacy-Preserving Secure Multiparty Computation



across life cycle stages

across impact categories

Public Models
lcacommons.gov

Conformant to the Open Standard from American Center for Life Cycle Assessment (ACLCA)

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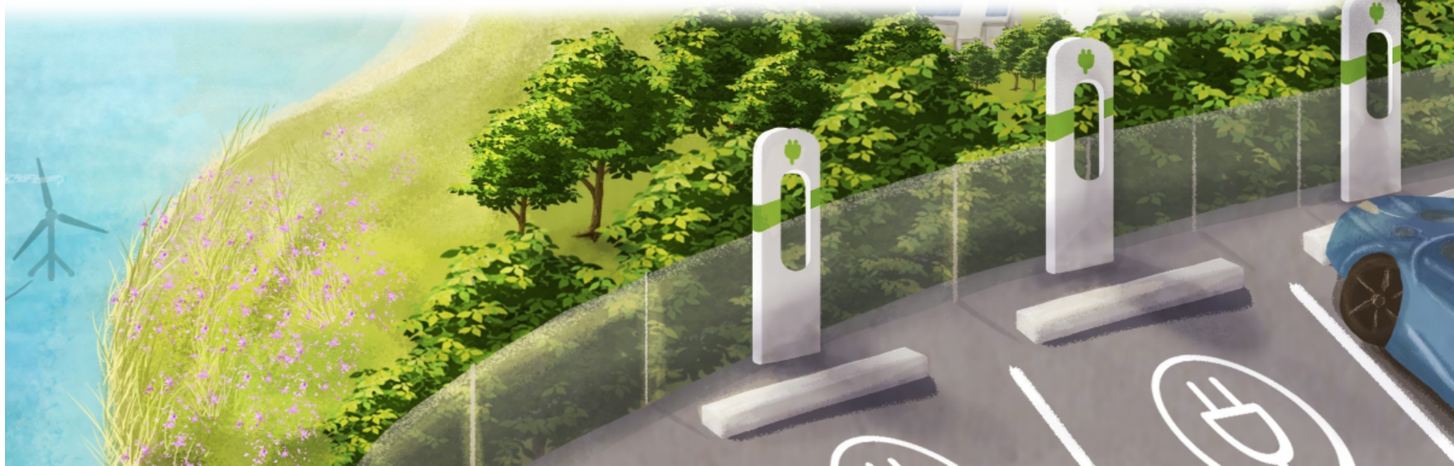
Thank you



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