



EFFICIENCY FOR ACCESS DESIGN CHALLENGE WEBINAR: LIFE CYCLE ASSESSMENT



FUNDED BY:



AGENDA

- Life cycle assessment (LCA) relevance to the Challenge
- Meet Stuart Walker and Victor Torres
- Presentation
- Q&A
- Challenge information
- Students' choice webinar



ASSESSMENT FRAMEWORK

Innovation

Sustainability

Social Impact

Scalability

LIFE CYCLE ASSESSMENT AND THE CHALLENGE



- **Sustainability**
 - Is your design reducing the environmental impact **throughout its lifecycle** compared to existing alternatives?
 - How well have you demonstrated your understanding of the potential connections with all the 17 SDGs and its associated targets?
- **Social impact**
 - What difference does your design make to people's lives?
- **Innovation**
 - What is the potential of your design to improve energy efficiency compared to existing DC and non-DC alternatives?

QUESTION:

**Do you plan on using life cycle assessment
in your Challenge project?**

MEET OUR CONTRIBUTORS



Stuart Walker

Energy Saving Trust



Victor Torres

Solar Cooling Engineering

**energy
saving
trust**



Life Cycle Assessment

Efficiency for Access Design Challenge

Pt. 1: Life Cycle Thinking

Pt. 2: Case Study

Solar Cooling Engineering

Pt. 1: Life Cycle Thinking

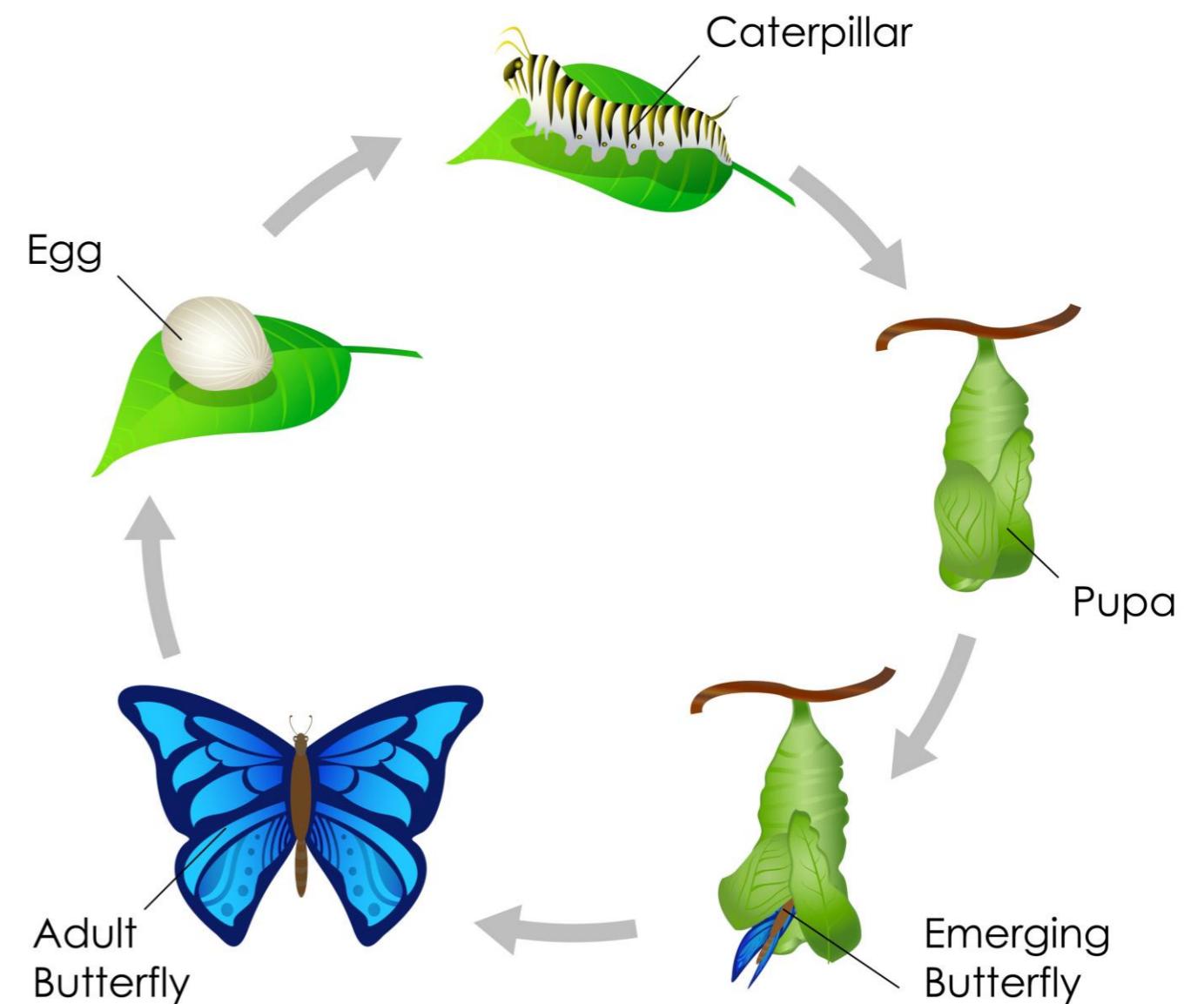
What is a Life Cycle?

Anything we can imagine has a life cycle. Products often have a linear life cycle:

Raw materials – product – disposal

Life Cycle Thinking is a way of designing a product with the full life cycle in mind.

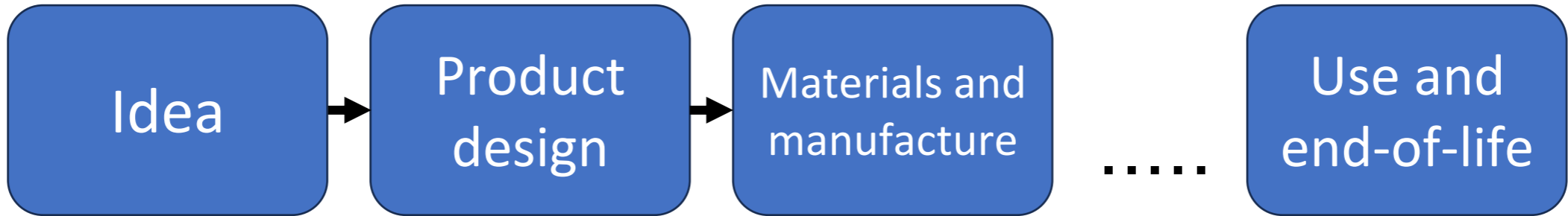
This helps us design more efficient products with more circular life cycles.



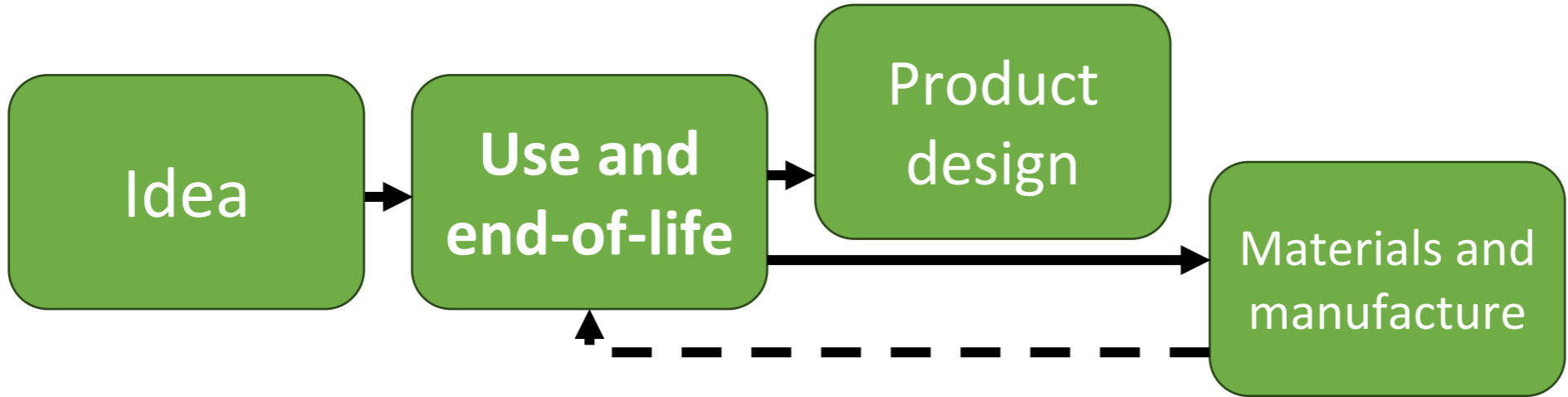
Life Cycle Thinking

Life Cycle Thinking is a way of designing a product with the life cycle in mind.

Not like:



But like:



Life Cycle Assessment

LCA is a tool to understand the environmental impact of a product.

(It can also be used to understand the social impact)

(and we can use it on more than products)

But most often, it's a way to understand the impact our product has on the environment, from raw materials and manufacturing through to the disposal after use

Life Cycle Assessment: Impact

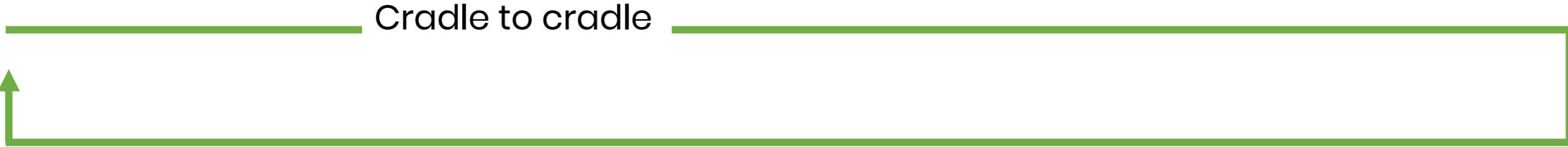
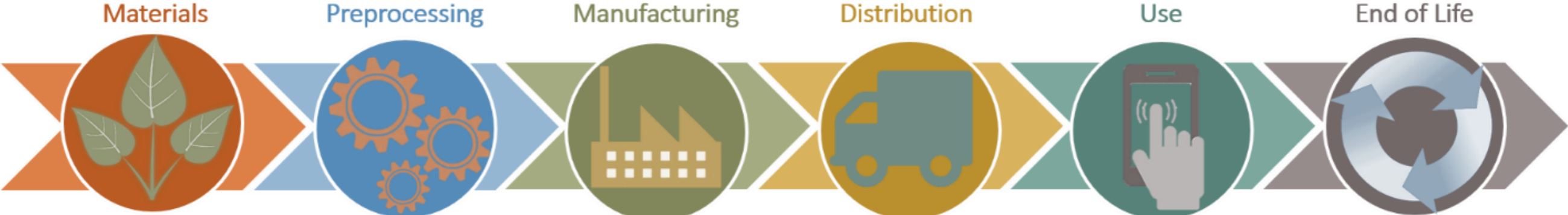
Impact means the change a product causes, compared to the world before it.

For example:

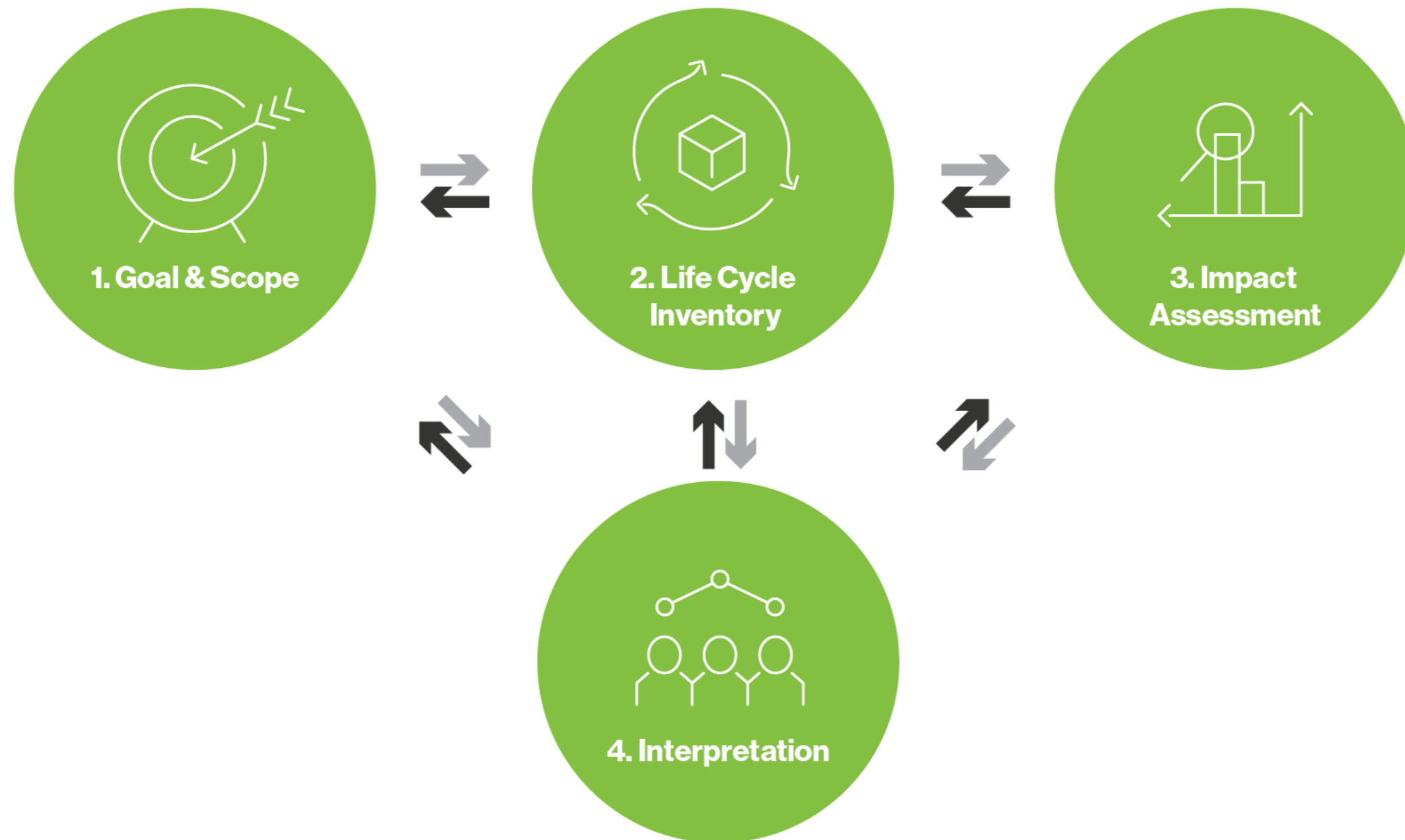
- Increased emission of greenhouse gas (CO₂) from energy use
- Increased land use to grow something used to make a product
- Increased water use to make a product or clean a process
- Increased Ozone depletion through release of damaging products
- Increased risk to human health through particulate matter release

Life cycle assessment helps us understand these impacts and minimise them

Life Cycle Assessment: Scopes



Life Cycle Assessment: Stages



Life Cycle Assessment: Stages

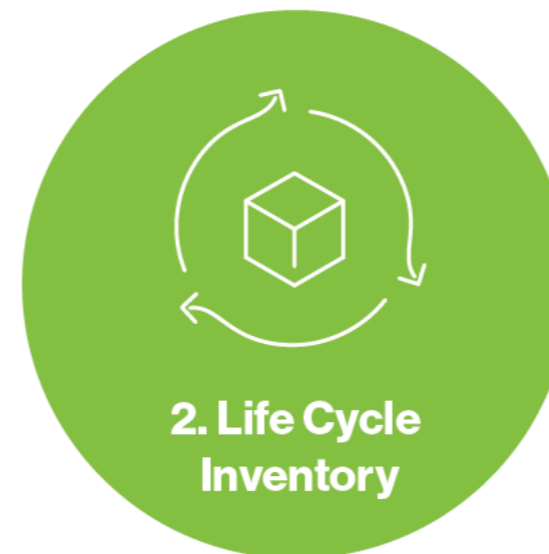


Goal and Scope

- Define goal
- Define scope of assessment
- Establish any comparisons
- Define system boundaries
- Define functional unit

Life Cycle Inventory (LCIA)

- Capture inputs and outputs
- Establish LCI data:
 - Primary data
 - Secondary data



Life Cycle Assessment: Stages



Impact Assessment

- Quantify impact inventory steps
- Define impact assessment method

Interpretation

- Weighting
- Impact Indicators:
 - Midpoint
 - Endpoint



Life Cycle Assessment: Software

Full LCA is normally undertaken using software, but even without it you can apply Life Cycle Thinking and use previous work to understand the impact of your product.

Software:

SimaPro

openLca

Database:

 **ecoinvent**

Combined package:



thinkstep
GaBi

LCA software can be expensive, but if you want to try using LCA software, you can:

Download openLCA (free software) from openlca.org

Visit nexus.openlca.org and search for free databases

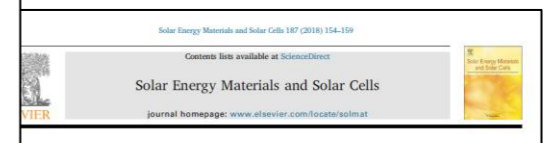
Follow OpenLCA tutorials to install databases and to begin to use the software

Life Cycle Assessment: Software

To understand the potential impacts of your products without undertaking a full LCA, you can use existing published work.

An EPD (Environmental Product Declaration) is produced by a manufacturer and gives the results of a simplified LCA.

Searching for Journal papers on a specific subject will often produce a number of LCAs.



Life Cycle Assessment: Software

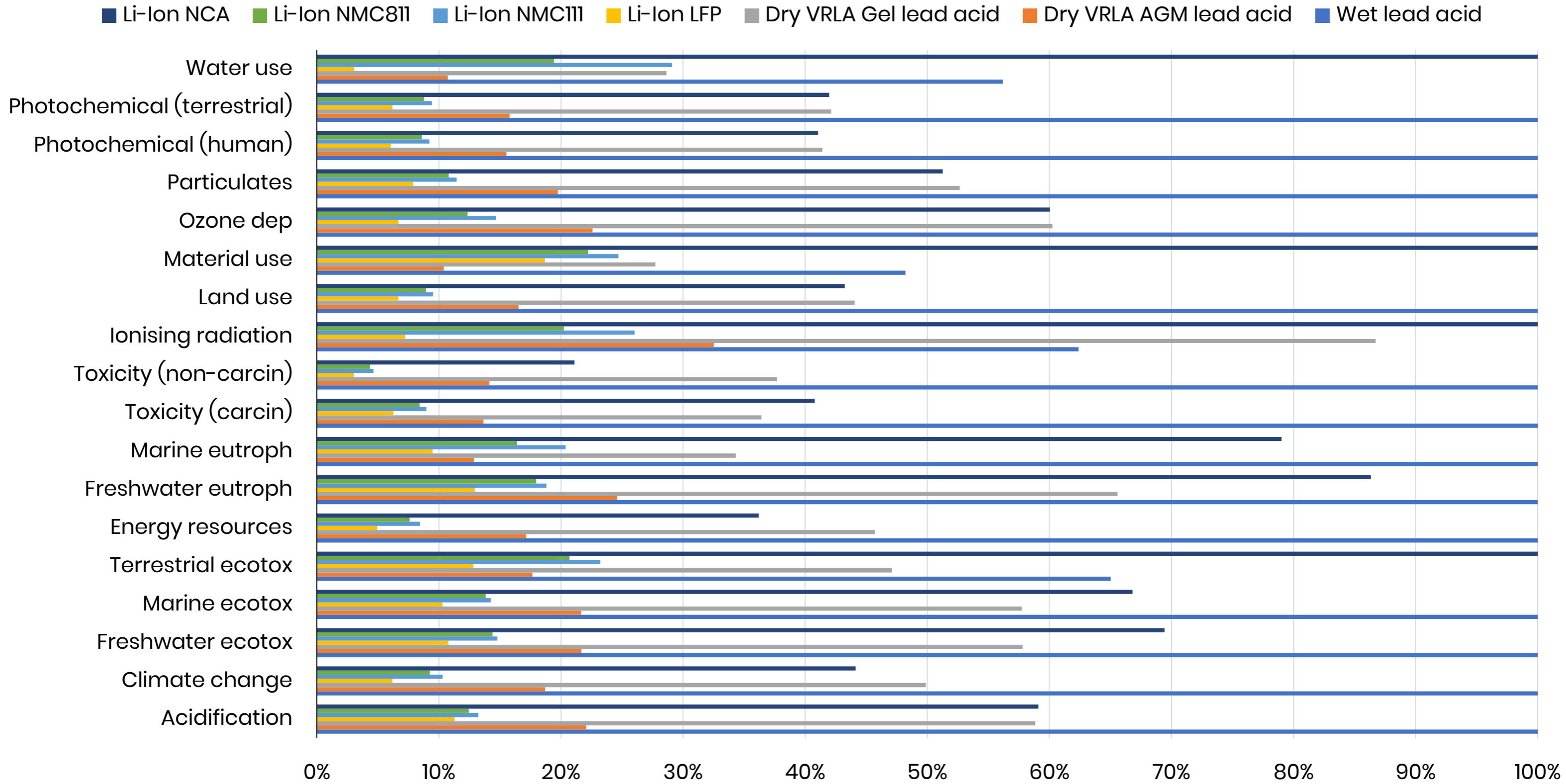
To understand the potential impacts of your products without undertaking a full LCA, you can use existing published work.

When reading an EPD or journal article, think about:

- The Goal and Scope of the study
- The Functional unit
(for example, per kWh generated or per m²)
- The location of the study
(particularly if grid electricity is significant)
- If possible, use multiple sources and compare results



Life Cycle Assessment: Software



Life Cycle Assessment: Summary

Consider potential impacts of your product and possible alternatives

For example:

- Does it use raw materials which are difficult to get (mined, heavily refined)?
- Does it require transport over long distances, particularly by air?
- Does it rely on a resource which is scarce in the place it is made?
- Does it rely on energy use in a country with high energy emissions?

Life Cycle Assessment: Summary

Consider potential impacts of your product and possible alternatives

For example:

- Does it use raw materials which are difficult to get (mined, heavily refined)?
 - Could it use a waste product from another process instead?
- Does it require transport over long distances, particularly by air?
 - Could it be made locally, or transported by land or sea instead?
- Does it rely on a resource which is scarce in the place it is made?
 - If you must use this resource, find a place where it is less scarce. Or use an alternative.
- Does it rely on energy use in a country with high energy emissions?
 - Try to undertake energy-intensive processes in locations with low grid electricity impact

Pt. 2: **Case Study**

Solar Cooling Engineering

Video: Solar Cooling Engineering



Solar Cooling Engineering GmbH, Germany

Your Partner for Sustainable Cooling



Research & Development

Modular Solutions (SelfChill Approach)
Performance testing
Consultancy



Local Manufacturing

Use of local sourced materials
Local assembly and maintenance
Performance assessment



Capacity Building

Design of solar cooling solutions
Agri-food value chains
Business models



Spin off company of



UNIVERSITY OF
HOHENHEIM

Solar Cooling Engineering GmbH, Donaustr. 38, 87700 Memmingen, Germany www.solar-cooling-engineering.com info@solar-cooling-engineering.com

Video: Cold Rooms

Sustainability of solar cold rooms



Refrigeration
system



Carbon emmisions

- Production of components
- Insulation blowing agents
- Refrigerants
- Transport to final location

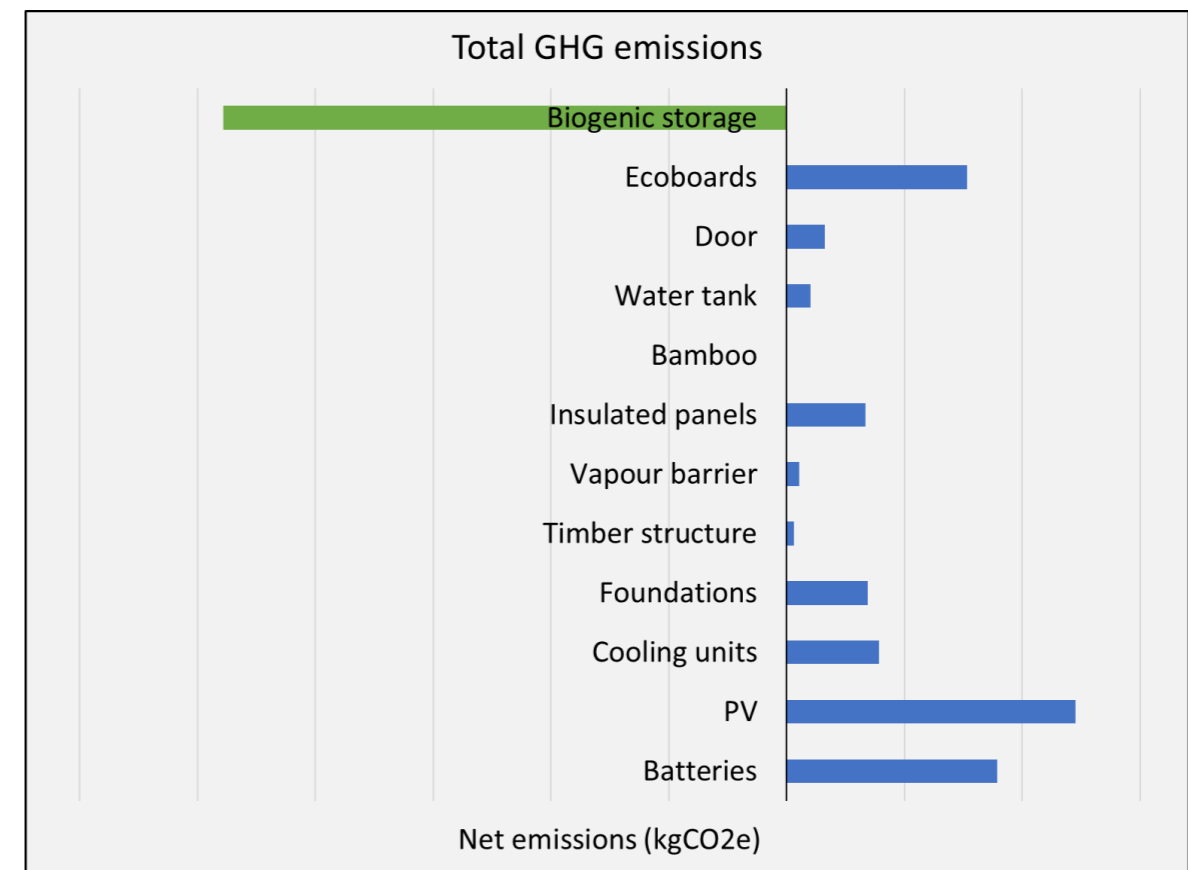
Carbon savings

- Use of carbon-negative materials
- Post harvest losses reduction



LCA: Net Zero cold room

We have worked with Solar Cooling Engineering to undertake LCA of the net zero cold room



Video: Key components

Solar Off-Grid Systems are not yet free from Carbon emissions



3-6 Tons Co2 eq. for typical 30m³ cold rooms

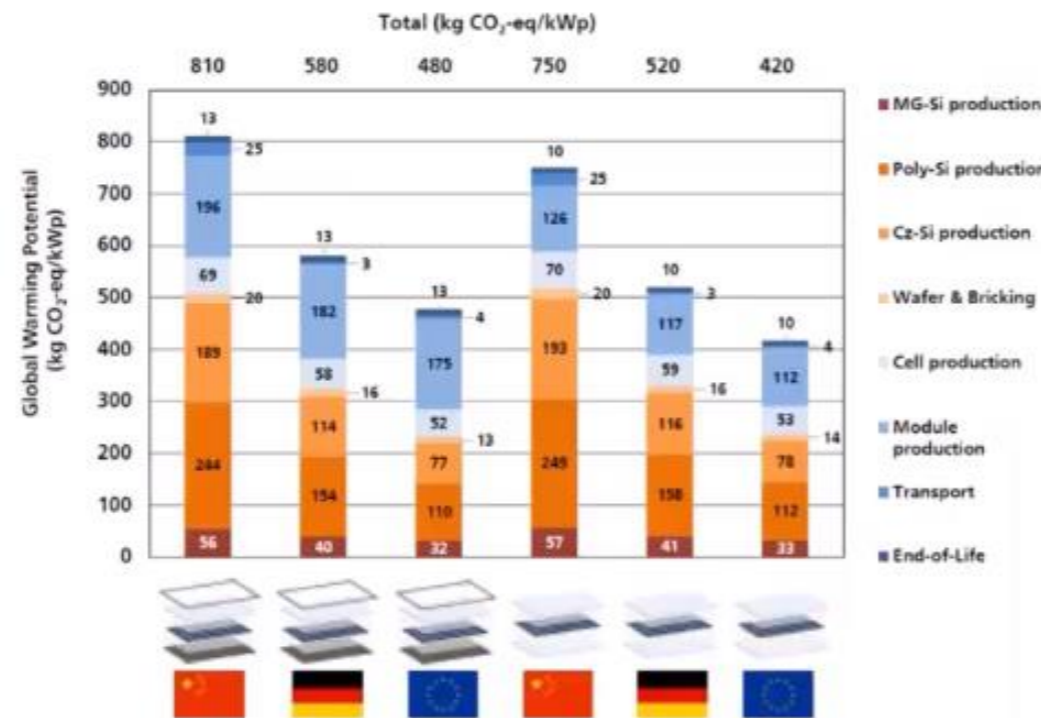


1-3 Tons Co2 eq. for typical 30m³ cold rooms

CO₂ EMISSIONS OF SILICON PHOTOVOLTAIC MODULES – IMPACT OF MODULE DESIGN AND PRODUCTION LOCATION

Christian Reichel, Amelie Müller, Lorenz Friedrich, Sina Herceg, Max Mittag, Dirk Holger Neuhans

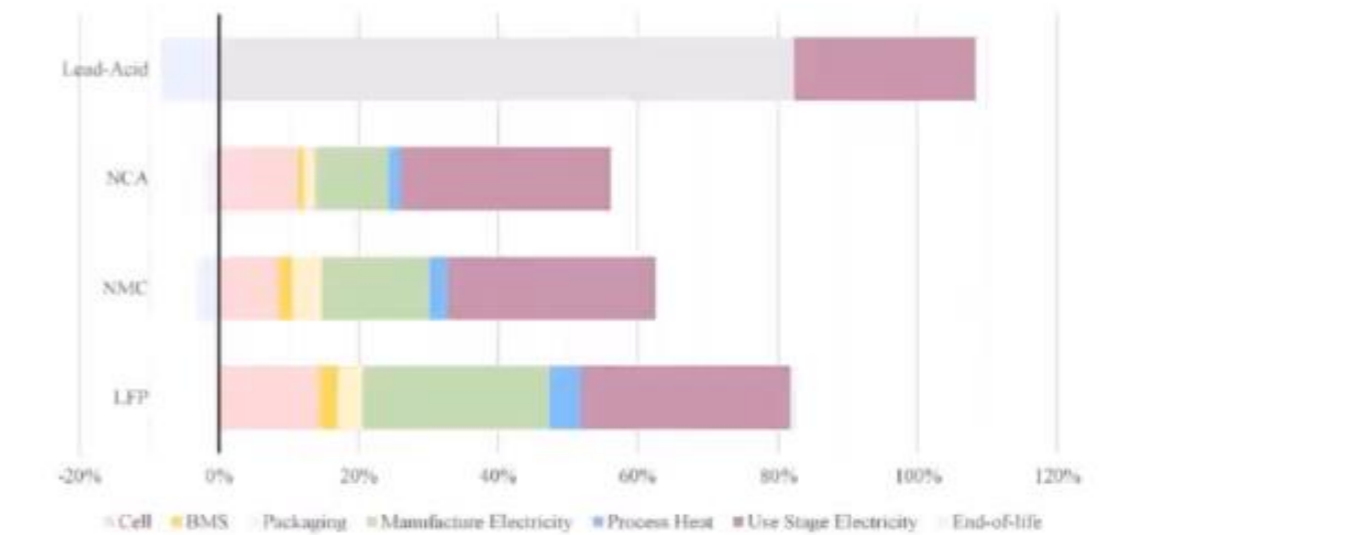
Fraunhofer Institute for Solar Energy Systems ISE, Heidenhofstrasse 2, 79102 Freiburg, Germany



A comparative life cycle assessment of lithium-ion and lead-acid batteries for grid energy storage

Ryutaka Yudhistira^{1,2}, Dilip Khatiwada^{1,2}, Fernando Sanchez¹

¹ Division of Energy System, Department of Energy Technology, KTH Royal Institute of Technology, Brinellitornen 6B, SE-100 44, Stockholm, Sweden
² Pulsar Energy Solutions AB, Åse Garbergs Torv 17, SE-164 40, Kista, Sweden



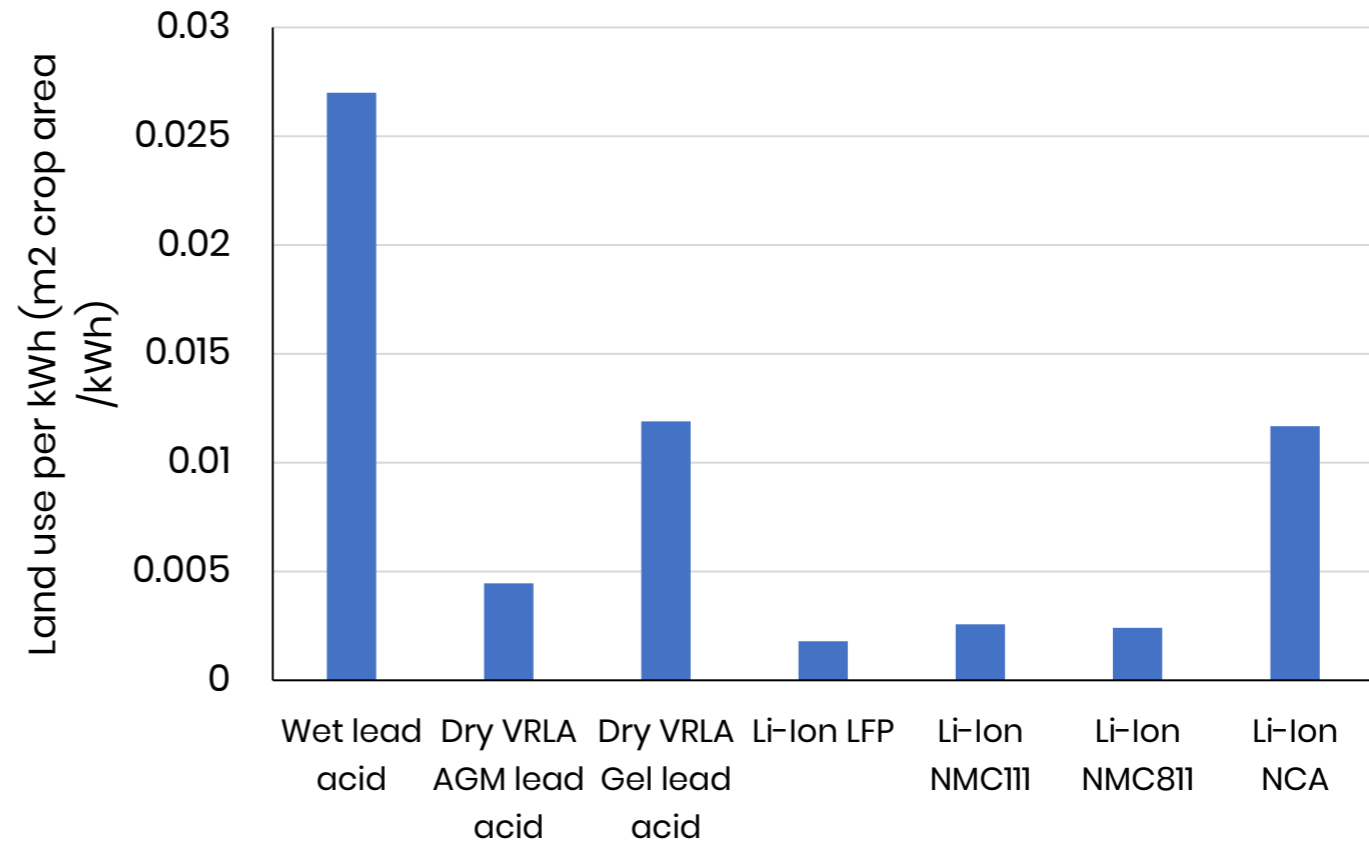
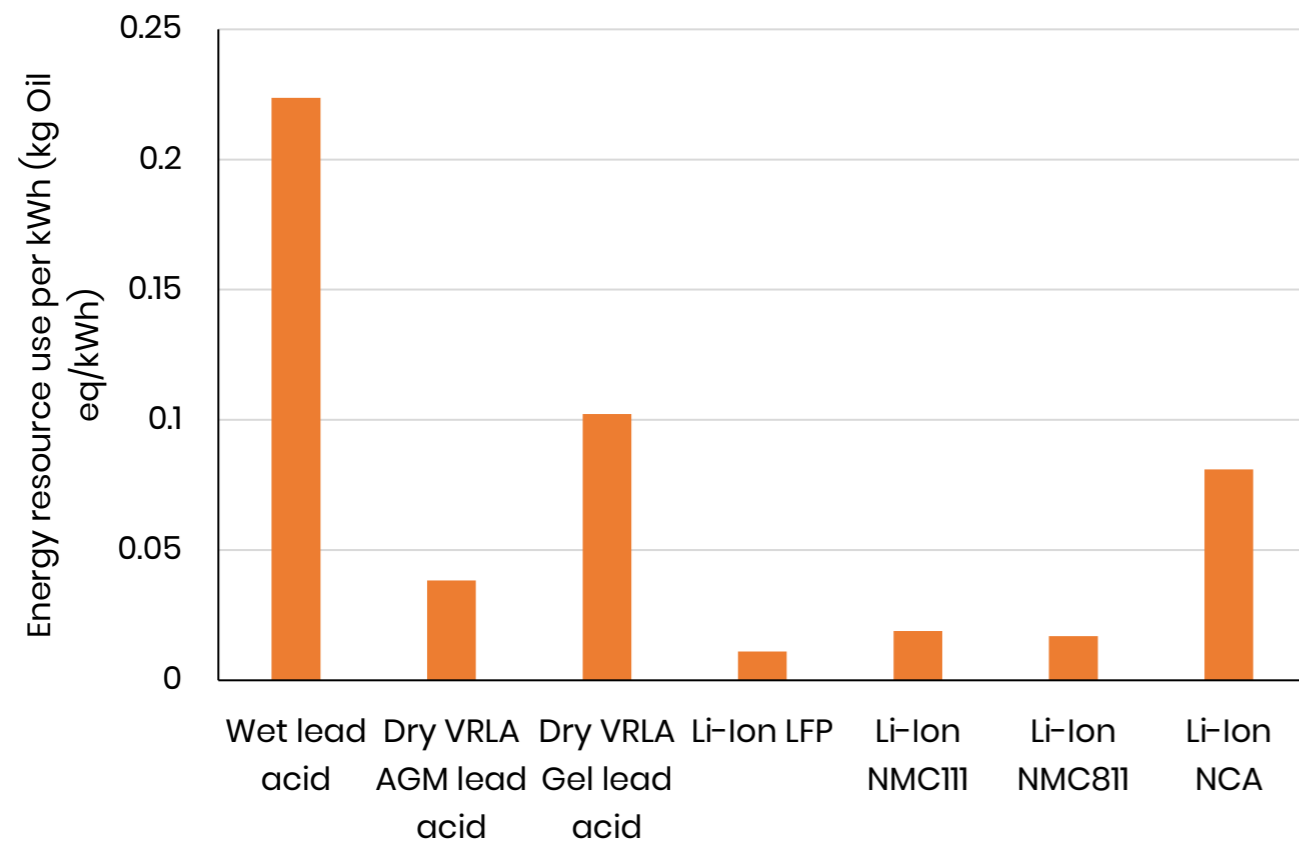
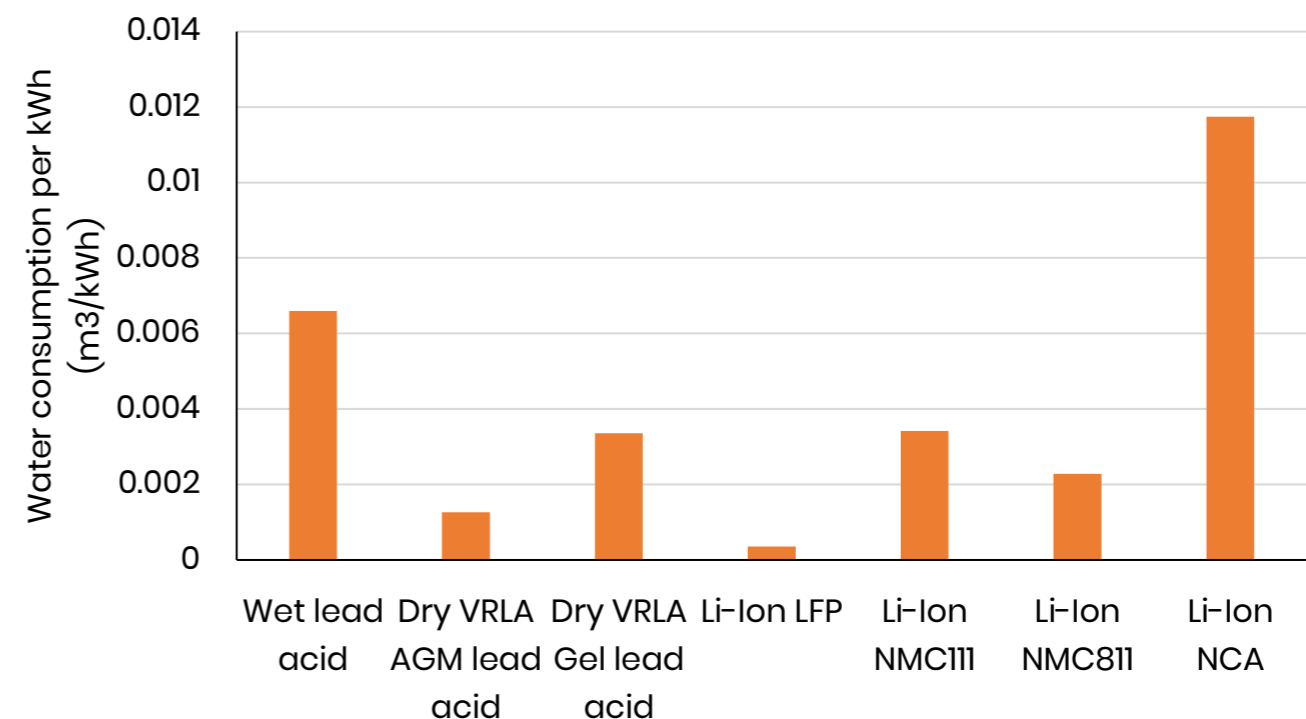
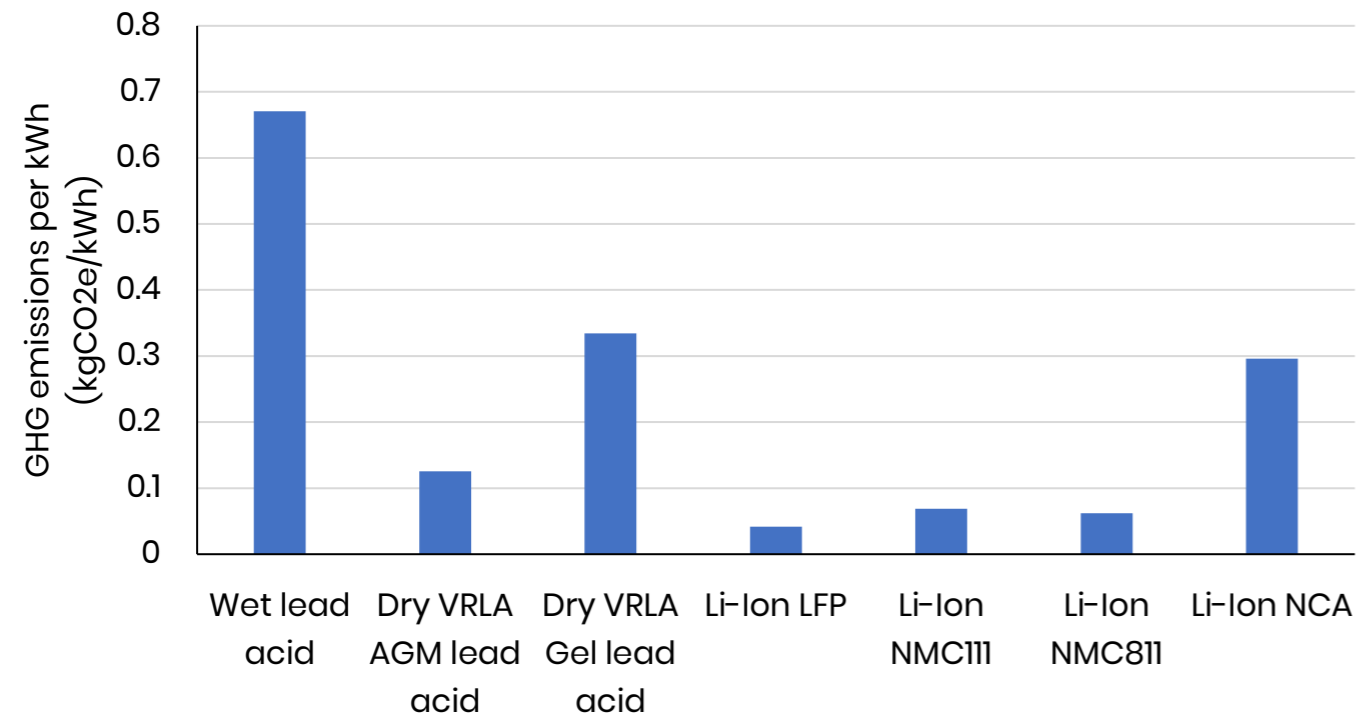
climate change impact, in kg CO₂eq per kWh energy delivered; the grey bar denotes the whole cradle-to-gate stage of lead-acid batteries.



LCA: Comparison of batteries

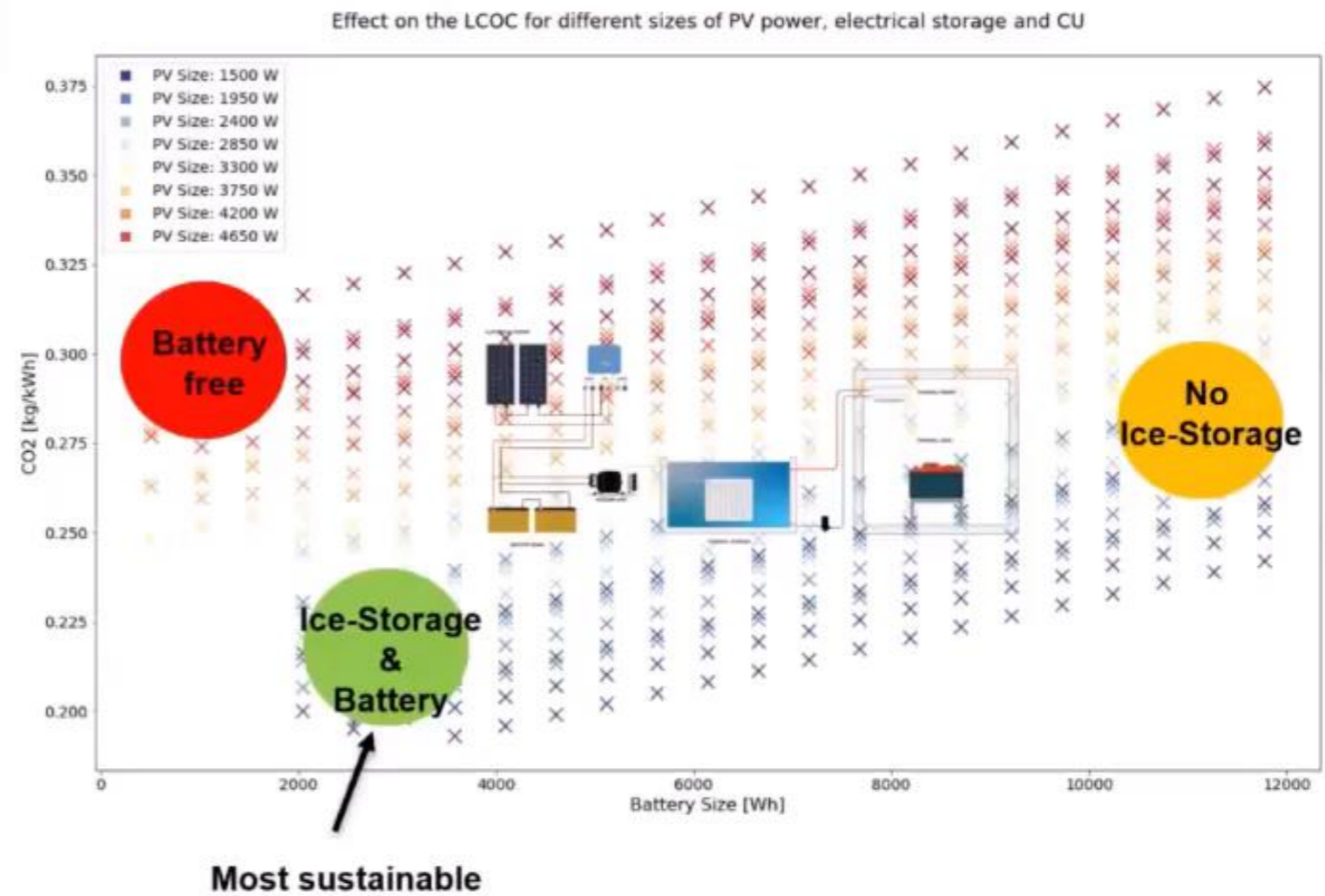
Depending on your environmental focus, the results are different

For example:



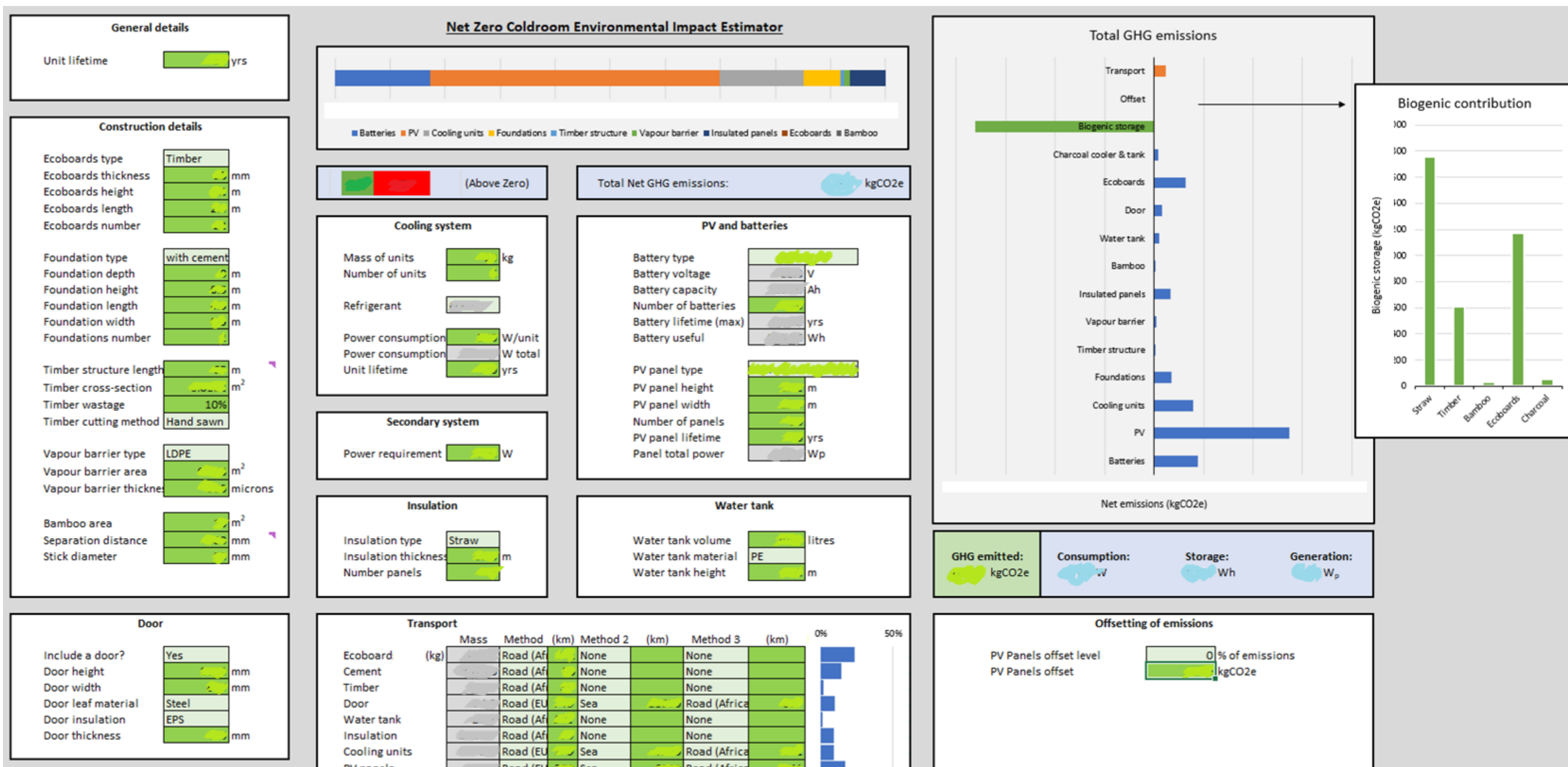
Video: LCA for optimisation

Thermal (Ice) storage as substitute of electrical batteries



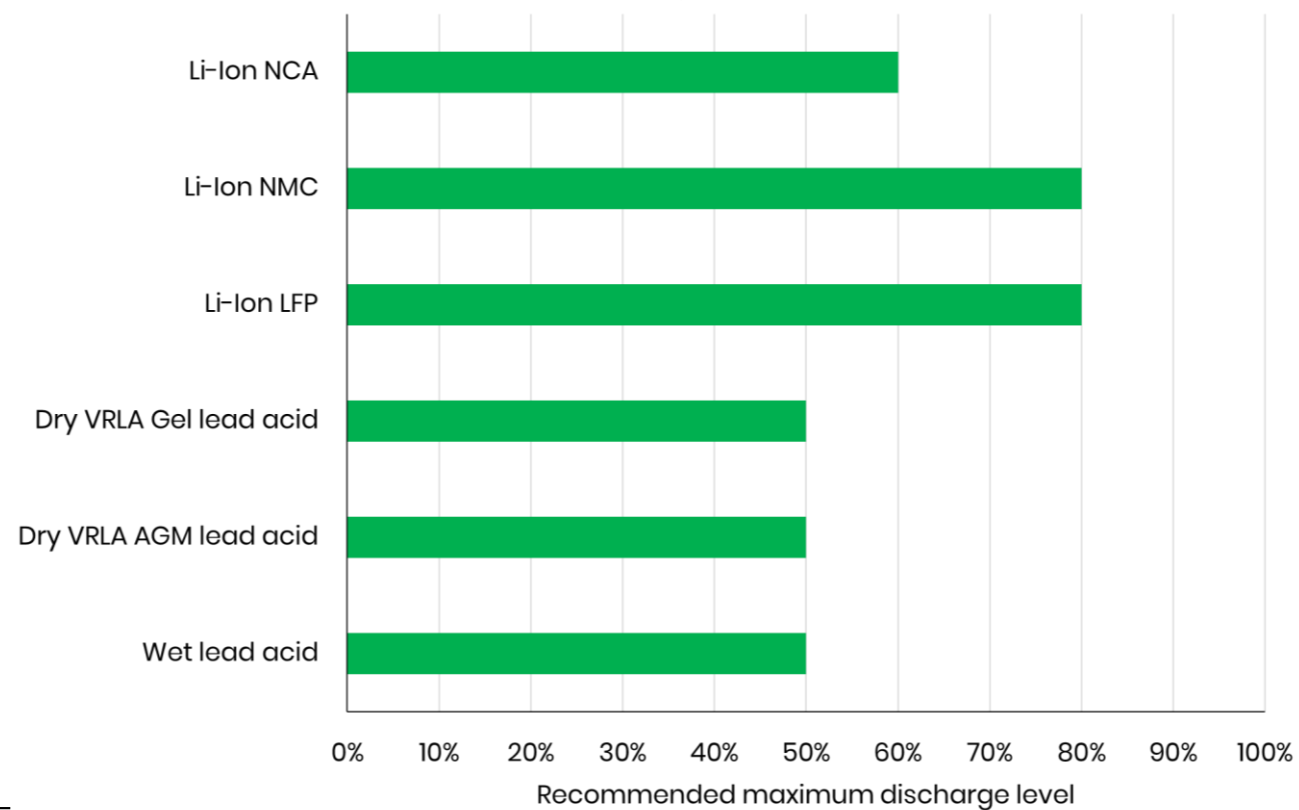
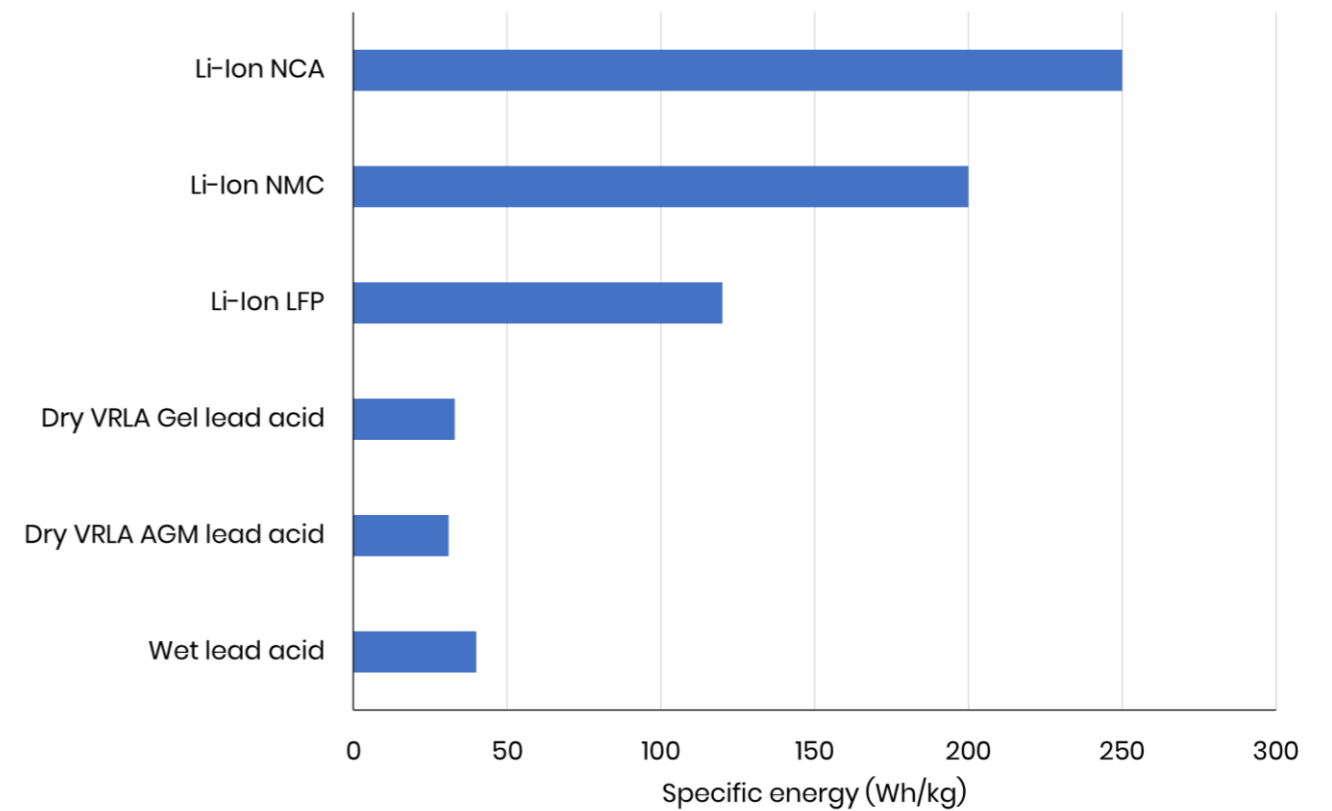
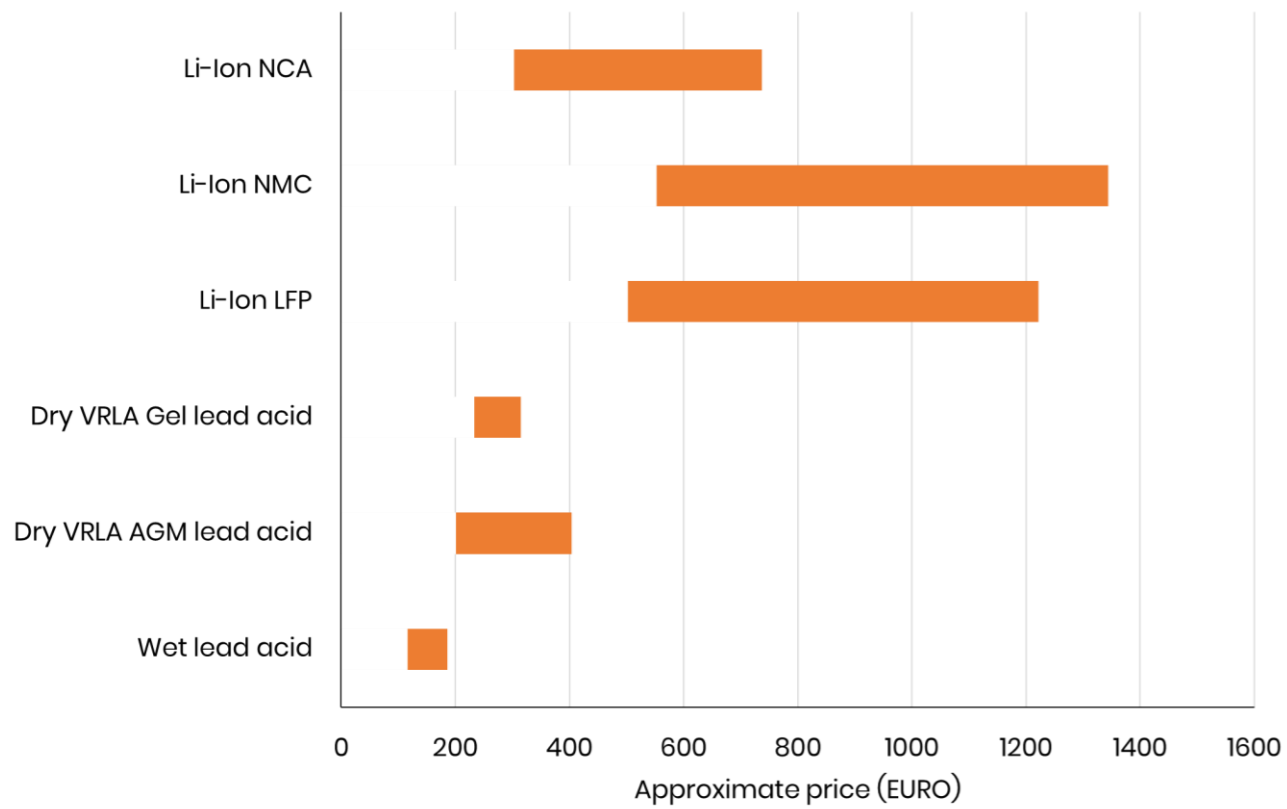
LCA: Optimisation tool

Combining LCA with other tools allows design optimisation for low emissions, high performance, and low cost.



LCA: Optimisation tool

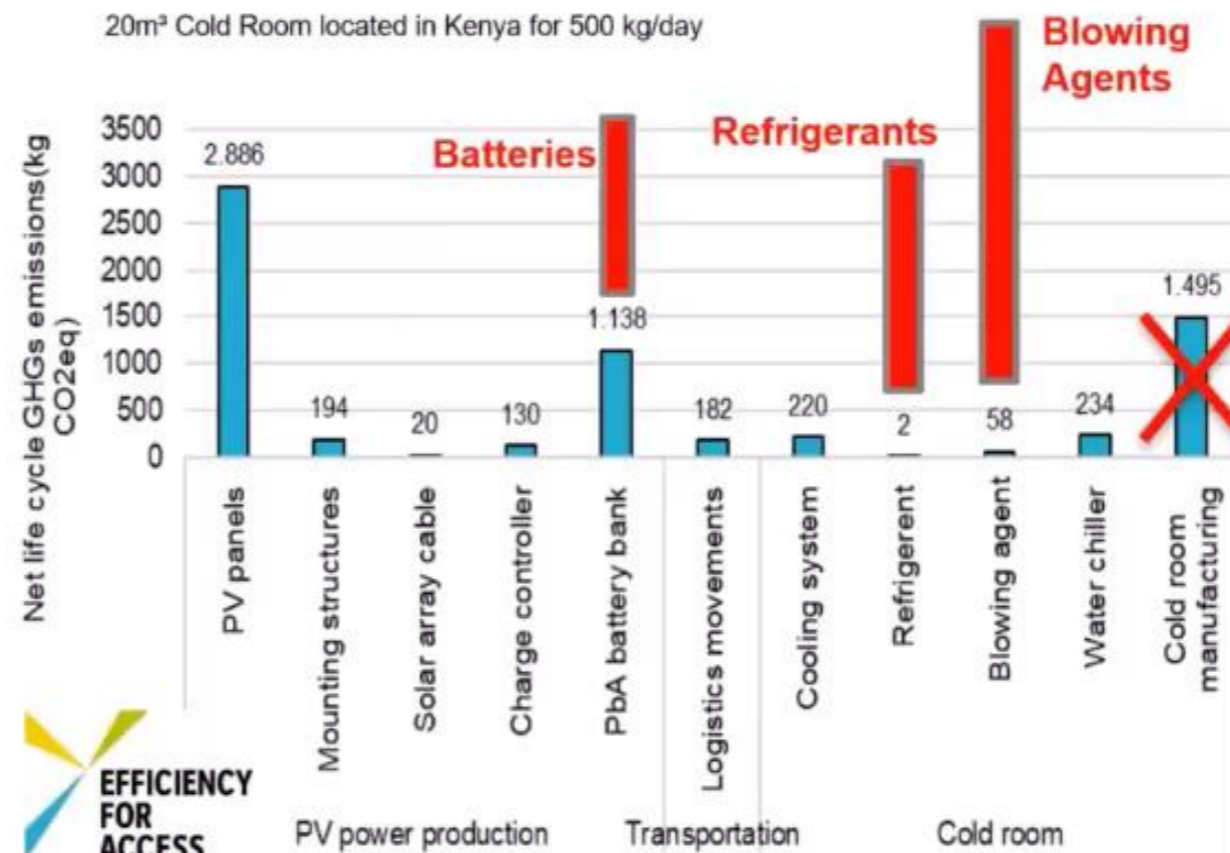
Combining LCA with other tools allows design optimisation for low emissions, high performance, and low cost.



Video: Targeting Net Zero



Carbon net-zero approach for solar powered cold



NET ZERO

Biogenic Materials



Current test of first prototype

Source: <https://efficiencyforaccess.org/publications/life-cycle-greenhouse-gas-emissions-assessment-of-off-and-weak-grid-refrigeration-technologies/>

Pt. 3: Conclusion

LCA: How can you use it?

By applying Life Cycle Thinking during your design process, you can optimise your designs, business models and plans for minimal environmental impact.

If you only remember three things:

- Consider the life cycle from the start
- Use the work others have already done, but compare it
- Avoid flying materials and parts wherever possible

energy
saving
trust



Thank you



Q&A

QUESTION:

**Do you plan on using life cycle assessment
in your Challenge project?**

WHAT'S COMING UP?

Now:

- Sign your terms and conditions
- Create your project space and add all your teammates
- Submit your Concept Note (by 14 February deadline)

Soon:

- You will be assigned your mentor
- **Prototype funding application window 2:** 5 February – 1 March
- **Drop-in 4:** 15 February
- **Early stage business steps webinar:** w/c 19 February
- **Career conversation 1 – scholarships:** w/c 26 February
- **Students' choice webinar:** w/c 11 March



ACTIVITY:

**Students' choice webinar
brainstorming**

FEEDBACK SURVEY



<https://bit.ly/3LhnoGS>

SIGN YOUR T&Cs



<https://bit.ly/458F2U1>

NEWSLETTER SIGN-UP



<https://bit.ly/4500X2A>

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