An introduction to ecodesign as brought to the SMEs during the EARASHI project

Funded by the European Union

EARASHI is an EU project funded by Horizon Europe under GA 101069994

A word of introduction about the EARASHI project (1/2)

In the context of EARASHI project (**E**mbodied **AI**/**R**obotics **A**pplications for a **S**afe, **H**uman-oriented **I**ndustry), 2 open calls were organized to select 10 projects distributing 2 M€ among them. The selected projects were requested to address one of EARASHI 10 challenges defined by EARASHI advisory board, and publicity announced within the open call.

Besides funding, the selected projects benefited from the **EARASHI programme**:

- **Integration of a Technical building block** of their choice and associated expertise, among the Building Block portfolio offered by EARASHI.
- **Coaching services** such as Business, human-centered design, eco-design, cybersecurity, engineering system integration, mentoring & access to validation facility.

The **funding instrument** included a lump-sum grant of up to 200 k€ per project for developing solutions at demonstration scale and coaching session during and beyond their developments within the following framework:

- The total duration of a granted project expected to be 15-18 months.
- Granted company cannot individually receive more than 200 k€.
- Only startups and SMEs were eligible to receive such funding.

R&D demonstration projects targeting EARASHI challenges had to be developed to reach Technology Readiness Level (TRL) 7 starting form TRL 4-5, following a competitive based approach. The demonstration projects had to respond to one of **EARASHI 10 challenges**, and address **EARASHI overall scope**:

- **Support the industry in the uptake of advanced digital eco-responsible technologies** (in particular AI, Data and Robotics)
- **Support workers in their daily activities and improve their working conditions** (safety, health and well-being) leading to a productivity increase
- **Adopt a worker-centric approach by considering worker well-being and health at work** (e.g., MSD and stress), design thinking methodology of production machines, worker acceptance and Ethics

A word of introduction about the EARASHI project (2/2)

The granted projects were expected **to have impact** on:

- Decrease of the number of workers that perceive stress at work / the number of accidents at work / number of workers already suffering from MSD
- Increase of the number of ROS-users (ROS=Robot Operating System)
- Improvement of trust in AI, Data and Robotics (implementation of ADR in manufacturing)
- Machine retrofit and refurbishment
- Deployment of eco-design approach
- Standardized, easy, non-hazardous dismantling processes shortened in time and costs

The granted projects products were expected to have **market potential** and reach **commercialization** as project's outcome.

Pan-European demonstration projects (EU member states or Horizon Europe associated countries) were strongly encouraged, through **cross-border collaboration** either with the EARASHI partners providing the technical Building Blocks and expertise or through the companies building up the proposal.

For a proposal **to be eligible for the evaluation** phase, the following conditions had to be respected

- Be written in English, use of the application form template and respect the length requirements
- Be proposed by a micro-consortium of a minimum of 1 independent legal entity (maximum 2) including exclusively Start-up or SME, established in the Member States of the European Union and its overseas countries and territories (OCT) and Horizon Europe associated Countries
- Involve one Building Block described in the Building Block catalogue
- Address one of EARASHI challenges

This document goals

1. Introduce you to the ecodesign approach
2. Explain you the reasons behind this approach
3. Describe the whole process you will follow

Agenda

1. Environmental issues
2. Main impacts of your technologies
3. The ecodesign approach

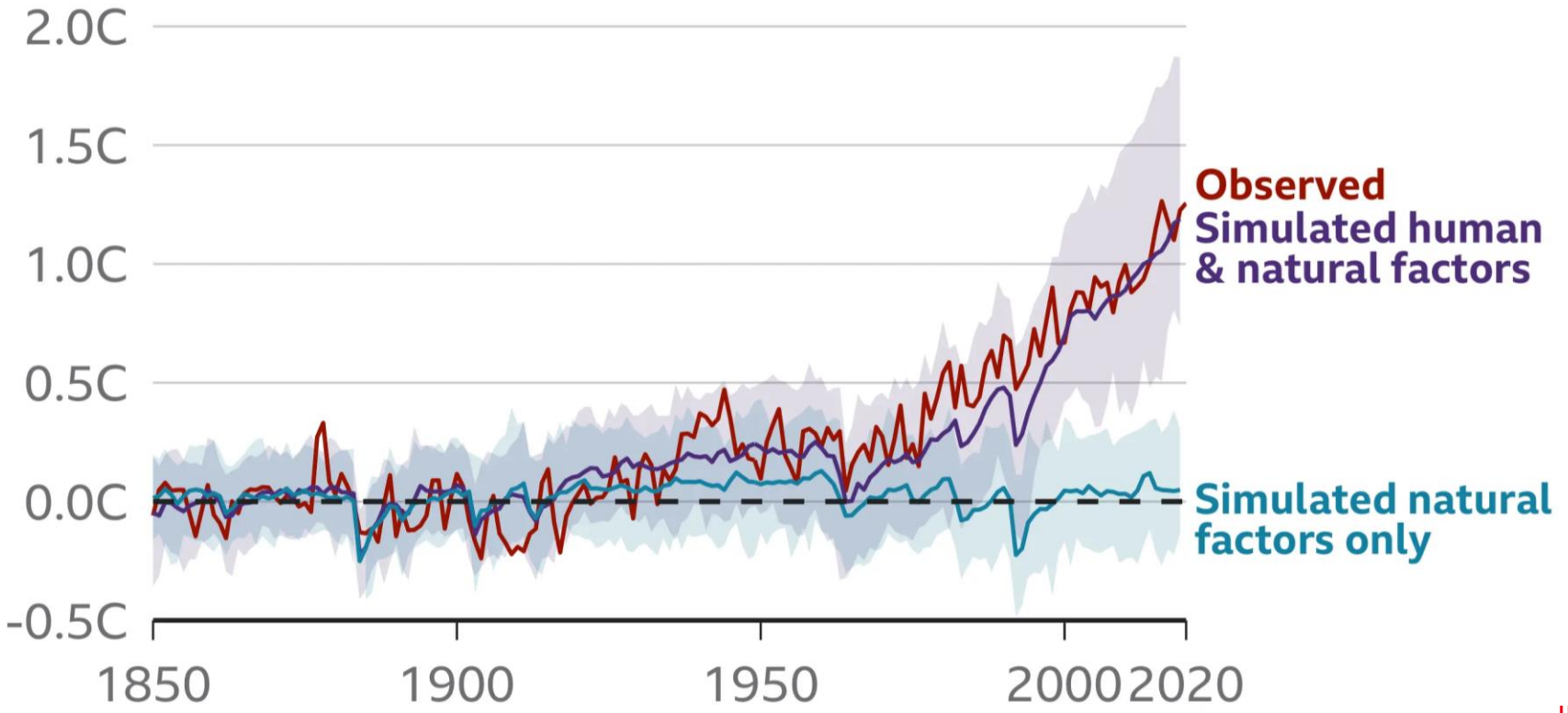
1. Environmental issues

What are the current environmental issues ?

Global warming

“emissions of greenhouse gases from human activities are responsible for approximately 1.1°C of warming since 1850-1900”

IPCC



IPPC, BBC

But remember, climate change is not limited to global warming !

Nasa

Recent catastrophes in Europe linked to climate change

The Conversation

Spain registers hottest August on record

With an average temperature of 25°C, this year's August was the hottest since rec
the country's meteorological agency said.

Le Monde with AFP
Published on September 3, 2024, at 1

Le Monde

Winemakers face new problems each year due to climate change in France

Vigneron Jonathan Hesford explains the unprecedented impact of extreme weather on his work in the vineyard

11 August 2023 12:25

The Connexion

Changes in Climate Will Drastically Affect Czech Republic's Well-Being

Prague Monitor

Olive oil, honey and wine: How heat is hitting harvests on the Greek island of Kos

Euronews

France badly hit by climate change and ill-prepared for its effects, warns report

France is being badly hit by climate change, is not prepared for its effects and is failing to sufficiently reduce its emissions, an independent climate body warned Wednesday.

Issued on: 28/06/2023 - 22:41 2 min

France24

Climate change threatens Germany's fairy tale forests

August 5, 2023 · 7:00 AM ET

By Esme Nicholson

NPR

España puede pasar de clima mediterráneo a estepario en 2050 por los efectos del cambio climático

Son las conclusiones de un nuevo estudio que advierte de que la situación es "muy grave"

Cadena SER

'Crippling' droughts in Sicily and Sardinia made twice as likely by climate change

Euronews

Come il riscaldamento climatico ha cambiato l'Italia: è sparito il freddo, Roma mai più sotto zero, a Milano boom di notti tropicali

Quarant'anni di rilevazioni ora per ora: così il riscaldamento climatico ha cambiato il nostro Paese. I dati choc città per città, raccolti da ilMeteo.it per il Corriere. Rieti la peggiore (+4 gradi di aumento medio). Al Nord le giornate di gelo crollate del 70%

Corriere della Sera

Germany's valley of floods is braced to withstand future disasters

▶ Changes for the better since 2021 flooding seek to adapt area to the consequences of climate change

The National News

Climate Crisis Intensifies: Hottest Summer on Record

By **Tasos Kokkinidis** September 6, 2024

Greek Reporter

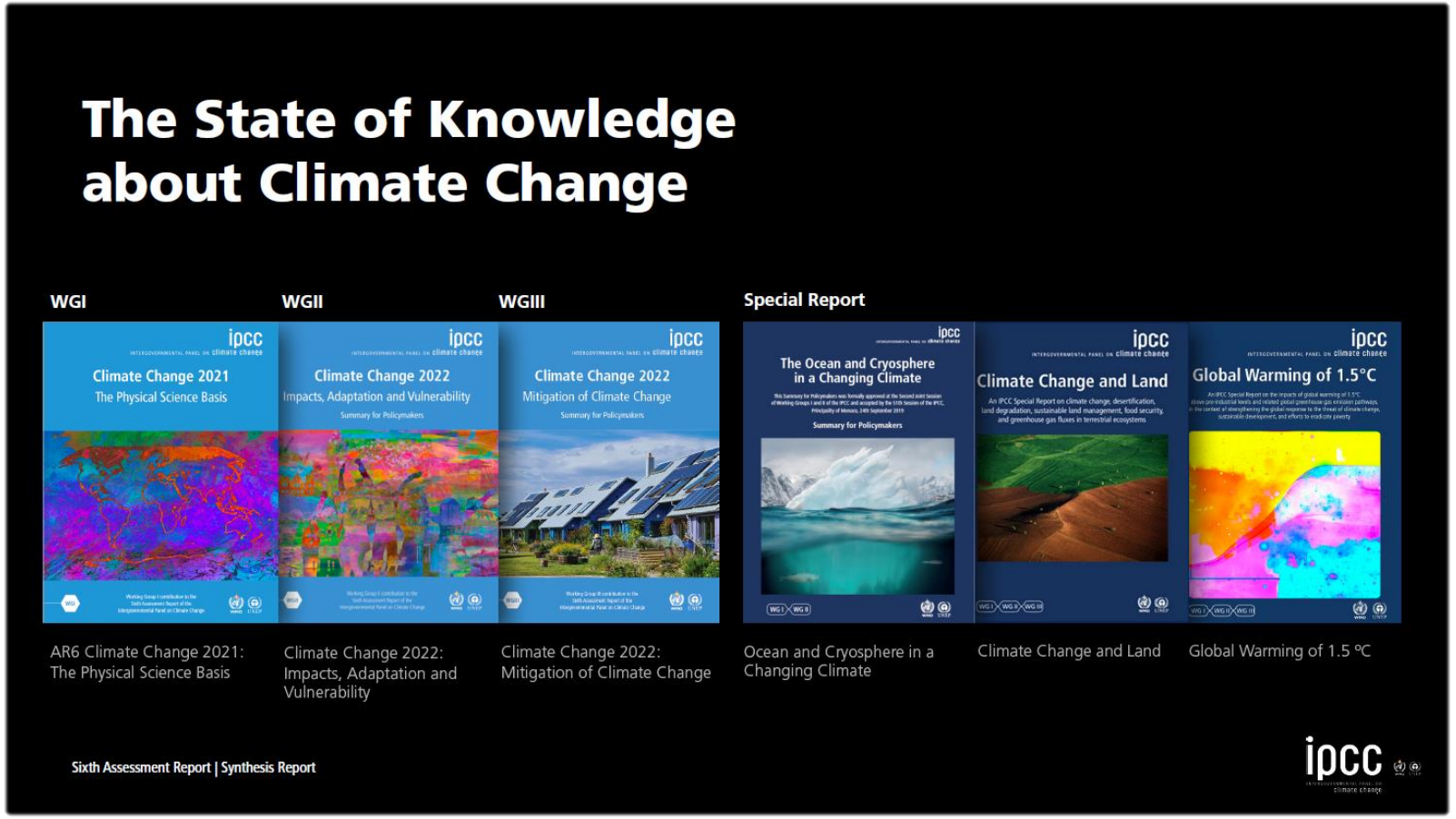
75% of young Czechs in favour stricter government measures for individuals to fight climate change

ENGLISH

21 MARCH 2023

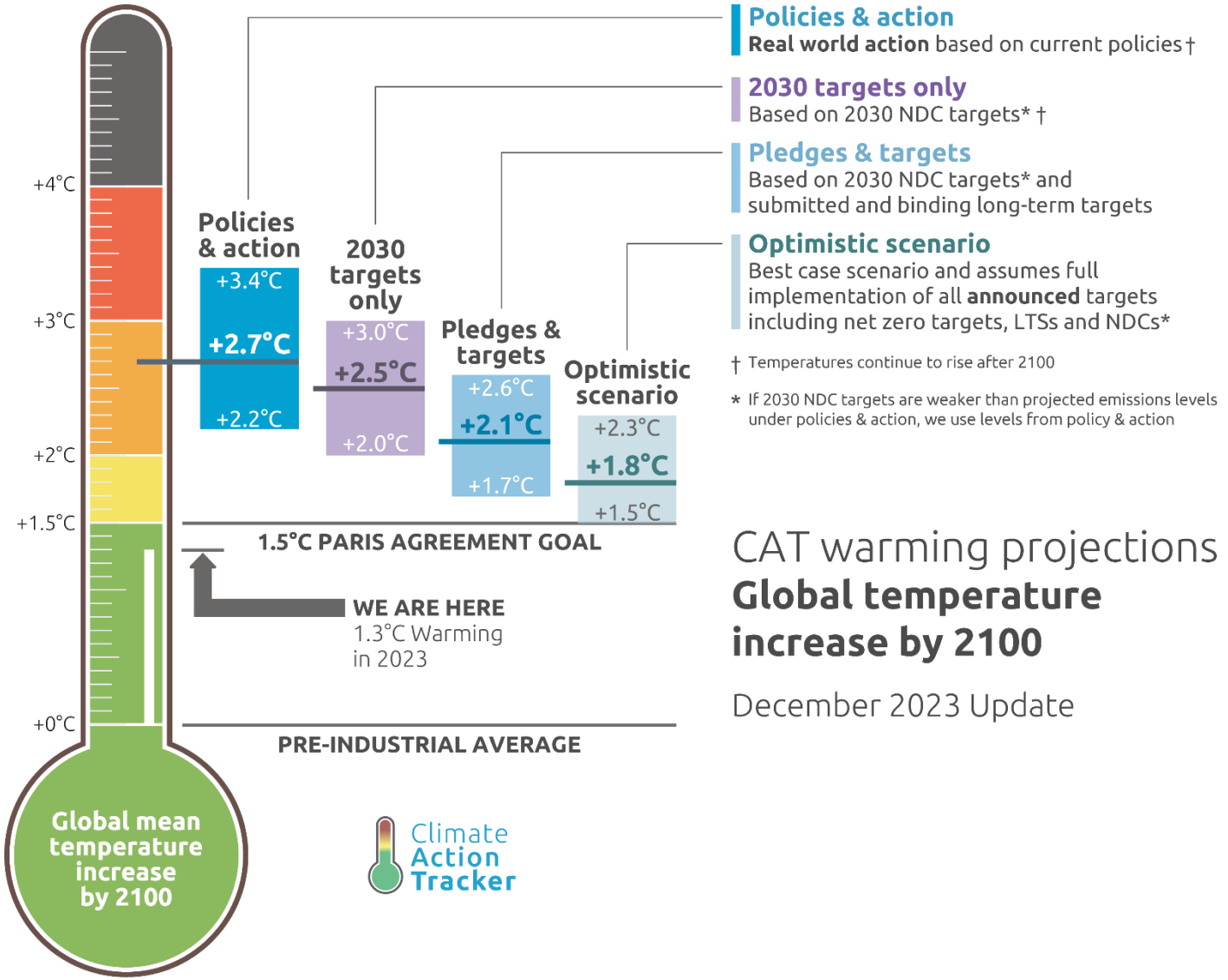
European Investment Bank

The latest update on climate change can be found on the website of the Intergovernmental Panel on Climate Change (IPCC)



IPCC reports IPCC

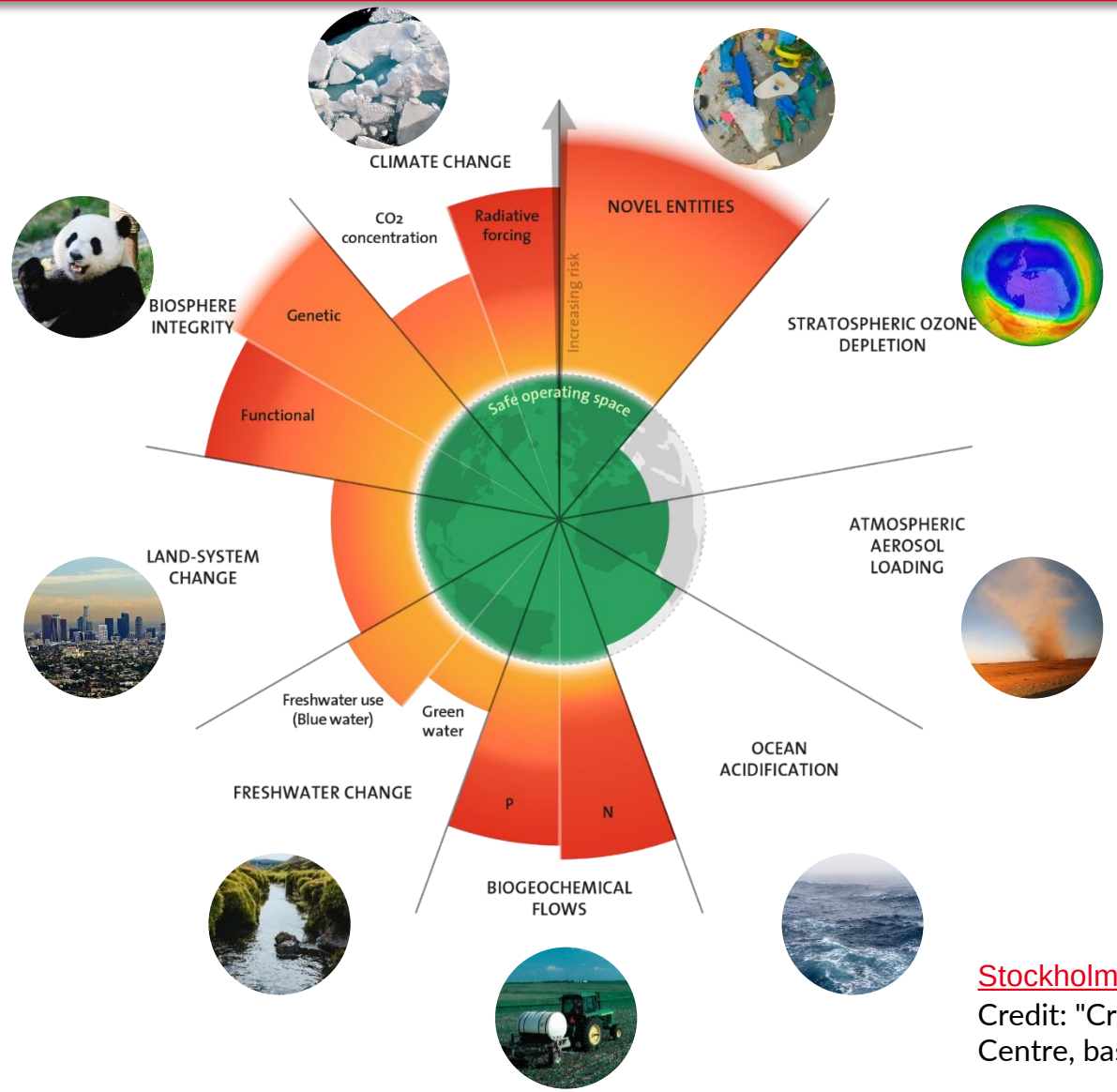
Here are the 2100 global warming projections



Climate Action Tracker

The 9 planet boundaries

Environmental issues are not limited to climate change !



Stockholm Resilience Center

Credit: "Credit: "Azote for Stockholm Resilience Centre, based on analysis in Richardson et al 2023"

2. Impacts of your technologies

How do your technologies specifically impact the environment ?

Here are the technologies used by the SMEs in the EARASHI project

Electronics devices

Articifial Intelligence

Cloud computing

Robotics

Digital technologies

Internet of Things

First, we need to talk about the Multi-criteria Life Cycle Assessment (LCA)

2 key notions

multi-criteria

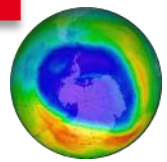

climate change


ocean acidification


greenhouse gas


biosphere integrity


atmospheric aerosol loading


stratospheric ozone depletion

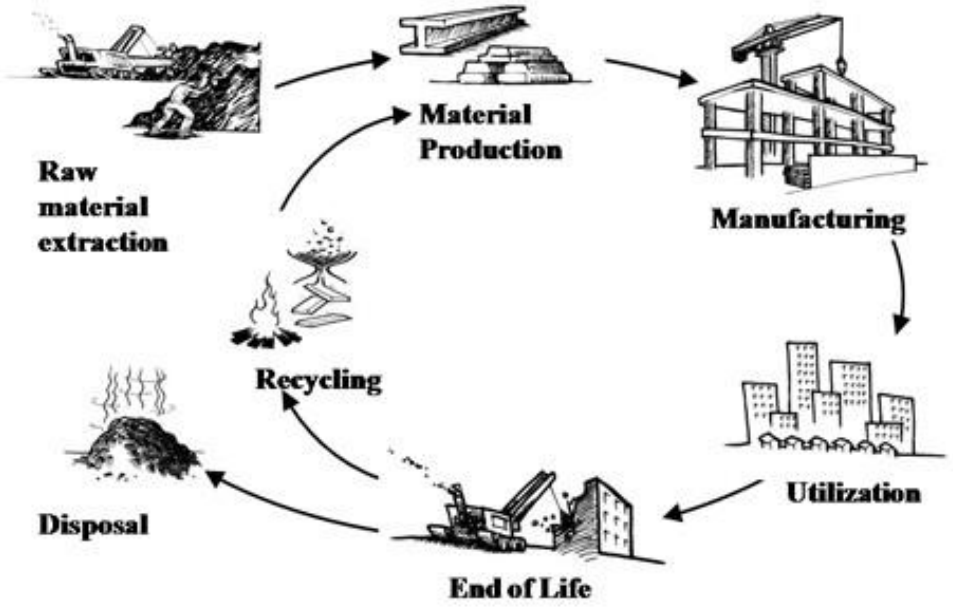

land-system change


biogeochemical flows


novel entities


freshwater change

life cycle

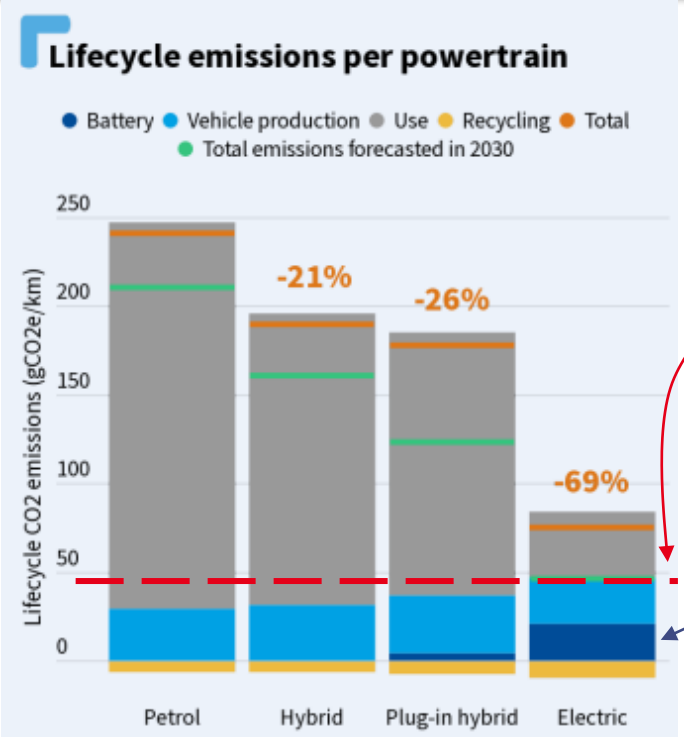


a long and complex study, performed by specialized engineers

Methodology specified by two standards: ISO 14040:2006 & ISO 14044:2006
Recommended method by the European Union: Product Environnemental Footprint (PEF)

An example: the Electric Vehicle (EV)

Why is it important to analyze the entire life cycle ?



only the production phase → the EV is the worst

only the use phase → we ignore a big EV impact

With a multi-criteria approach ?

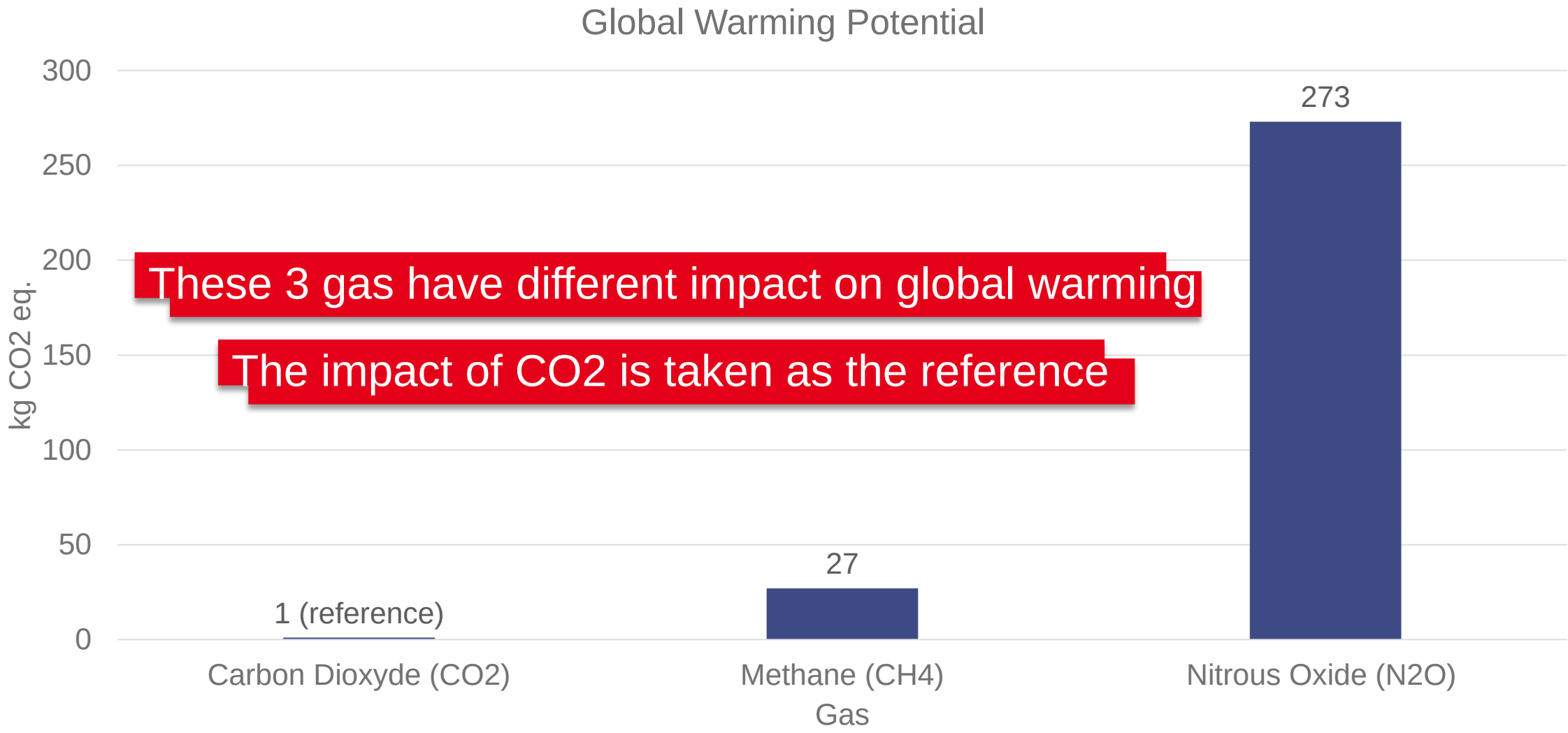
greenhouse gas

human toxicity

> "emissions level decrease for EV […]
> but there is an increase in human toxicity level for EV"
> Vermal et al.

T&E, LCA analysis of a medium-sized car, battery assumed to be produced with the EU27 average grid, charging with the EU27 average grid

What does kg CO2 eq. mean ?
And the global warming potential ?



These 3 gas have different impact on global warming

The impact of CO2 is taken as the reference

United States Environmental Protection Agency

What is the impact of digital technologies in the world in terms of green house gas ?

information and communication technologies (ICT)

represent 2 - 4%

of global greenhouse gas emissions

BUT

“ [the ICT sector] would have to: reduce its CO_2 emissions by 42% by 2030, 72% by 2040 […] and net zero by 2050 ”

Freitag et al.

The digital technologies use resources & contribute to climate change

main impacts & When during the life cycle ?

Table 1—Normalised and weighted results[1]

Resource use, minerals and metals	22.9%
Resource use, fossils	17.0%
Acidification	4.5%
Ecotoxicity, freshwater	4.7%
Climate change	16.2%
Ionising radiation, human health	11.1%
Particulate matter - Disease occurrence	4.0%
Photochemical ozone formation - human health	1.8%

Results are normalized to compare the impact on each criterium

mainly **manufacturing** phase

mainly **use** phase

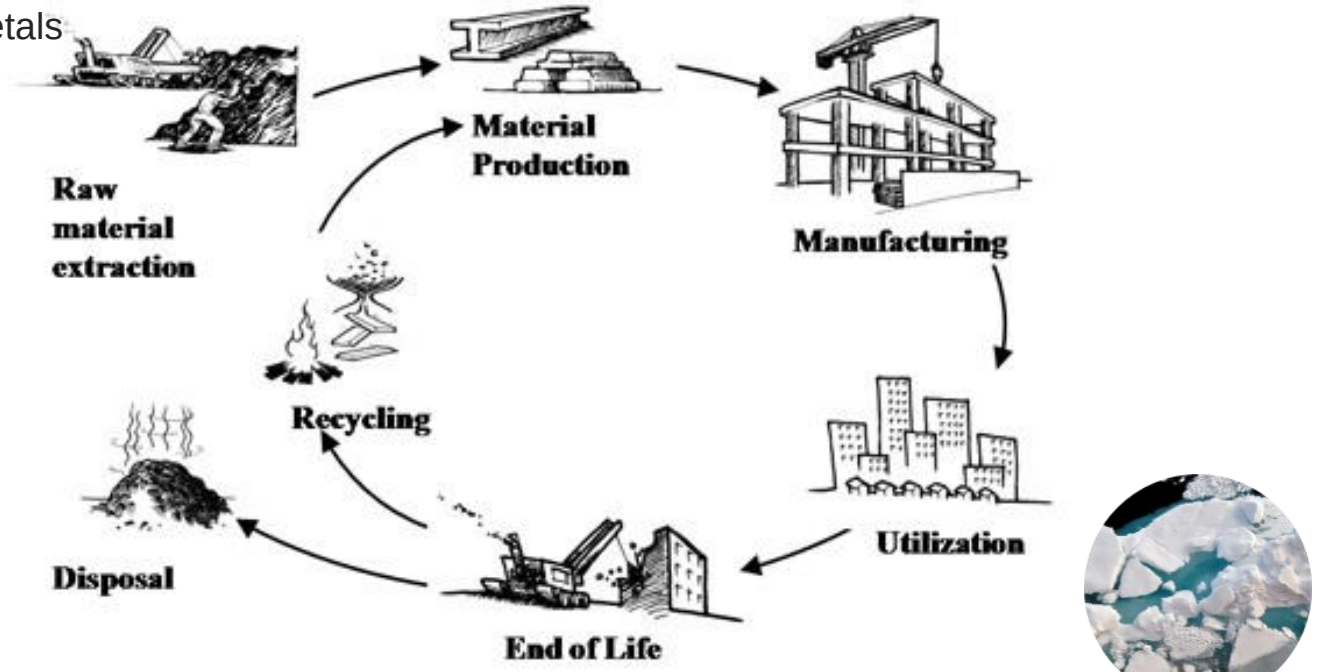
= 1 round trip of a plane passenger between Paris and Athens
per EU-28 inhabitant per year

[1] Digital technologies in Europe

The digital technologies use resources & contribute to climate change

resource use
fossils

resource use
minerals & metals

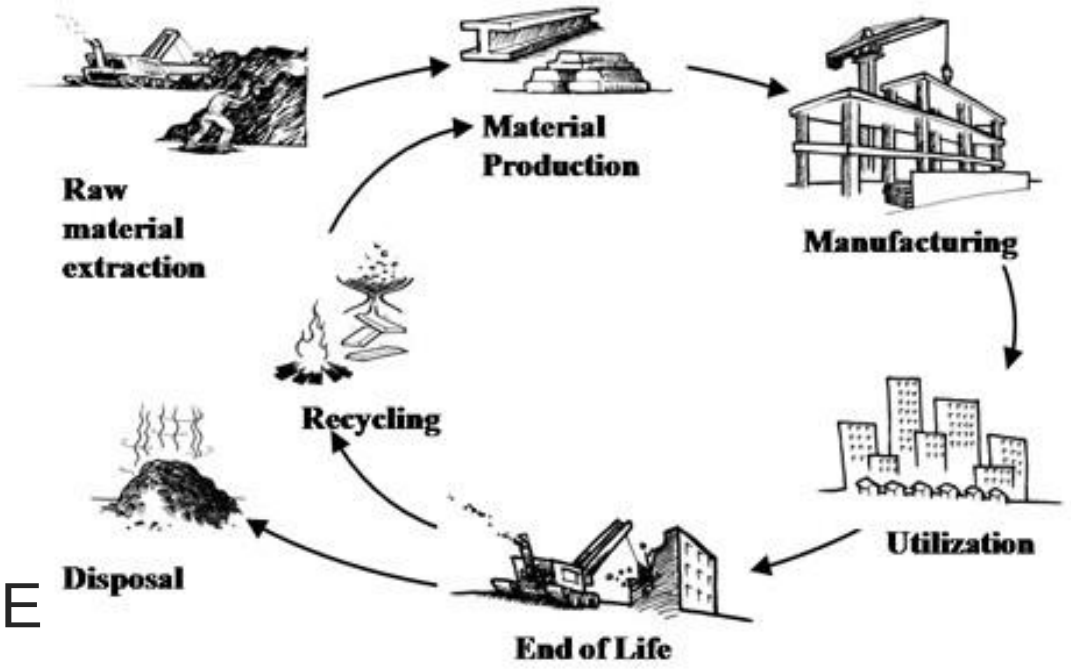


climate change

Digital technologies in Europe Arushanyan et al.

The digital technologies create waste

in total 225 kg per EU-28 inhabitant per year



Other waste (majority)

e-waste or WEEE (more toxic)

17,4% of global e-waste is documented to be collected and properly recycled

Global E-Waste

WEEE: Waste Electrical and Electronic Equipment

IOT creates a new challenge

essentially, the same impacts as the ICT

but the number of devices will explode !

“ estimates projecting up to 200 billion connected objects in 2030[2] ”

+

“ if the objectives of the Paris Agreement (PA) also apply to the production of ICT devices, it should follow […] a reduction of GHG emissions by 7.6%/year starting in 2020 to be consistent with the 1.5°C target ”

=

the trends are conflicting

[1] Pirson et al., 2021 [2] Pirson et al., 2023

AI has to address its carbon footprint, with the rise of Large Language Models (LLM)

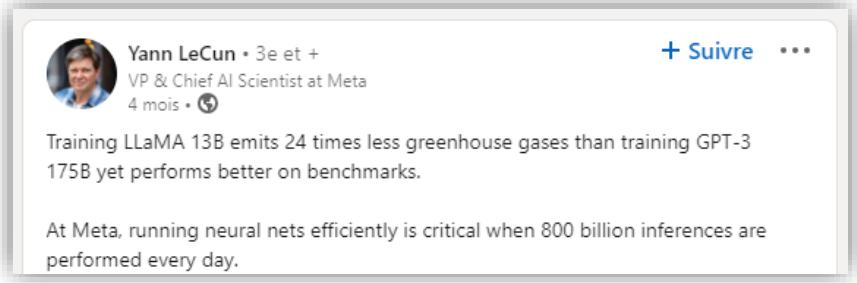
Environmental impacts are more and more taken into account

during training and inference

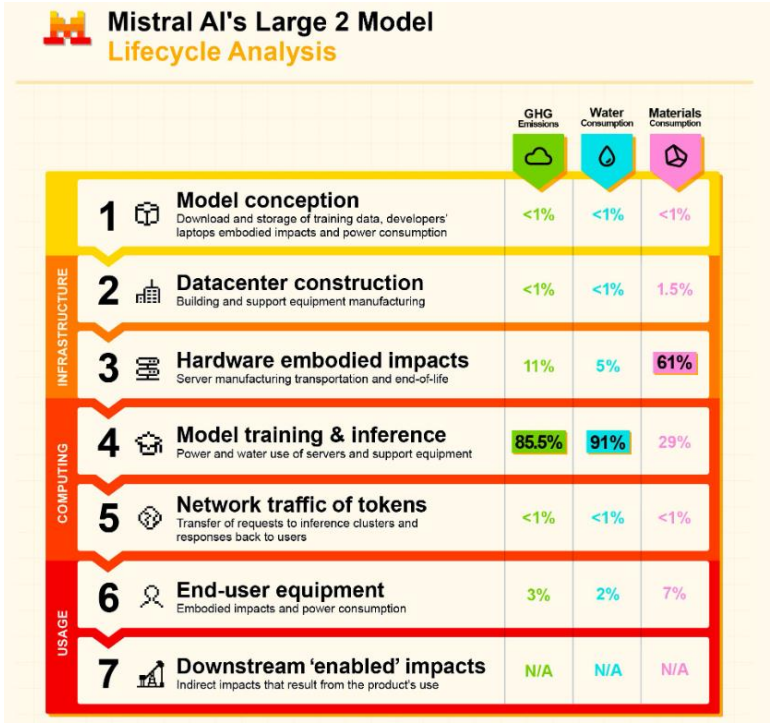
Model name	Number of parameters	Datacenter PUE	Carbon intensity of grid used	Power consumption	CO_2eq emissions	CO_2eq emissions × PUE
GPT-3	175B	1.1	429 gCO_2eq/kWh	1,287 MWh	*502 tonnes*	552 tonnes
Gopher	280B	1.08	330 gCO_2eq/kWh	*1,066 MWh*	*352 tonnes*	380 tonnes
OPT	175B	*1.09* [2]	*231 gCO_2eq/kWh*	*324 MWh*	70 tonnes	*76.3 tonnes* [3]
BLOOM	176B	1.2	57 gCO_2eq/kWh	433 MWh	25 tonnes	30 tonnes

Table 4: Comparison of carbon emissions between BLOOM and similar LLMs. Numbers in *italics* have been inferred based on data provided in the papers describing the models.

Luccioni et al.



Yann LeCun on LinkedIn

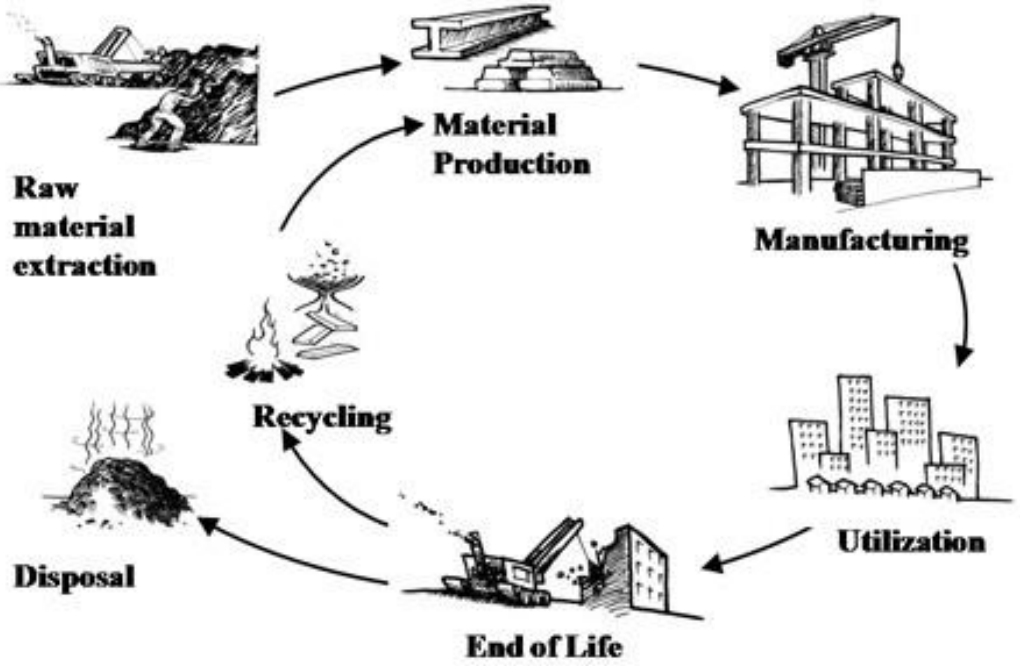


The first comprehensive lifecycle analysis of an AI models

Impacts of robotics are not well studied

resource use
minerals & metals

more copper, magnets for the motors
more metals for the case



there is a gap in the research

climate change

more energy consumption during use

Auer et al., 2018

3. The ecodesign approach

How to decrease your impacts following the ecodesign approach ?

What is ecodesign ?

also called environmentally sustainable design, environmentally conscious design, etc.

The integration of environmental aspects into the product development process, by balancing ecological and economic requirements.

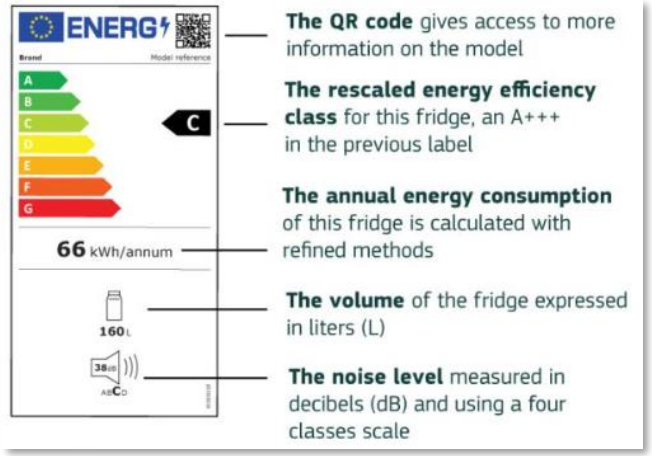
Ecodesign considers environmental aspects at all stages of the product development process, striving for products which make the lowest possible environmental impact throughout the product life cycle.

What is ecodesign ?

soon a mandatory practise

the Ecodesign for Sustainable Products Regulation (ESPR), July 2024

> “It enables the setting of performance and information conditions – known as ‘**ecodesign requirements**’ – for almost all categories of physical goods (with some exceptions, such as food and feed)”



European Commission

Key product aspects under ESPR

Next products to be included

Figure III. The 12 shortlisted end-use products.

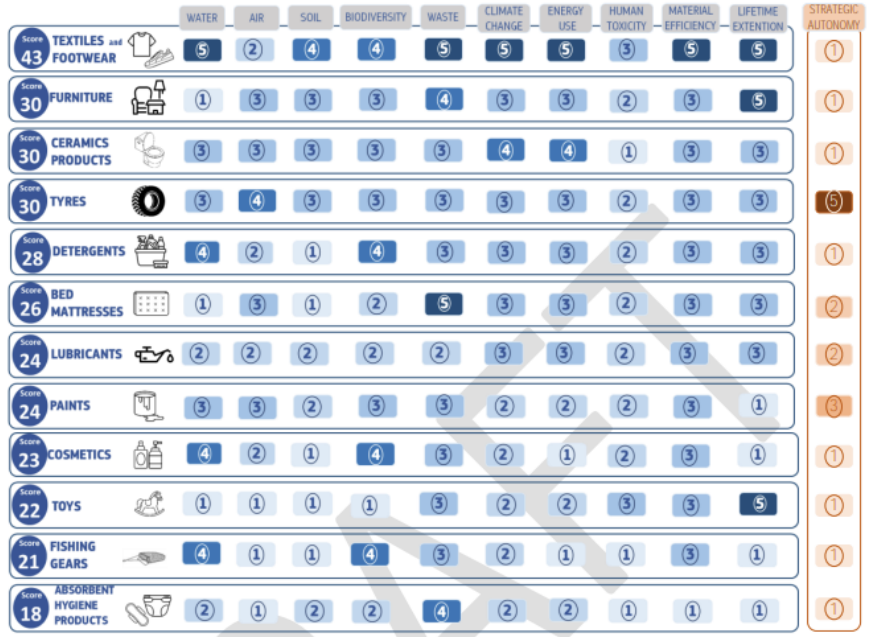
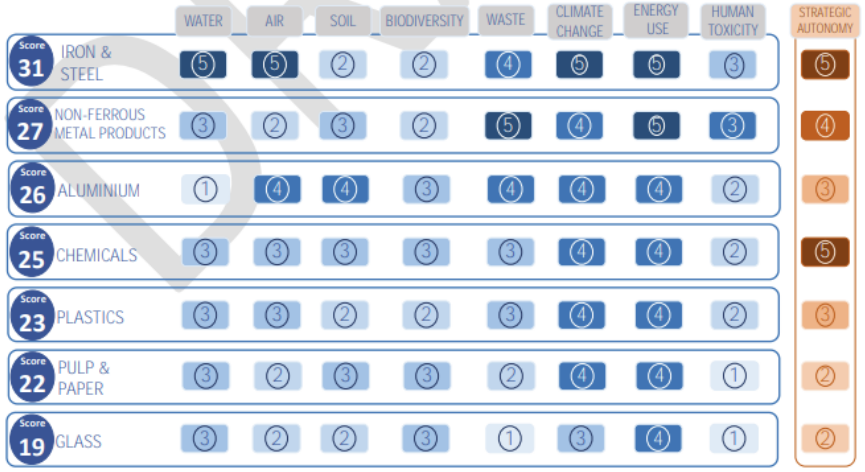
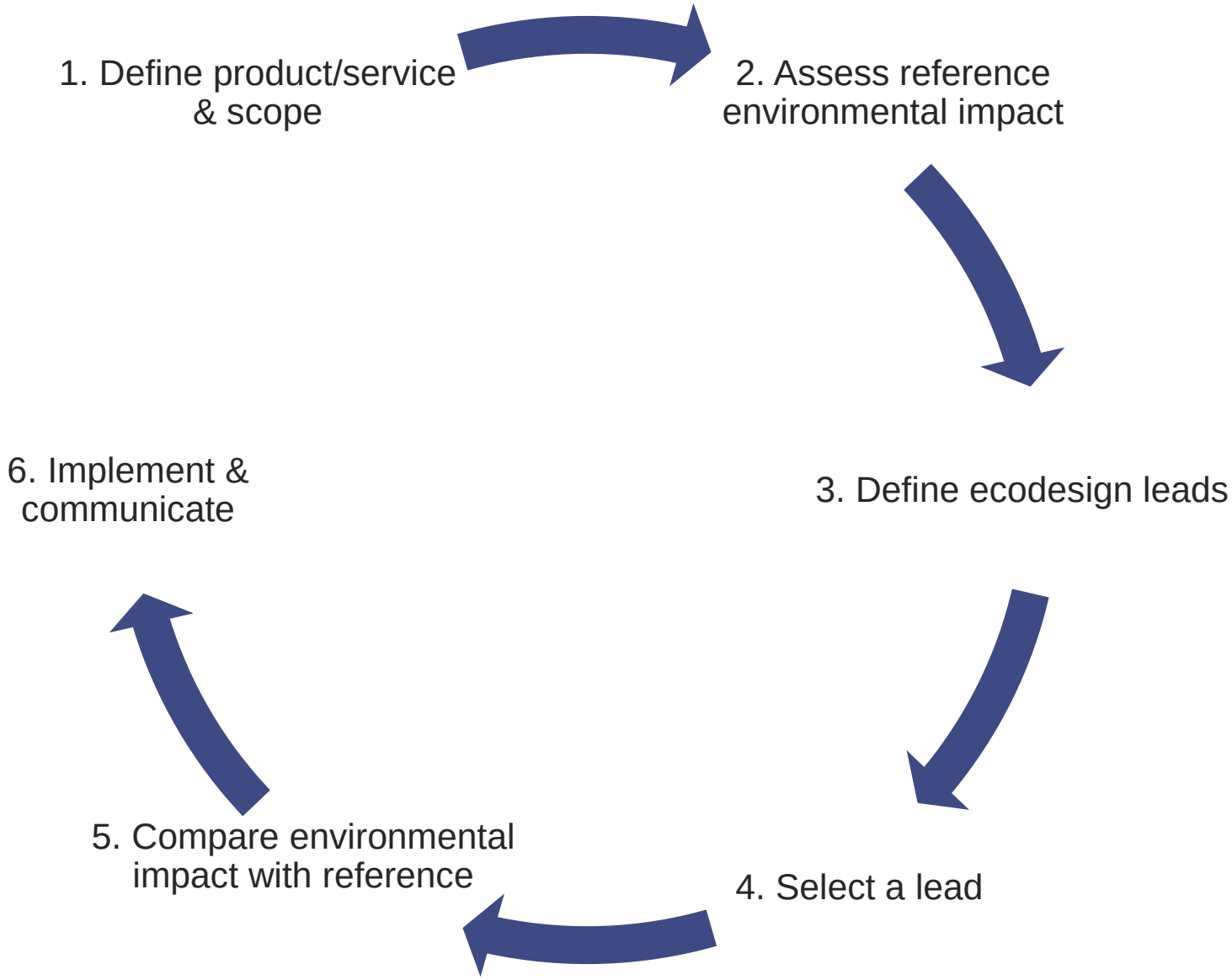


Figure IV. The 7 shortlisted intermediate products.



Ecodesign has several steps

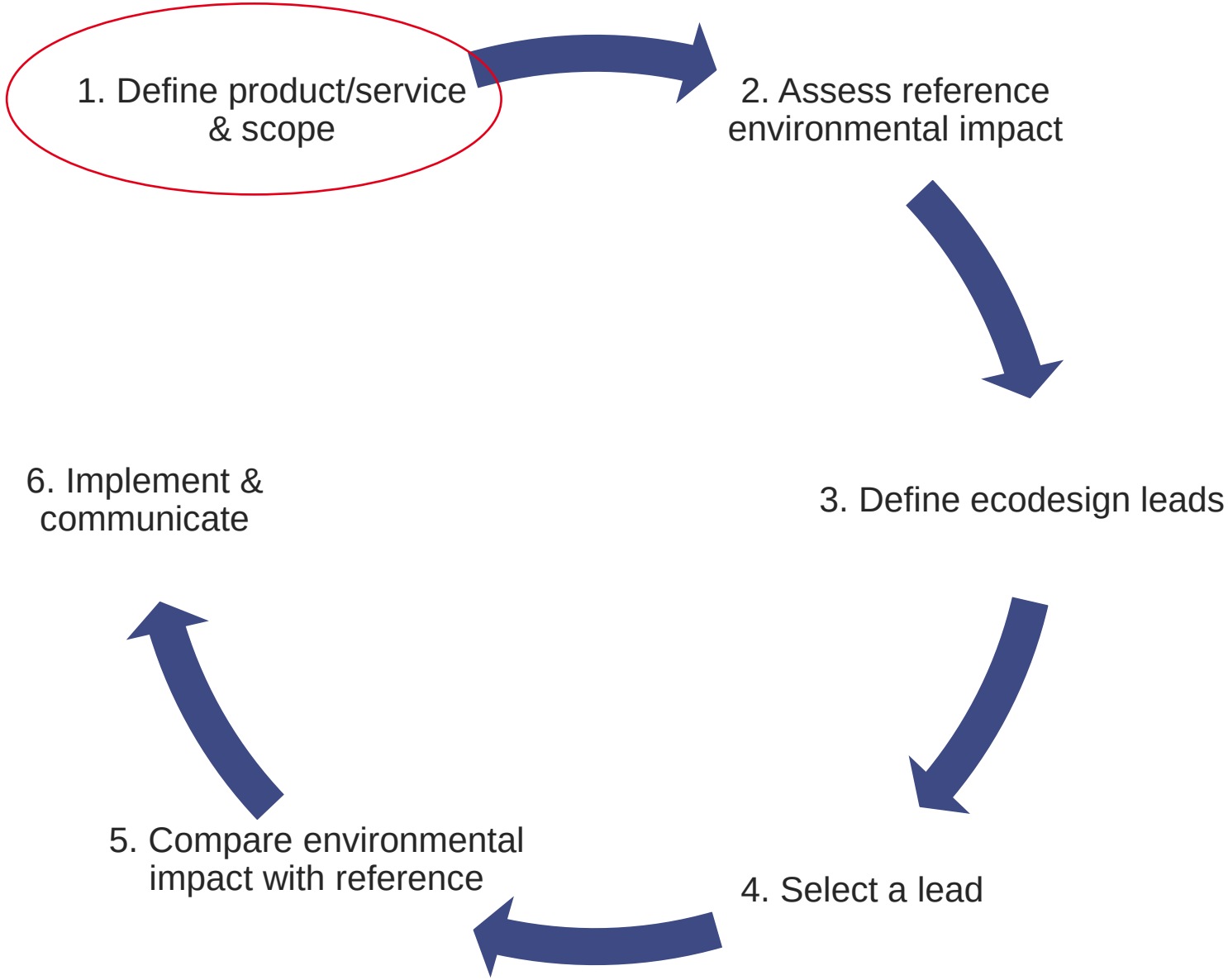


First, let’s give an example

FAIRPHONE

Fairphone

Ecodesign has several steps



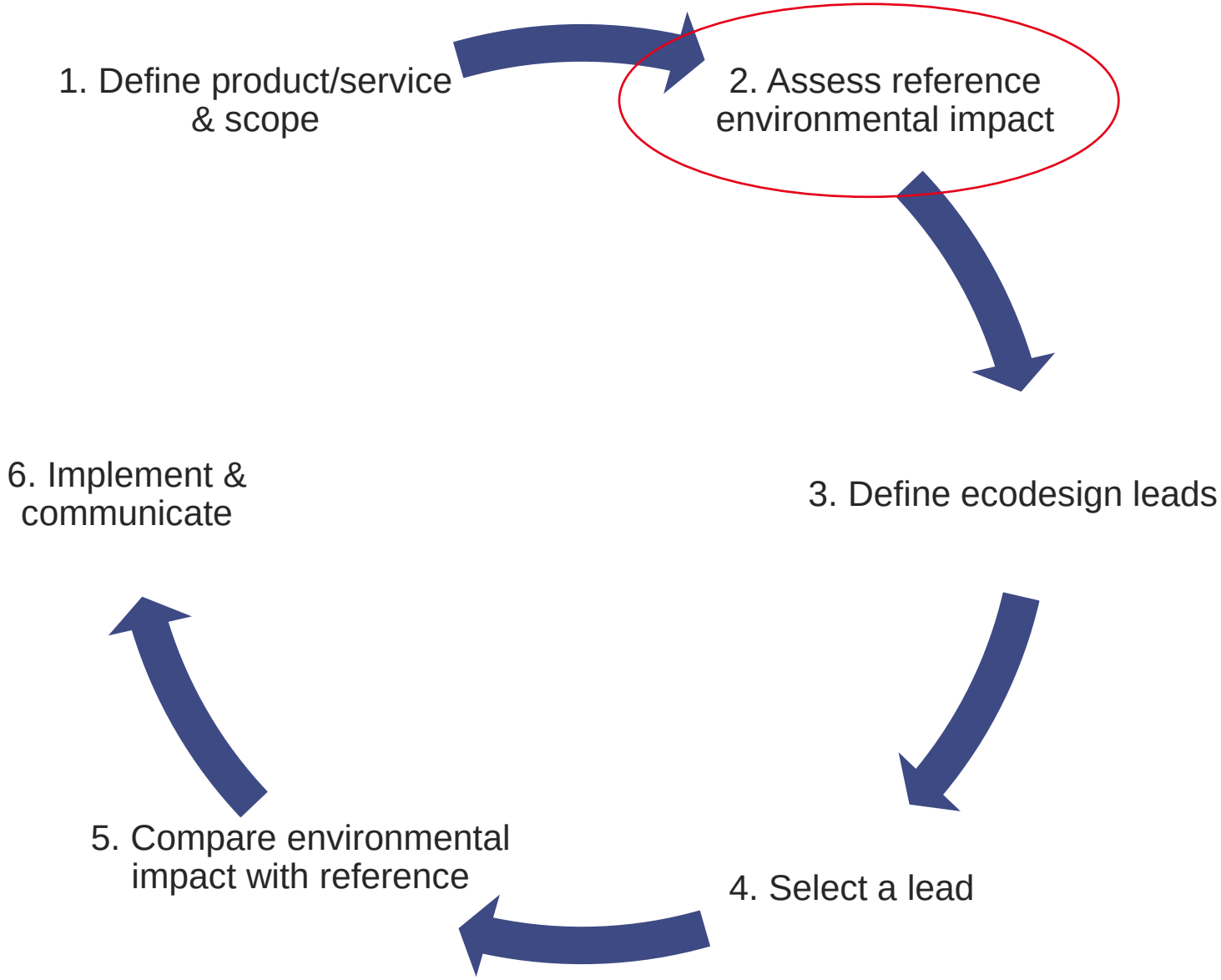
1. Define product/service & scope

- Product → a mobile phone

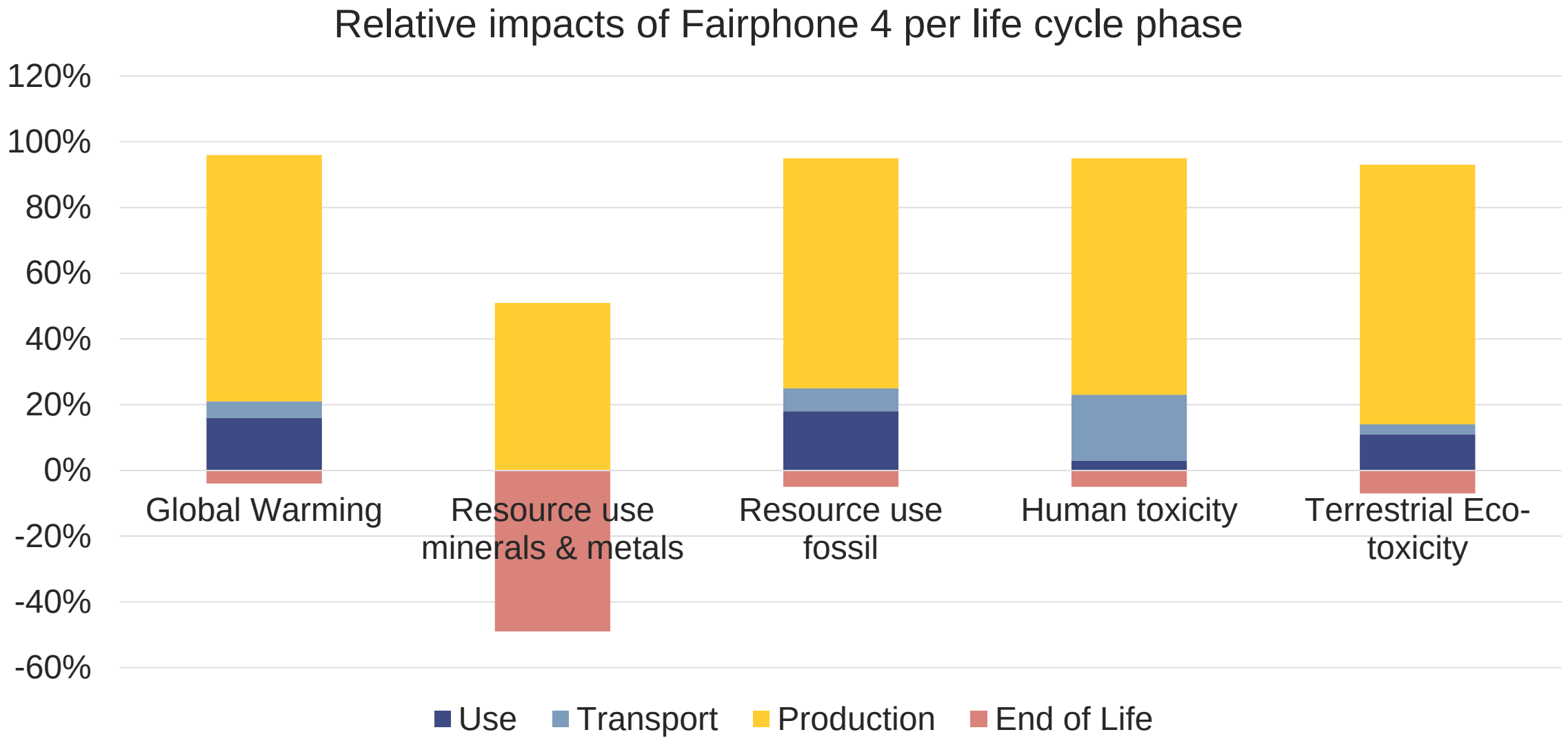
- Functional unit

« Allow to perform all the functions of a modern smartphone, including voice/ video calling, installing apps, taking pictures, etc, for 7 years. »

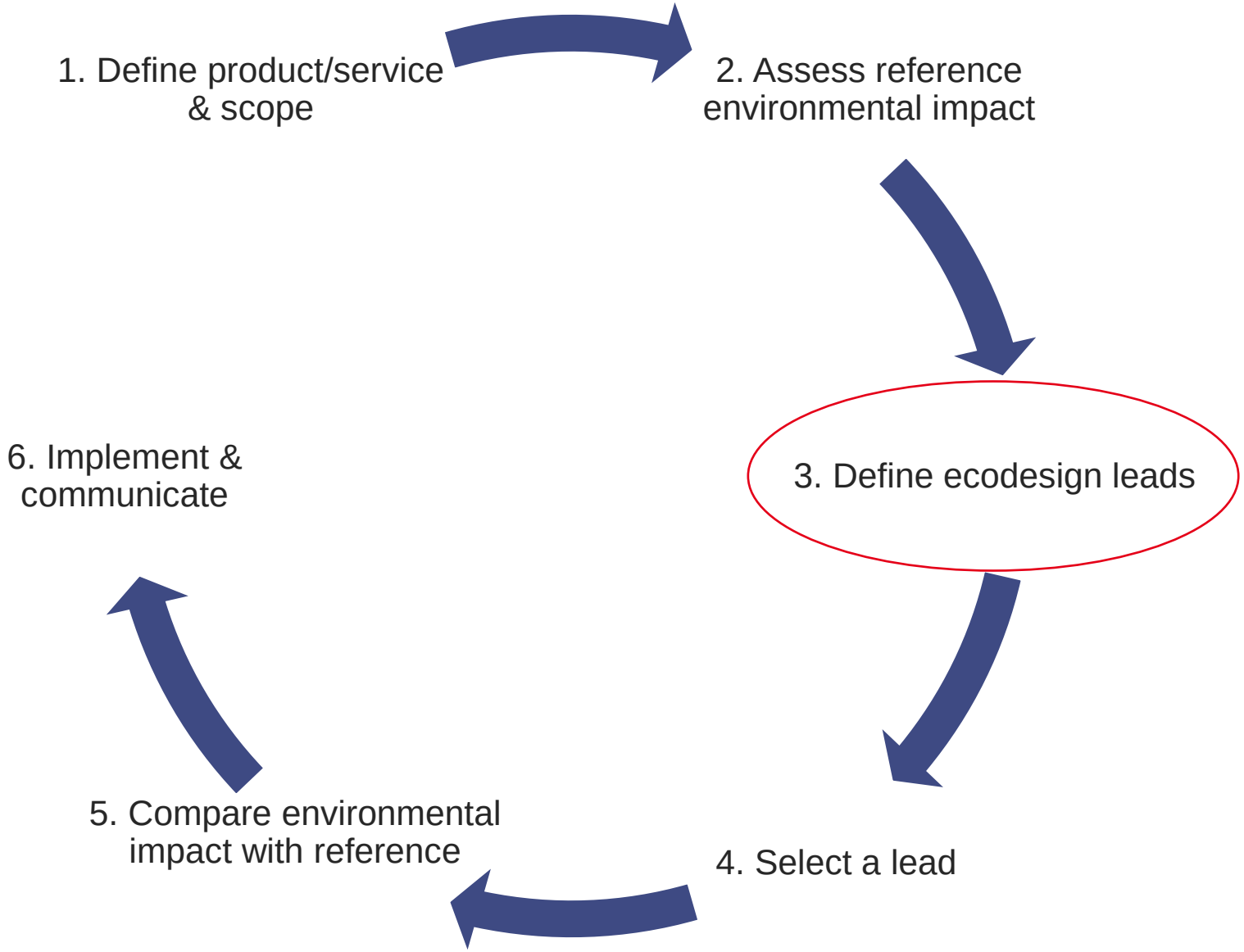
Ecodesign has several steps



Assess reference environmental impact



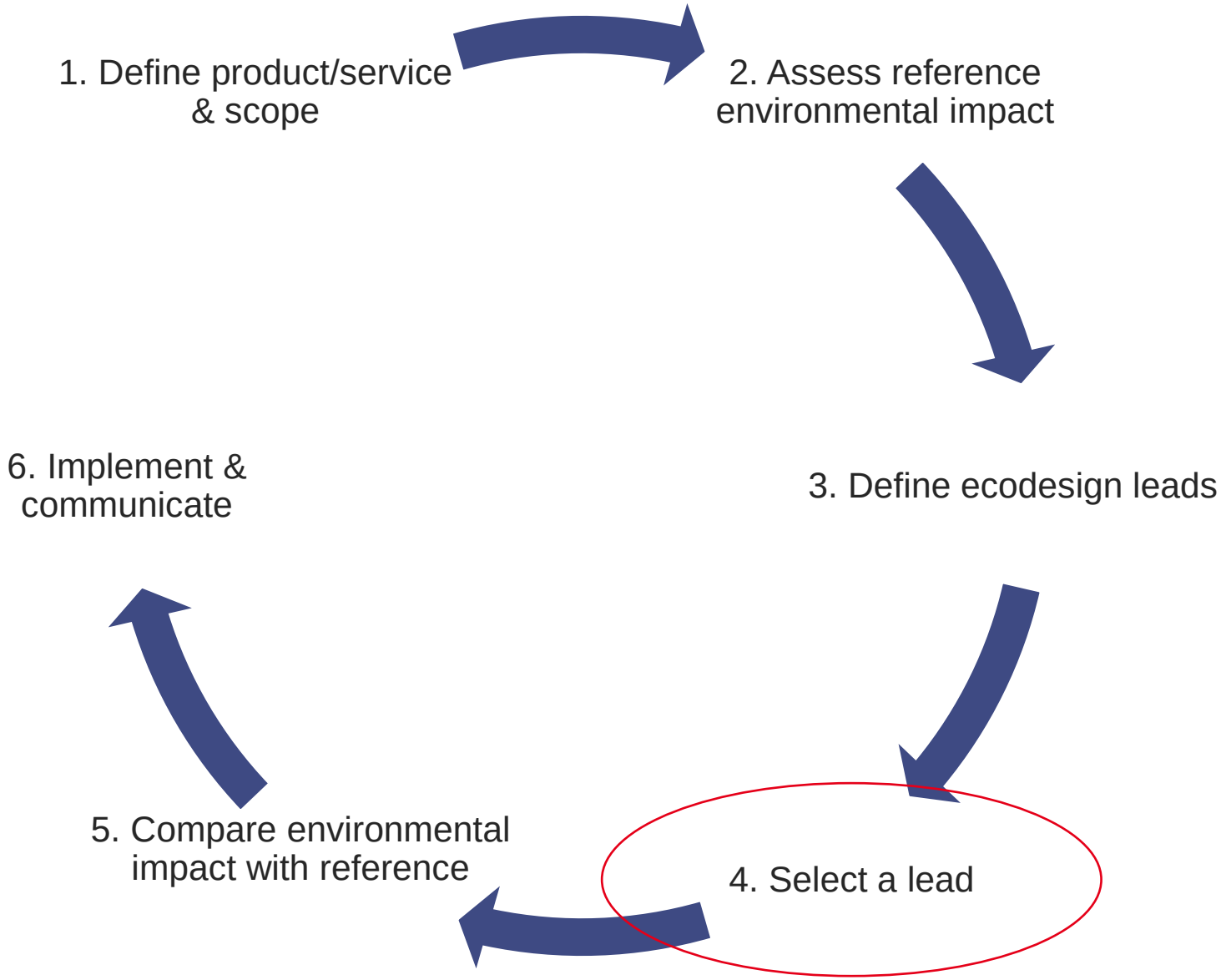
Ecodesign has several steps



3. Define ecodesign leads

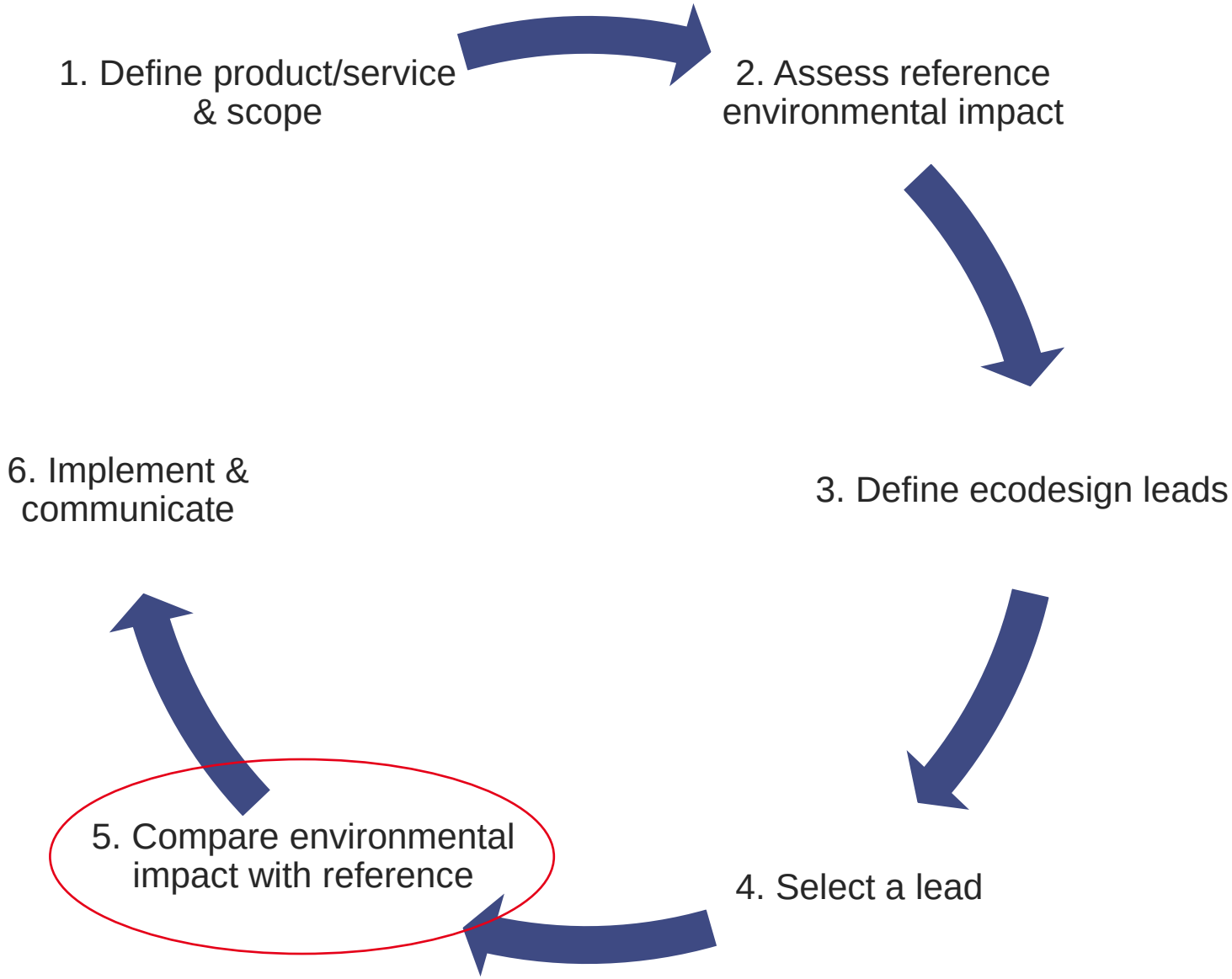
What other materials can be used ? Use recycled plastic for the case Use other materials than gold in connectors	How to remove raw materials to reduce the resource use ? Optimize the case to use less plastic as possible Do not dye the case material	How to optimize fabrication techniques ? Use less chemicals to produce electronic components	How to optimize the logistics ? Minimalistic packaging Assemble near the customer
Think about new concepts Rent the mobile phone Upgradable phone to improve performances over time	How to optimize the end of life ? Allow to easily separates modules inside the phone	How to increase the lifetime ? Make the product repairable by everyone Increase the reliability of the failure-prone components	How to reduce the impact during the use ? Increase the efficiency of the charger

Ecodesign has several steps

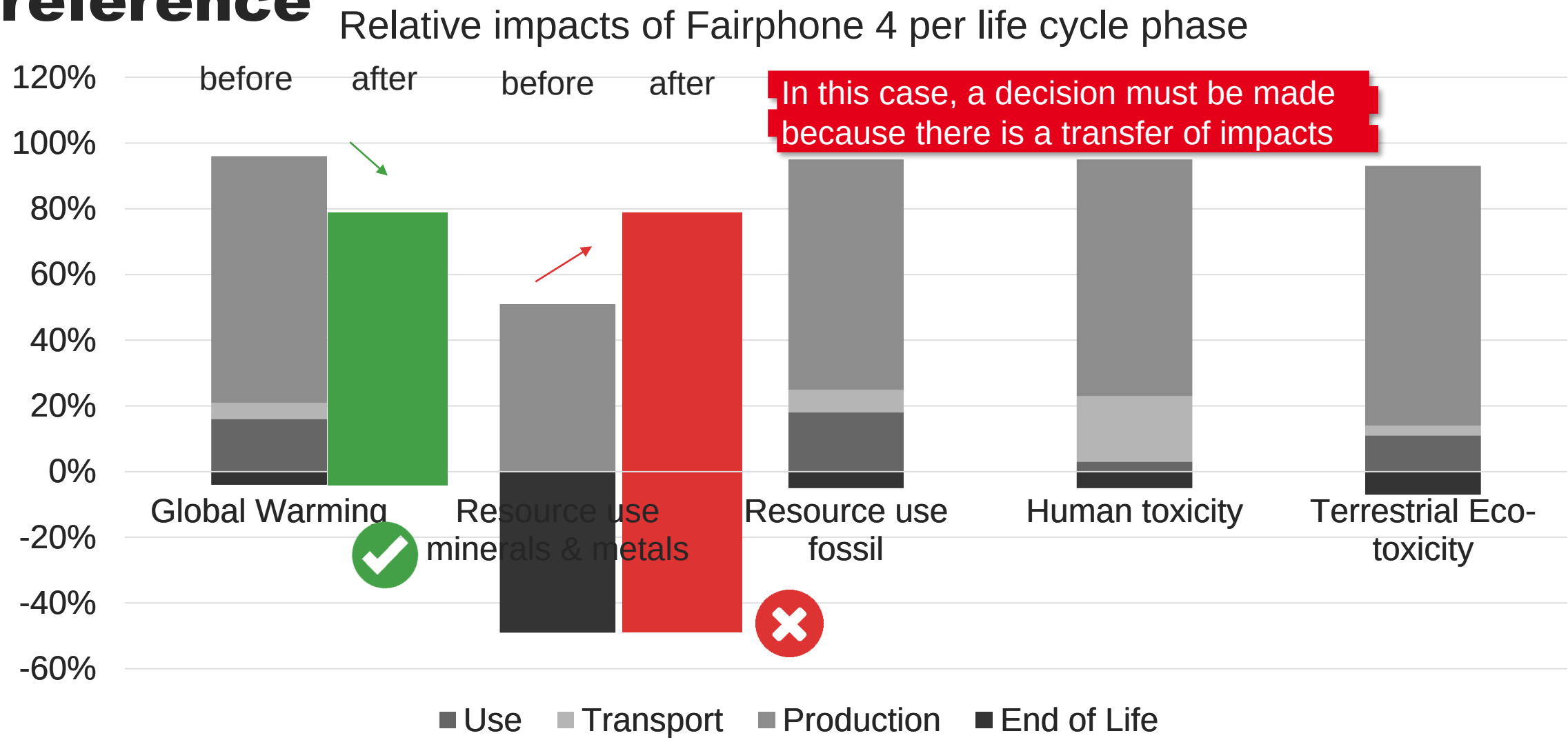


4. Select a lead
There are many methods, this a simple one

Ecodesign has several steps



5. Compare environmental impact with reference



(the impact after is fictitious data)

5. Compare environmental impact with reference

Fairphone has performed a quantitative assessment of the modularity in its phone

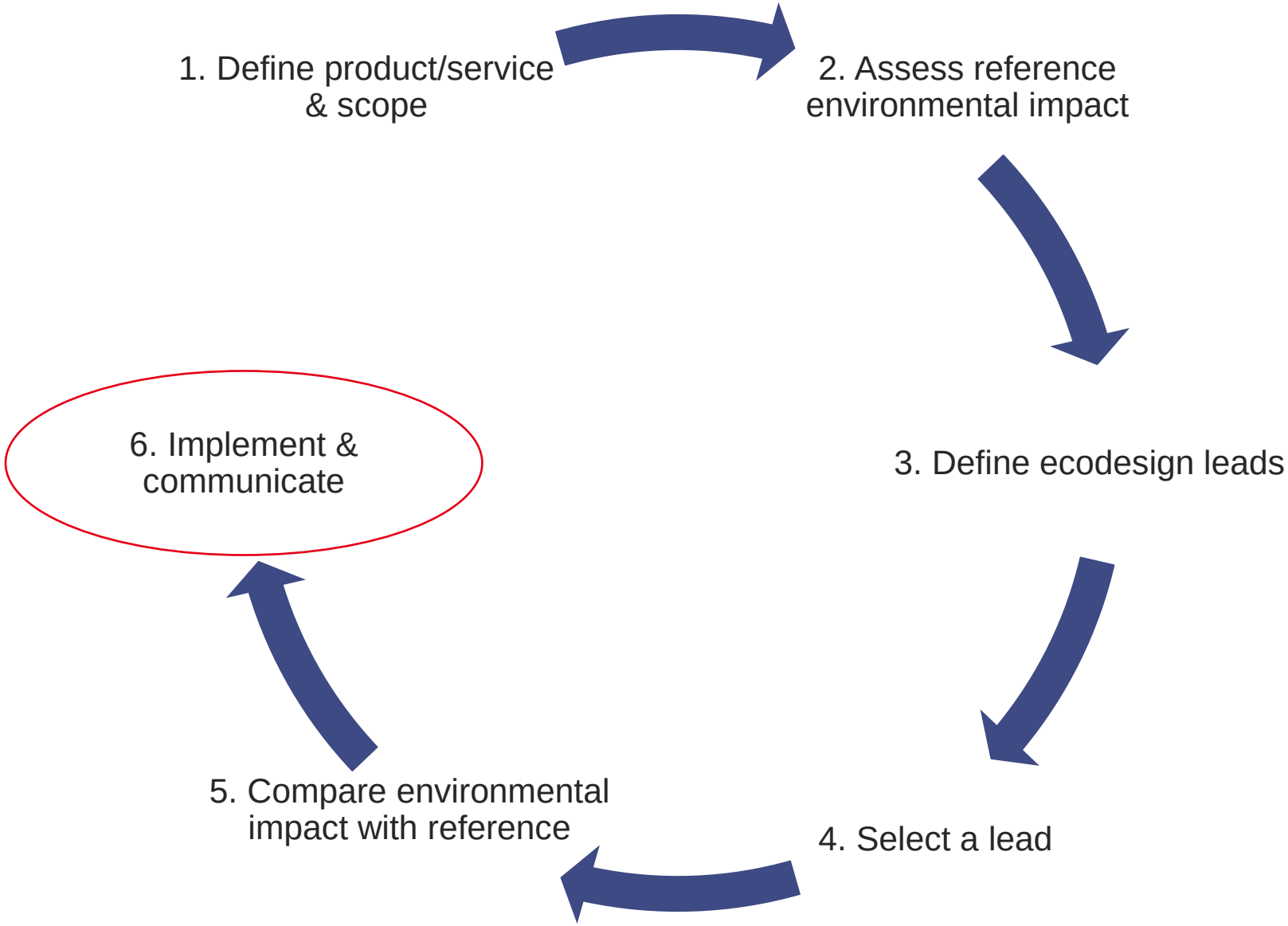
Additional fasteners (screws), pieces of housing for the modules, flex boards and press-fit board to board connctors which are needed to enable modularity in Fairphone 4 are called 'modularity overhead'. The GW value of this modularity overhead is estimated to be 0.25 kg CO2 eq. and it is driven mostly by the additional housing necessary. This represents only 1 % of the total GW value of the entire device.

Table 1 - Absolute impacts of modularity

	GW	ADPe	ADPf	Human tox	Eco tox
	kg CO_2e	kg Sb eq.	MJ	kg DCB eq.	kg DCB eq.
Totals	2.47E-01	2.92E-05	2.69E+00	6.51E-02	1.08E-03
Connectors	6.82E-03	6.13E-06	7.07E-02	9.07E-04	1.95E-05
Flex	4.01E-02	2.26E-05	4.23E-01	5.91E-03	1.25E-04
Fasteners	7.93E-04	3.15E-08	9.15E-03	1.92E-02	4.86E-06
Housing	2.00E-01	4.12E-07	2.18E+00	3.91E-02	9.34E-04
% of production	1 %	2 %	1 %	1 %	2 %

Fairphone Life Cycle Assessment

Ecodesign has several steps



Implement & communicate

Fairphone has implemented
a 3 level communication strategy

1. Easily idenfiable logos

B-Corporation certified

Certified B Corporation

An important part of our social enterprise identity is the open collaboration with independent certification organizations. We're proud to be B-Corp certified, joining a community of over 1000 companies, using business to address social and environmental issues.

EcoVadis platinum medal

PLATINUM Top 1% 2022 ecovadis Sustainability Rating

The Fairphone philosophy is embedded in the way we run our company. This commitment to fairness has been made measurable by the globally-recognized EcoVadis sustainability rating. We're one of the most sustainability-focused companies in the mobile technology sector with a platinum Ecovadis medal, putting us in the top 1% of our industry.

iFixit 10/10 score

IFIXIT

Our core value of longevity is designed directly into our smartphones. We created the Fairphone 3 to last – both in its original design and in making the repair as easy as possible. This made it the only smartphone in the world to be awarded a perfect iFixit score for repairability.

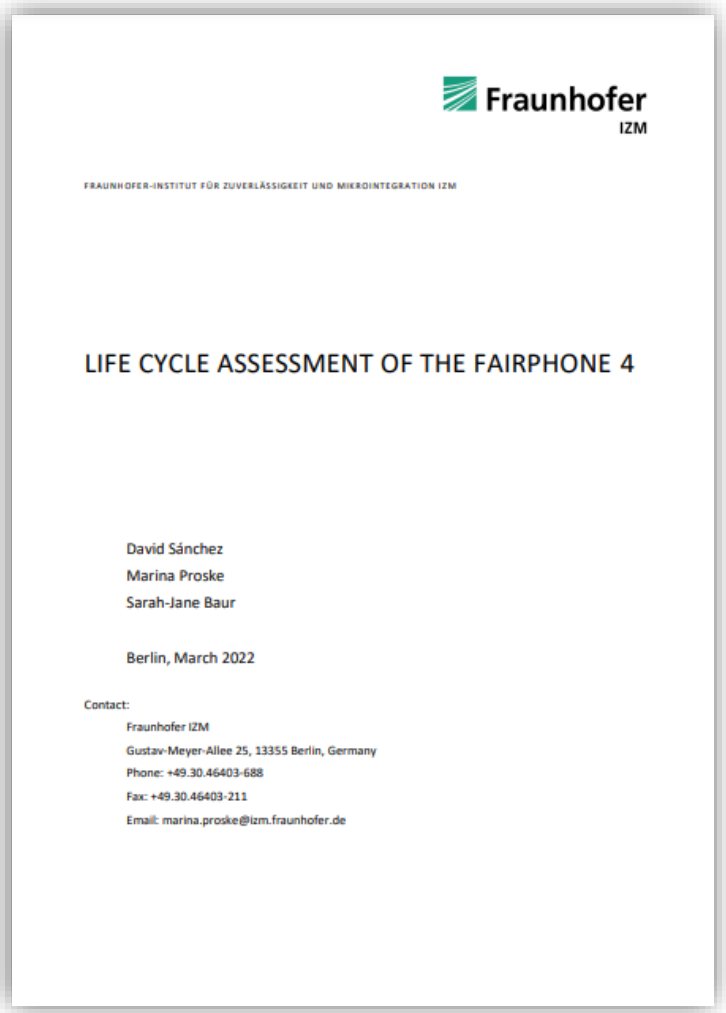
Fairtrade gold integrated

FAIRTRADE GOLD

The materials that go into your phone have an impact on people and the planet. We want to go straight to the source to make sure we're creating positive change. Using responsibly sourced materials, we are the first and only smartphone company to be Fairtrade gold certified.

2. Short descriptions explaining the claims

3. A full LCA supporting the claims



Fraunhofer IZM

FRAUNHOFER-INSTITUT FÜR ZUVERLÄSSIGKEIT UND MIKROINTEGRATION IZM

LIFE CYCLE ASSESSMENT OF THE FAIRPHONE 4

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Berlin, March 2022

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GOOD OR BAD COMMUNICATION ?

5 criteria to analyse an environmental communication

Relevant

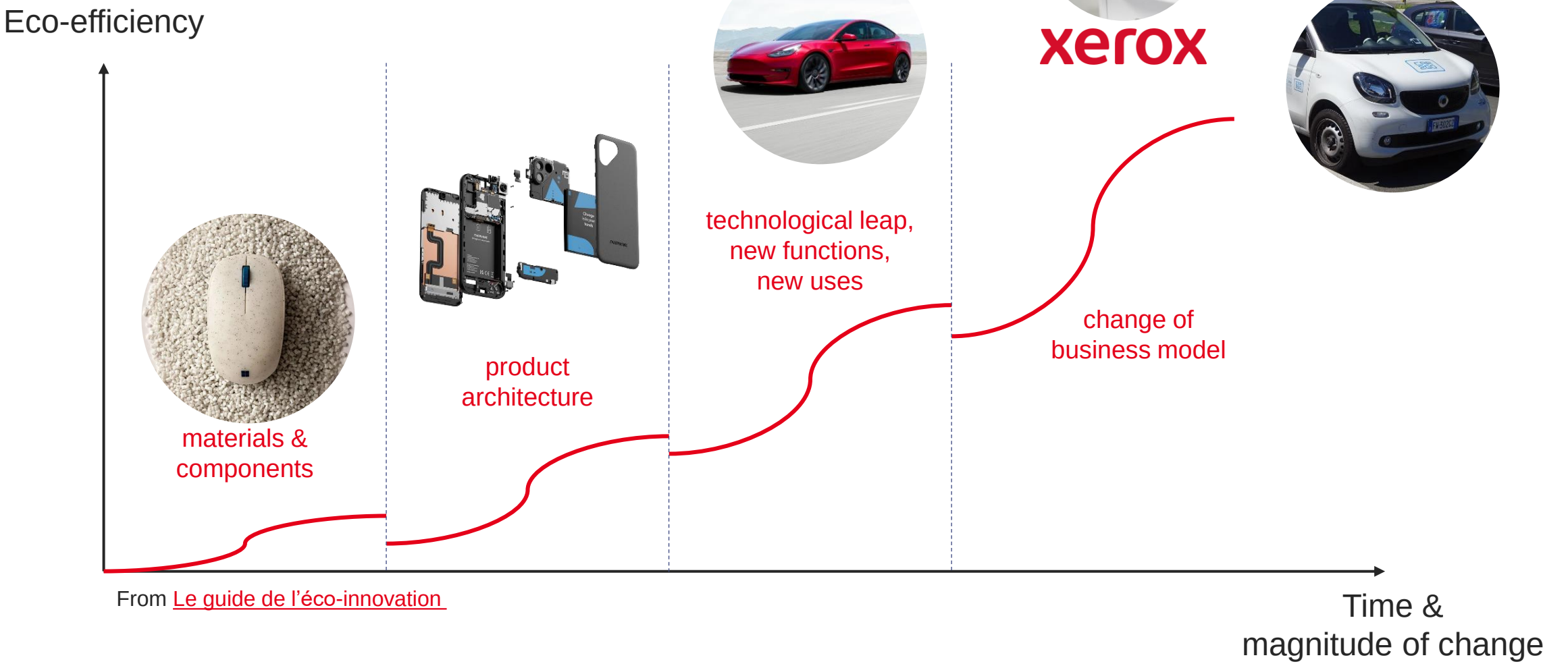
Accurate

Checkable

Not misleading

Humble

The four levels of ecodesign



Ecodesign will also benefit your company

- Answer to customer expectations
- Improve your company image, mitigate image risks
- Be socially accepted by citizens
- Anticipate future laws
- Access new markets
- Reduce your costs
- Position yourself strategically
- Attract investors

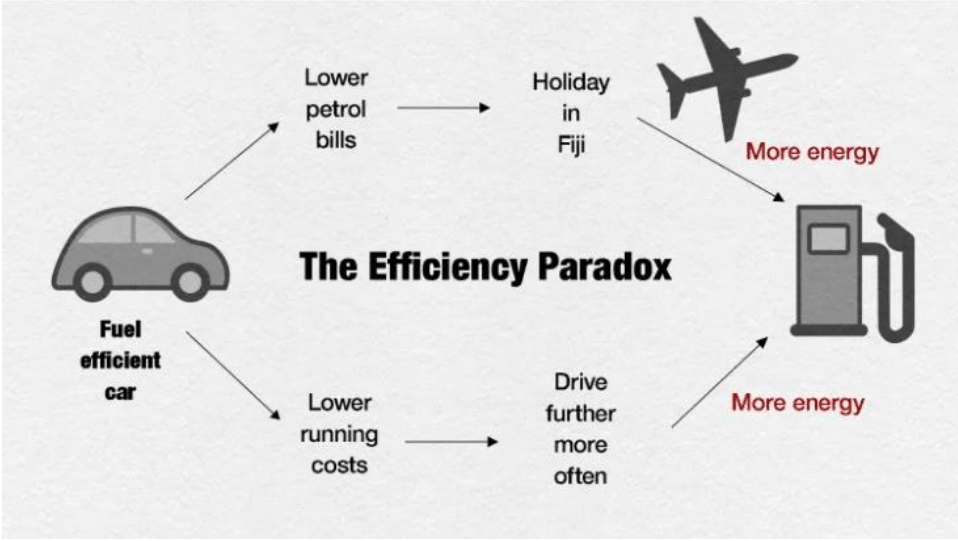
Beware

Greenwashing

Impact transfer

“ emissions level decrease for EV […]
but there is an increase in human toxicity level for EV ”
Vermal et al.

→ decision to be made



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Recent examples of greenwashing The sustainable agency Efficiency paradox or Jevons paradox or rebound effect
EV: Electric Vehicle

Ecodesign is NOT

following your intuition

a way to justify green washing

perfect

the only solution to the environmental problems we are facing

easy and straightforward

a justification to sell more fundamentally bad products for the environment

Ecodesign is…

a method which all companies will have to implement

a way to take into account the environmental impacts during the product design phase

should lead to a lower environmental impact

a multi-criteria approach

a set of methods to ensure the impacts of the products are understood and reduced

takes into account the whole life cycle