apeiron

Alternatives Assessment in EU

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DISCLAIMER

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- The contents are intended to provide a general guide to the subject matter only and should not be treated as a substitute for specific advice concerning individual situations.
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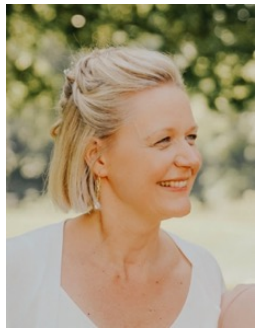
Create Positive Impact



1993
Bioscience & Environmental Engineering

1998
Waste & Recycle industry

2001
Polymer Industry

2009
Founded Apeiron

2013
first Apeiron AfA

11 yrs in industry

11 yrs Apeiron

since
2009

Passion

to drive
Improvement

Together
with our clients

The Team


Celina


Tine


Laurence


Richard


Katrien


Hiram


Elke


Valérie


Mike


Valentina


Michel


Shari


Laetitia

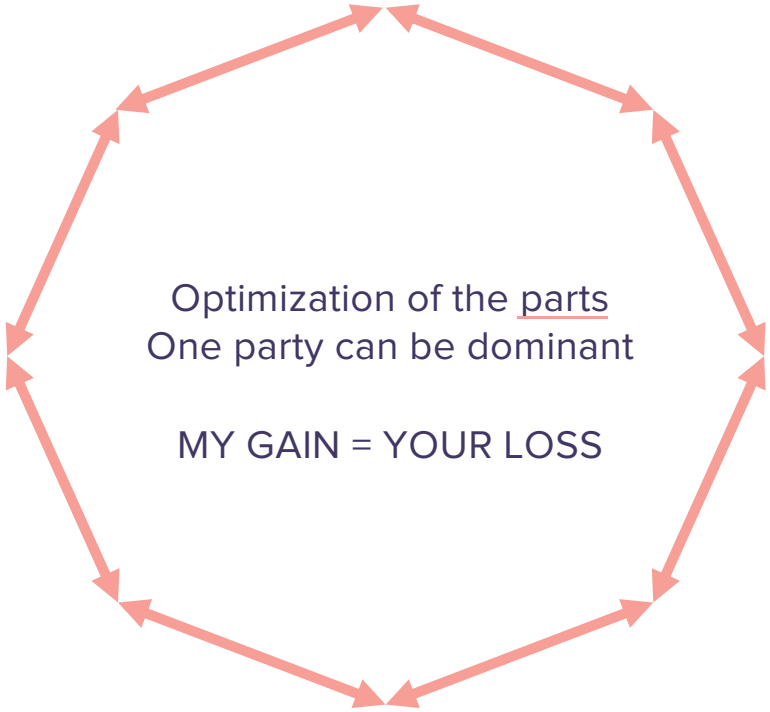

Eva


Willy

DRIVING THE TRANSITON

Starting from safe use of chemicals,
Apeiron guides its clients to
sustainable, future proof business operations.

Stepping up from
“LINEAR-IN-A-CIRCLE” to “CIRCULAR”



Linear-in-a-circle

= Bilateral system

OR

Circular

= Ecosystem

Where Innovation & Regulation meet

Chemicals are used everywhere

and that is OK, they bring health & prosperity for society

- Surfactant in *in vitro* diagnostics used to diagnose diseases, e.g. Covid-19
- Solvent used in the production of promising innovative cancer treatment
- UV filters in sunscreen to protect us from skin cancer
- Adsorbing agents used in sanitary towels and tampons
- Polymers used in tents to make them light and wheather resistant in the mountains
- Surface treatment that ensures that the ballustrade of your 6th floor appartment is robust

but … we need to maximally avoid Substances of (Very High) Concern

Where Innovation & Regulation meet

Apeiron assesses its client's substance portfolio for improvement opportunities.
We identify where they can achieve the biggest impact with the available resources

Apeiron developed a standard methodology with Priority setting for

Proactive Alternatives Assessment

This includes assessment of

- Toxicity & Risk
- Climate
- Circularity
- Resource depletion

For the entire life cycle of the substances

→ ensuring the alternative does not create a new risk up-or downstream = regrettable substitution
→ e.g. Alternatives for Cr(VI) based on Cr(III)sulfate, which is produced starting from Cr(VI)

Alternatives Assessment (AA)

Reactive AA	Proactive AA
Result of legal obligation, Fits in a regulatory process e.g. REACH	Fits in voluntary effort
Pushes all companies to improvement	Works only with fronrunners, while others leg behind
Demonstrates there is no suitable alternative = negative assessment Obliges to make commitment via substitution plan	Looks open mindedly for future opportunities = positive assessment
Has to stand external scrutiny	Internal process
Time for substitution = minimum needed Time is intrinsic element of AA & of decision by authorities	Time as needed to develop the most sustainable alternative
Time pressure = Risk for regrettable substitution Unless sufficient time is granted ! (see examples later)	Most optimal substitution for industry & society (see examples later)

Learning

Proactive Alternatives Assessment

is more effective to achieve sustainable substitution

but only the frontrunners act

Thus, to make a difference...

the world needs regulatory & voluntary actions

Alternatives Assessment under REACH & Beyond

"Look for the alternative"

Registration

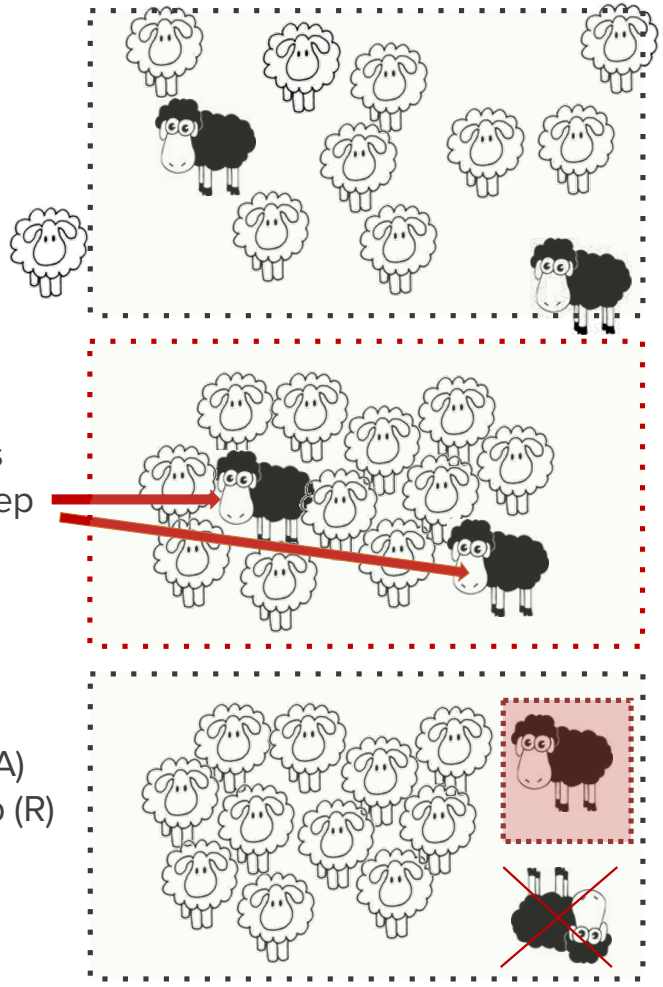
= Inventory of Substances
= Gathering all EU sheep & Defining the Borders of Safe Use

Evaluation

= Evaluation of Substances
= Identifying the black sheep

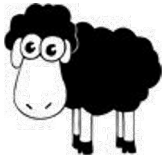
Authorisation & Restriction

= Ban of the black sheep (A)
= Isolating the black sheep (R)



Safe Use of Chemicals

What is an SVHC?



Carcinogen to humans

Mutagen to humans (DNA damage)

Reprotoxic to humans (fertility and/or development of foetus)

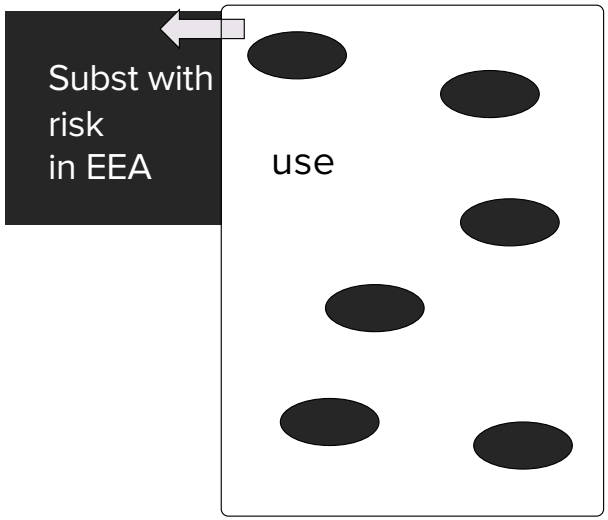
PBT / vPvB

Equivalent concern

Edocrine disruptors
Respiratory sensitizers
PMT/vPvM

Restriction

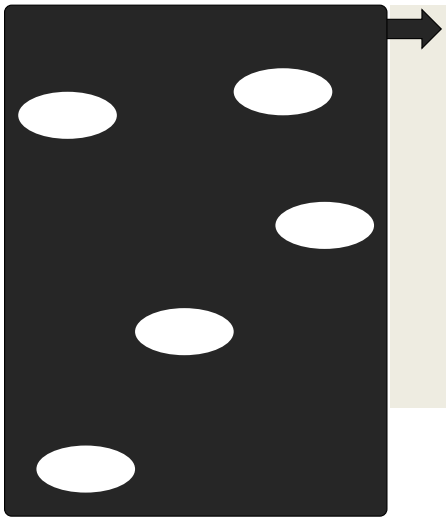
Annex XVII



Allowance to use,
under restricted conditions
→ Forbidden zones

Authorisation

Annex XIV

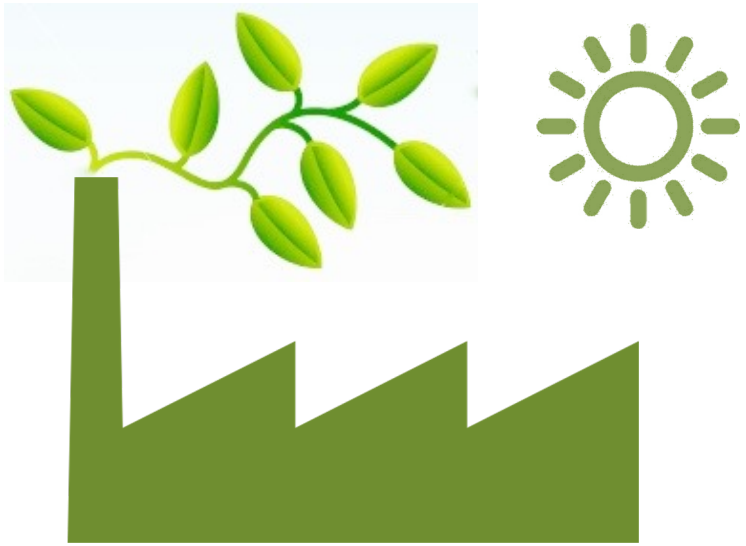


SVHC*
CMR cat 1A/B
PBT / vPvB
Equiv. concern:
- endocrine disrupt.
- Resp.sensitizers
- PMT/vPvM
- ...

Prohibited to use,
unless authorisation granted
→ Islands of allowed use
→ Time Limited

*SVHC = Substances of Very High Concern

Application
for
Authorisation



1. Risks properly controlled
2. SVHCs progressively replaced

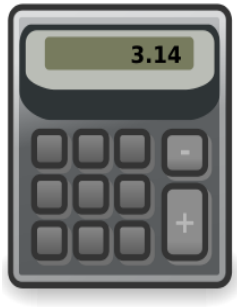
= AIM AUTHORISATION (art 55)

Exposure & emissions are minimized

Opportunities to further reduce emissions

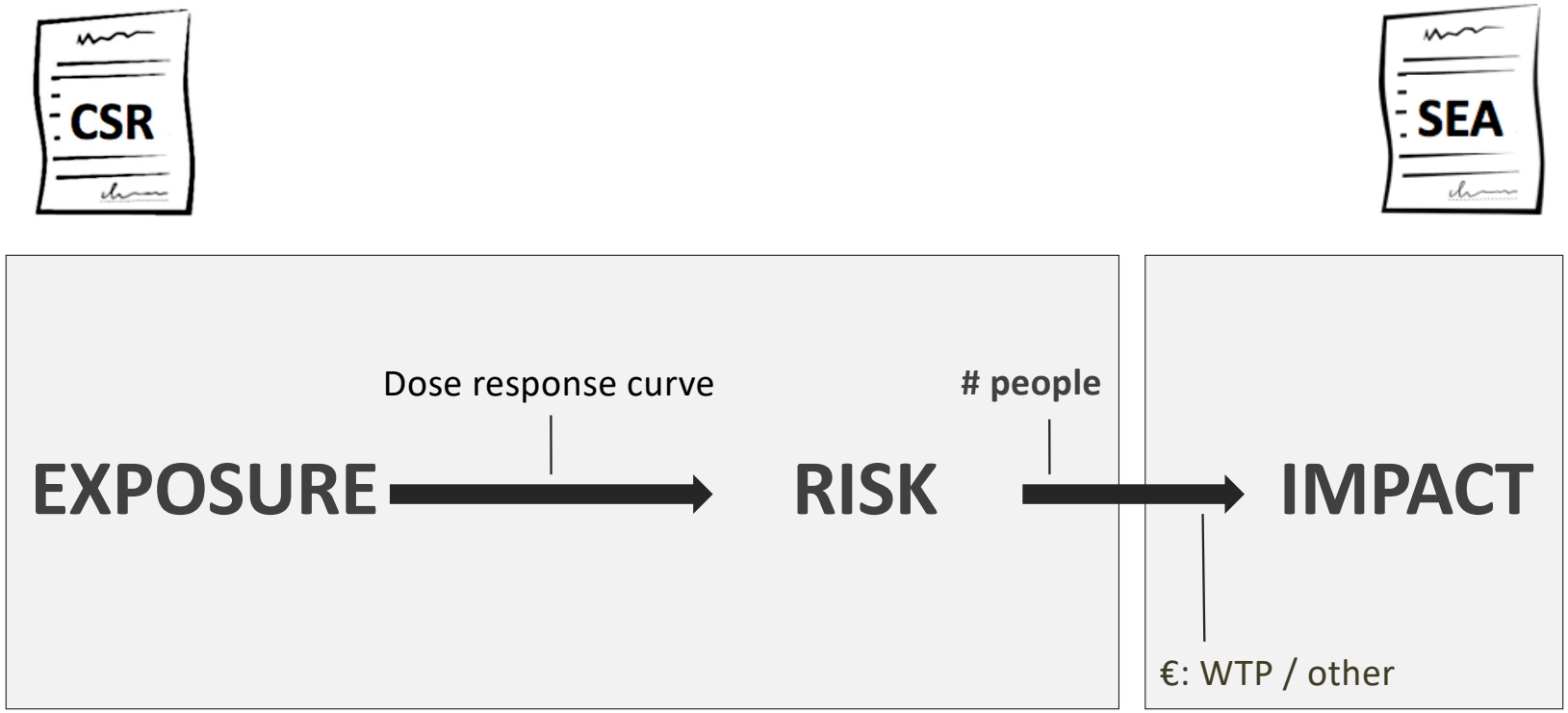
Description R&D history

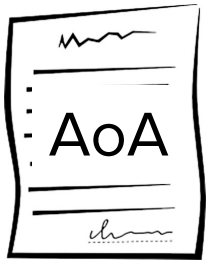
Opportunities to find even better solutions

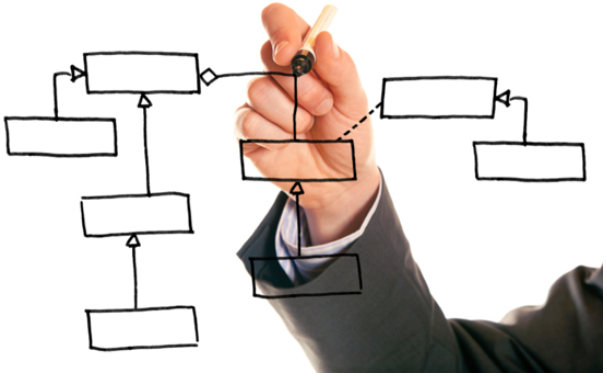


Balance of impacts

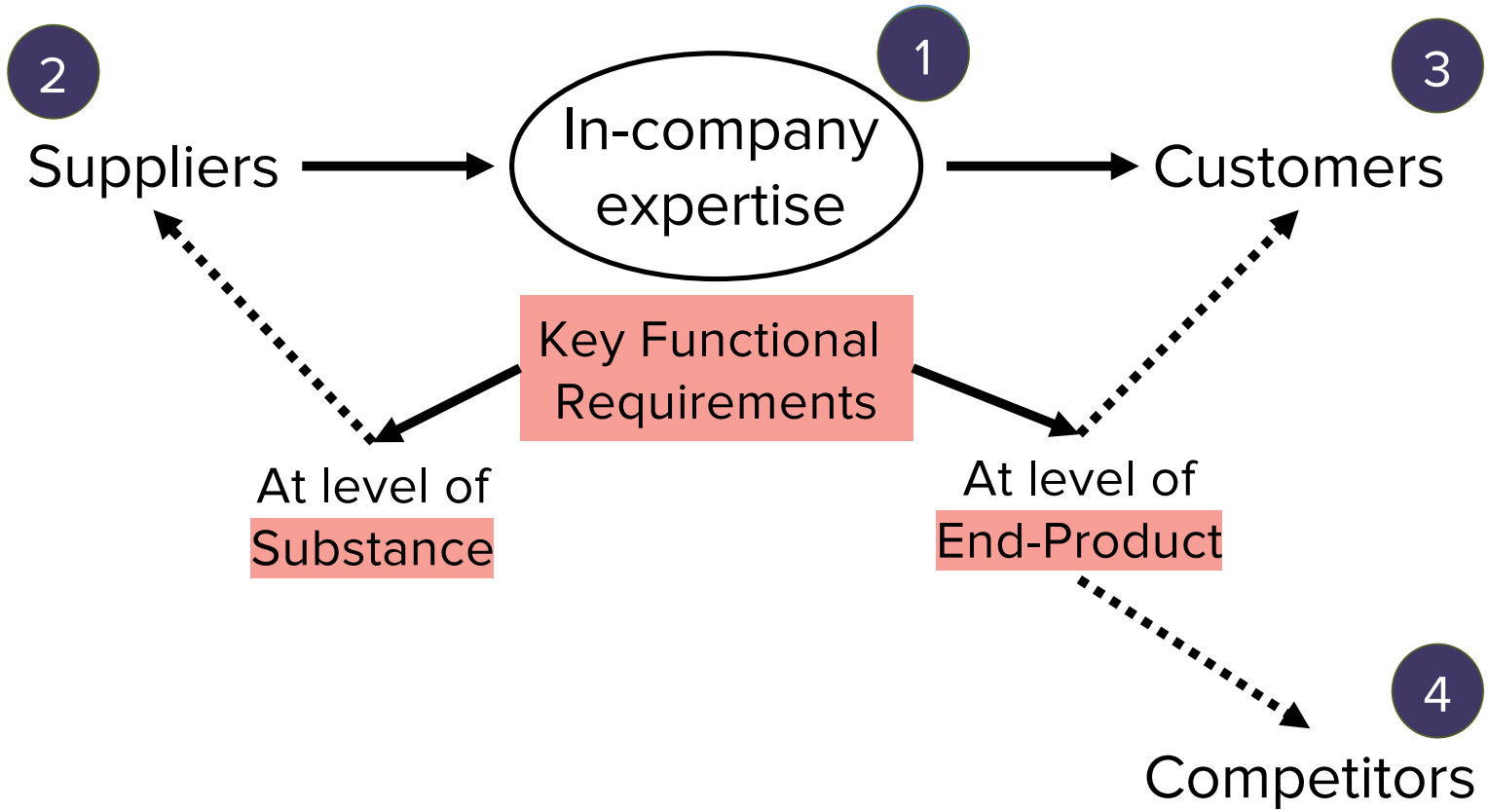
“use -applied-for” vs “non-use”


CSR
SEA
Dose response curve
people
EXPOSURE
RISK
IMPACT
€: WTP / other





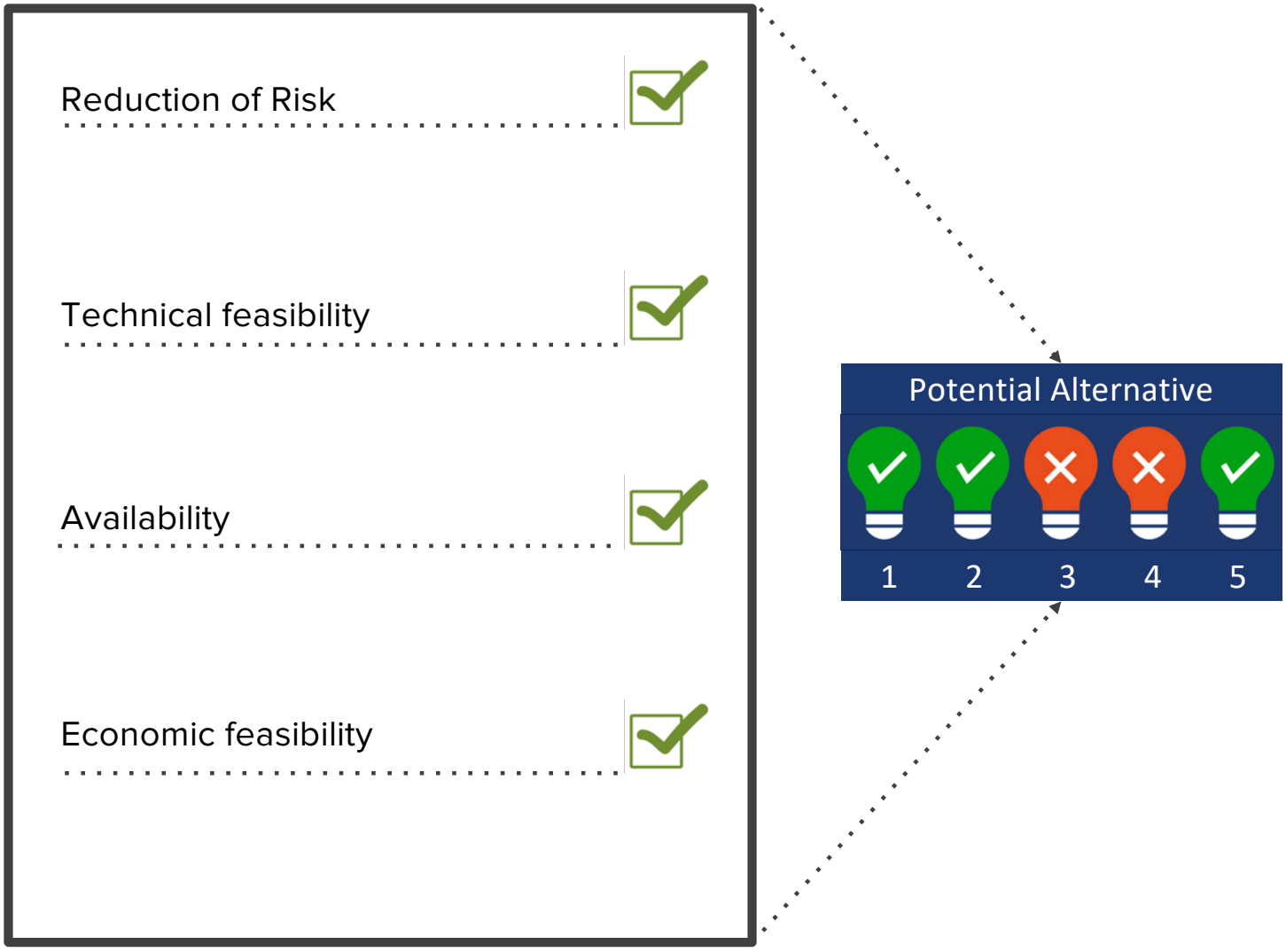
Key Functional Requirements



5 Google

6 Dbases (WIPO Green, Market Place, Chemycal,...)

7 Green Chem. Conferences

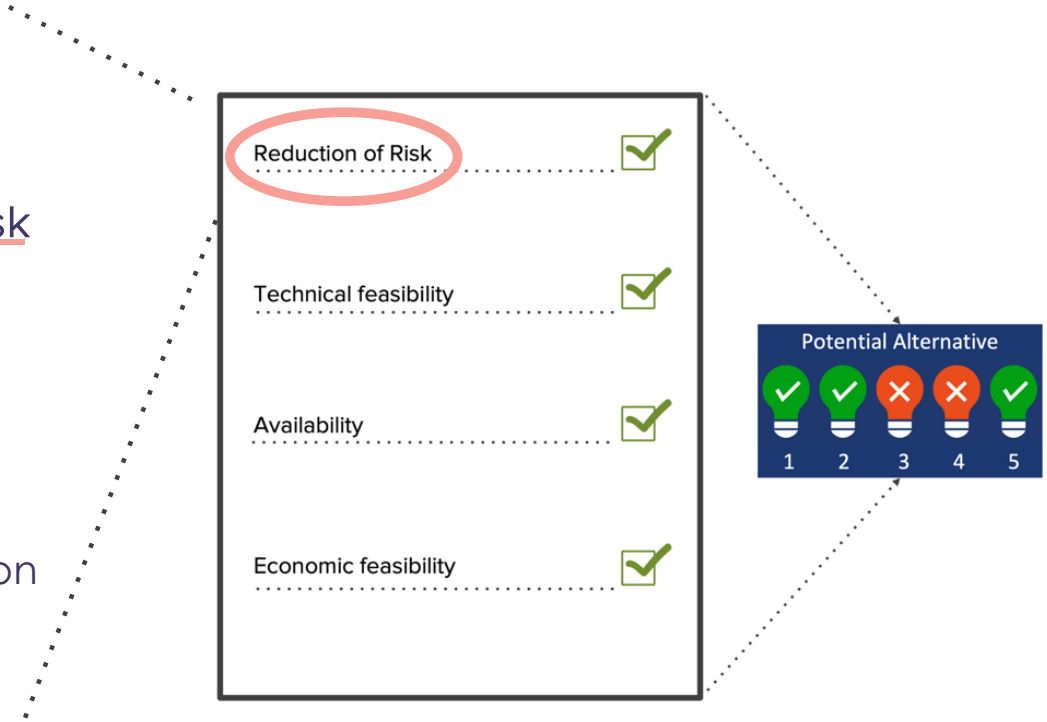


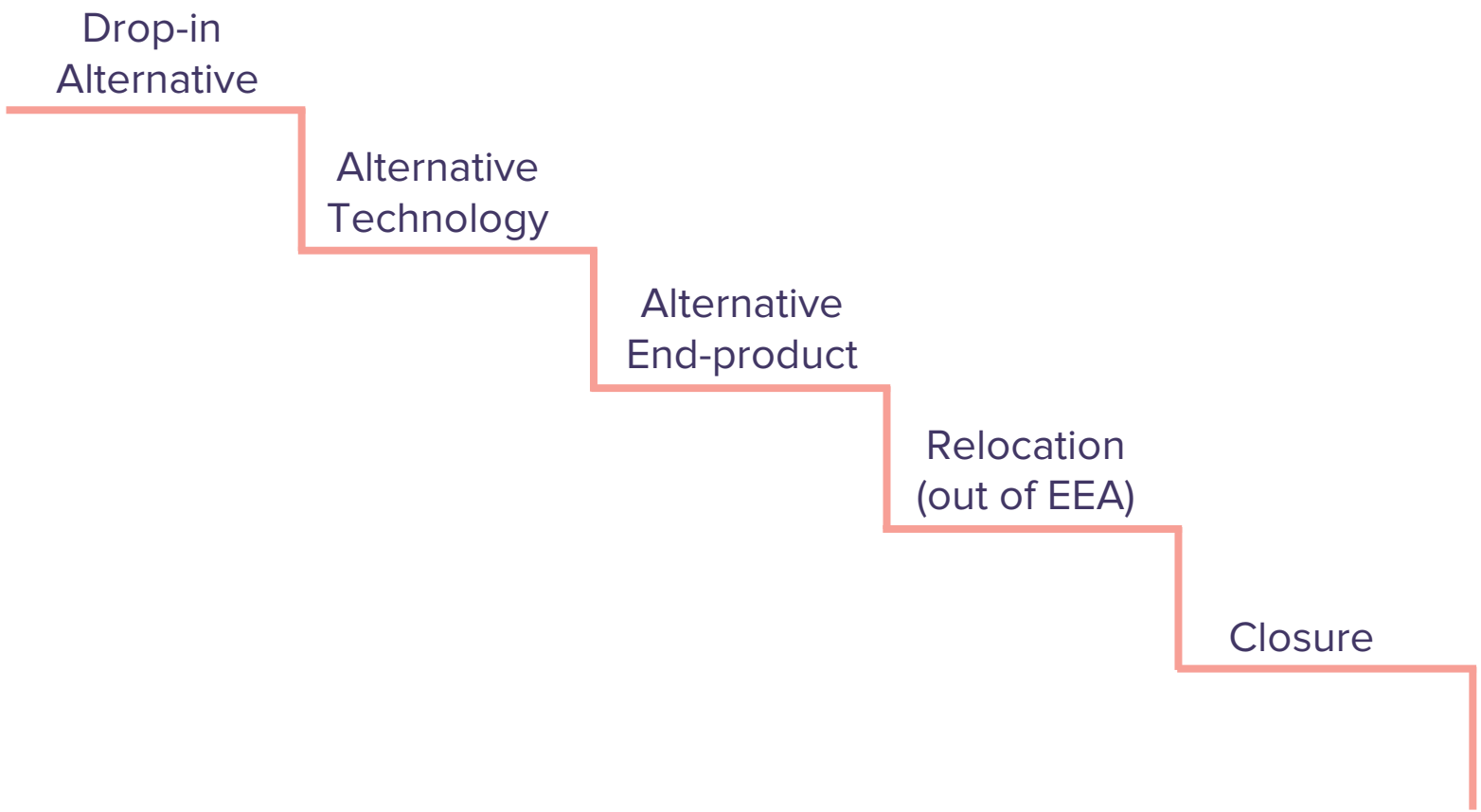
the AoA is company and business dependent

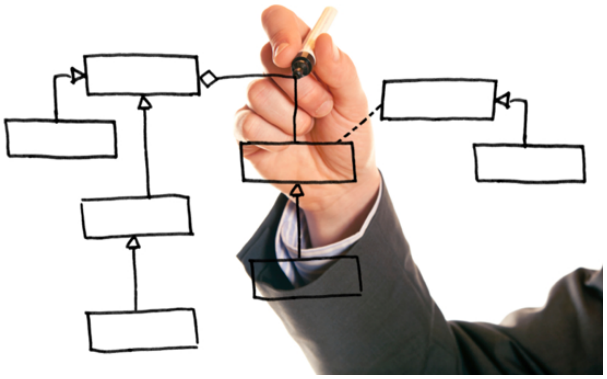
Comparative Risk Assessment

on Toxicity & HH/ENV Health Risk
on Climate
on Circularity
on Resource Depletion

for the entire life cycle
→Avoiding regrettable substitution




Drop-in Alternative
Alternative Technology
Alternative End-product
Relocation (out of EEA)
Closure



Applied for Use Scenario
with development plan
&
Non Use Scenario

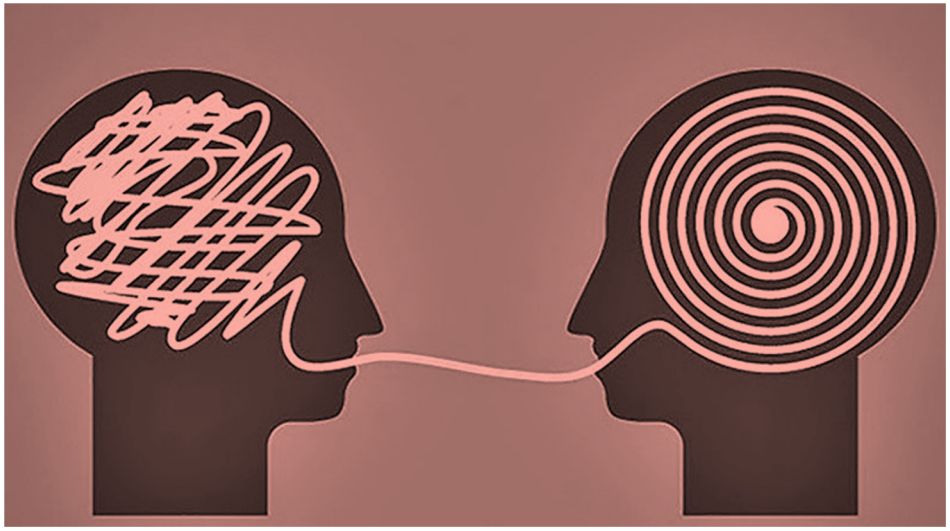
the AoA defines the future business strategy

Authorisation is **not avoiding** substitution

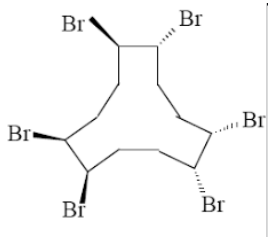
Authorisation is **a plan towards** substitution,

while emissions & exposure (to workers & man-via-env) are continuously improved/miminized

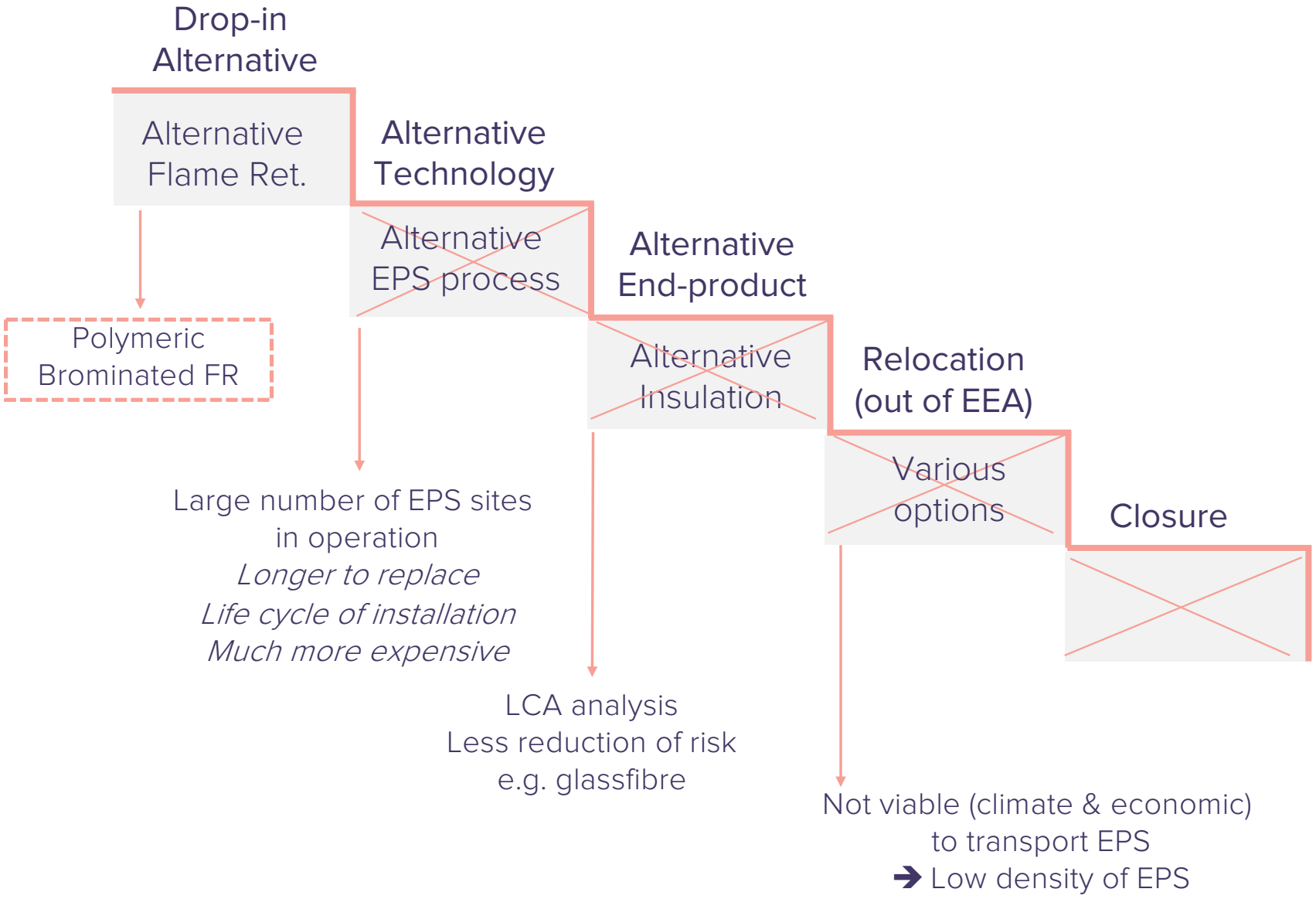
What can we learn from Example Cases?

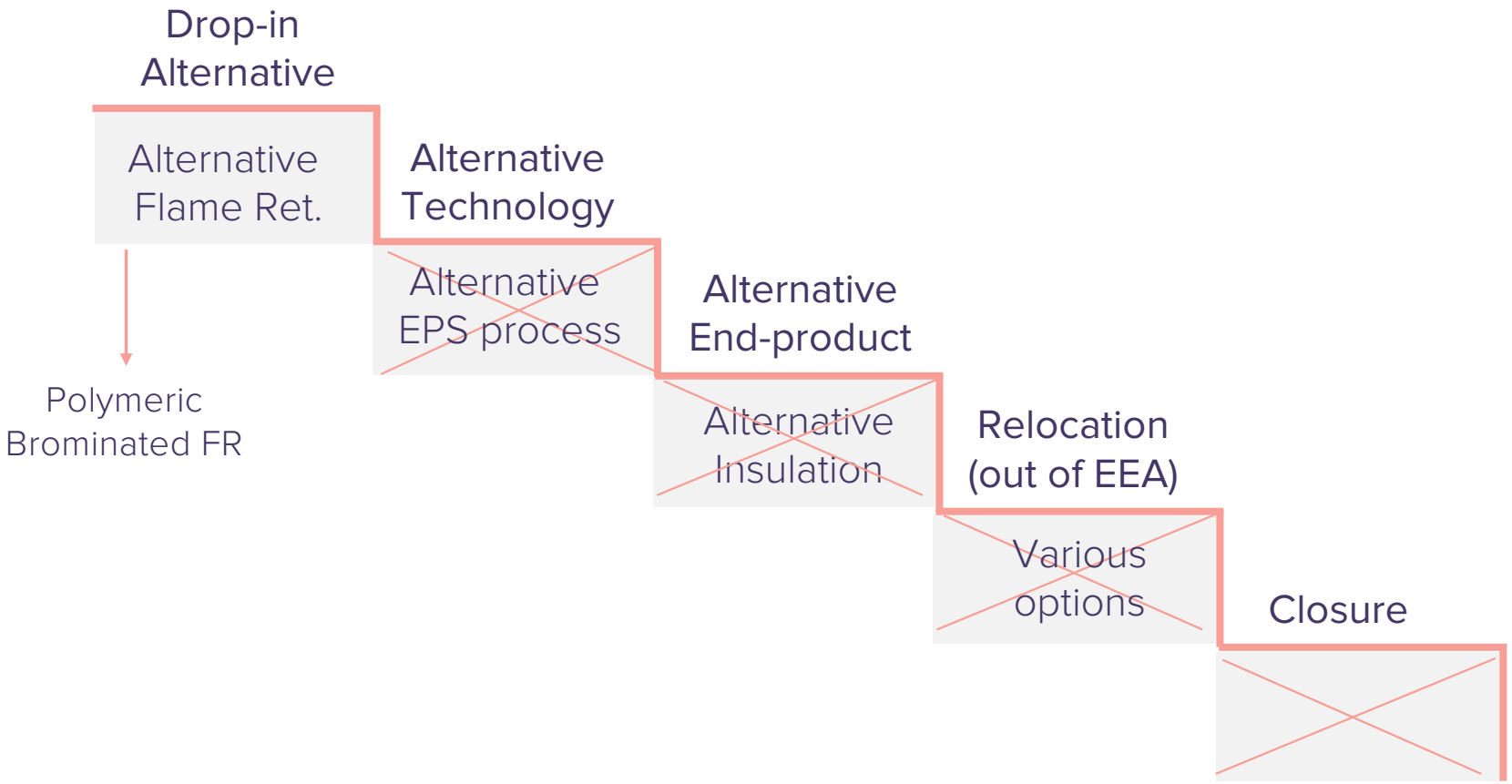


HBCDD



- Flame retardant for EPS and XPS
- PBT properties
- Regulated by POPs convention (2013)
- Included in Annex XIV of REACH (2009) as one of the first substances
- Sunset date for the substance 21/8/2015


Drop-in Alternative
Alternative Flame Ret.
Polymeric Brominated FR
Alternative Technology
Alternative EPS process
Large number of EPS sites in operation
Longer to replace
Life cycle of installation
Much more expensive
Alternative End-product
Alternative Insulation
LCA analysis
Less reduction of risk
e.g. glassfibre
Relocation (out of EEA)
Various options
Not viable (climate & economic) to transport EPS
➔ Low density of EPS
Closure



Joint effort between flame retardant suppliers & EPS producers
Pro-Active research before regulatory scrutiny: 9 years search (2003-2012)
Authorisation requested for only 2yrs until enough market volume of alternative available
Authorisation granted for the 2yrs. Substitution in meantime completely implemented.

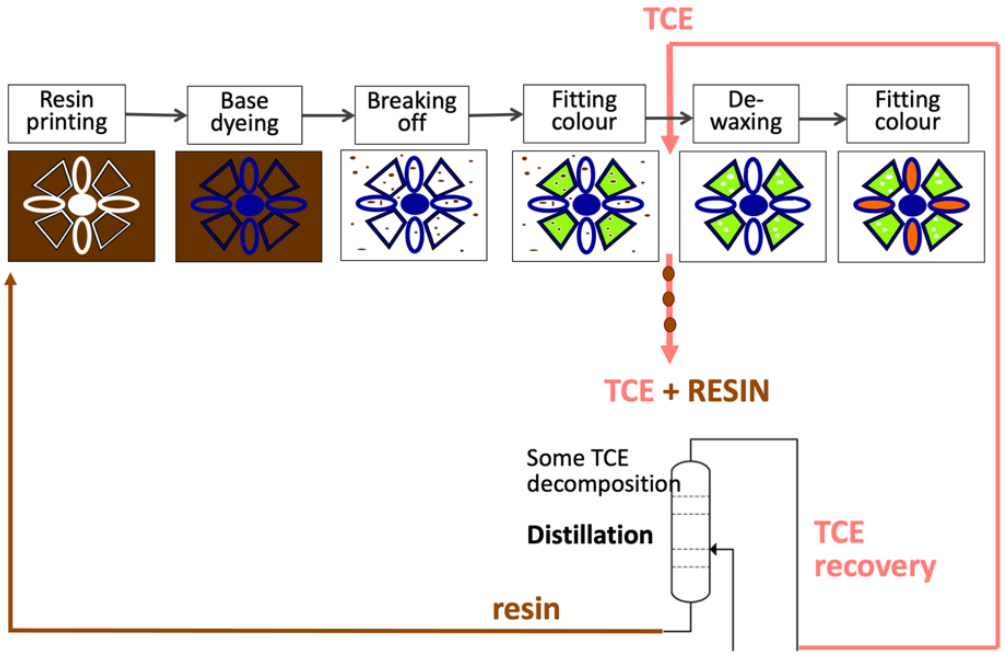
Learning

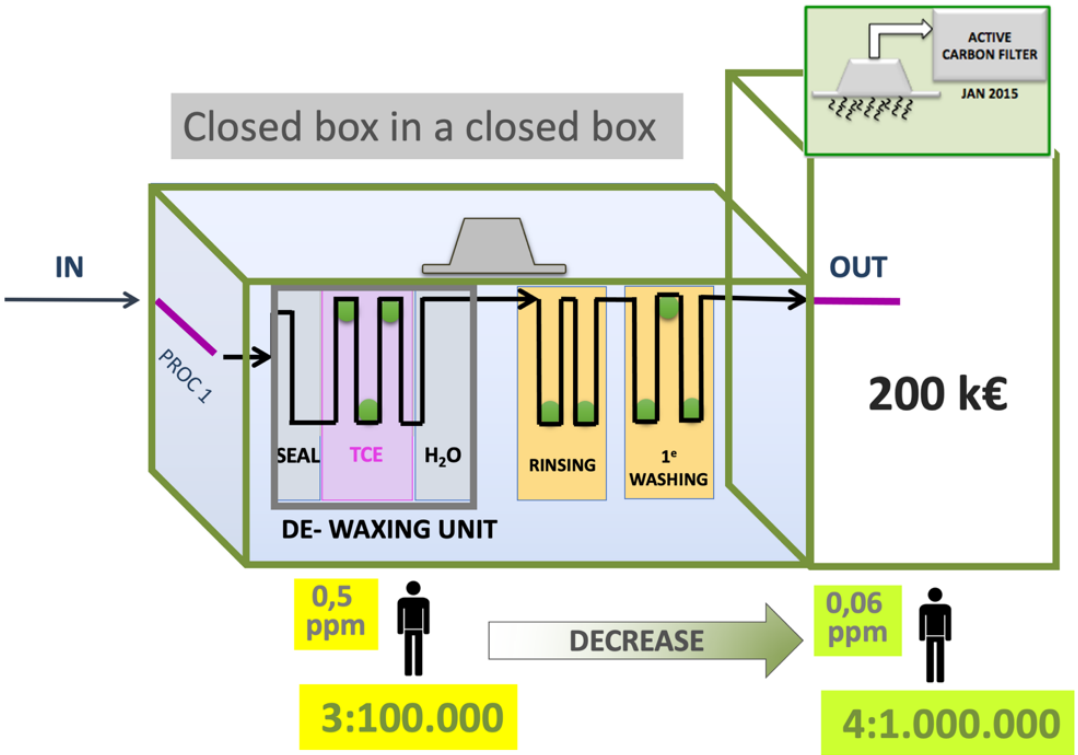
Joined effort between users and producers

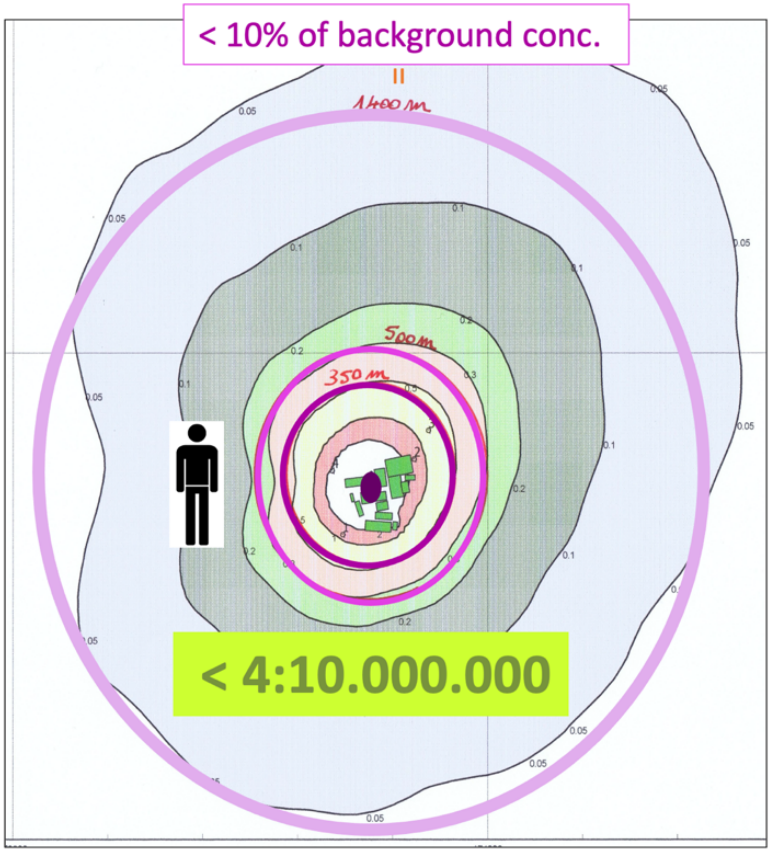
Proactive AA based on inherent property of substance

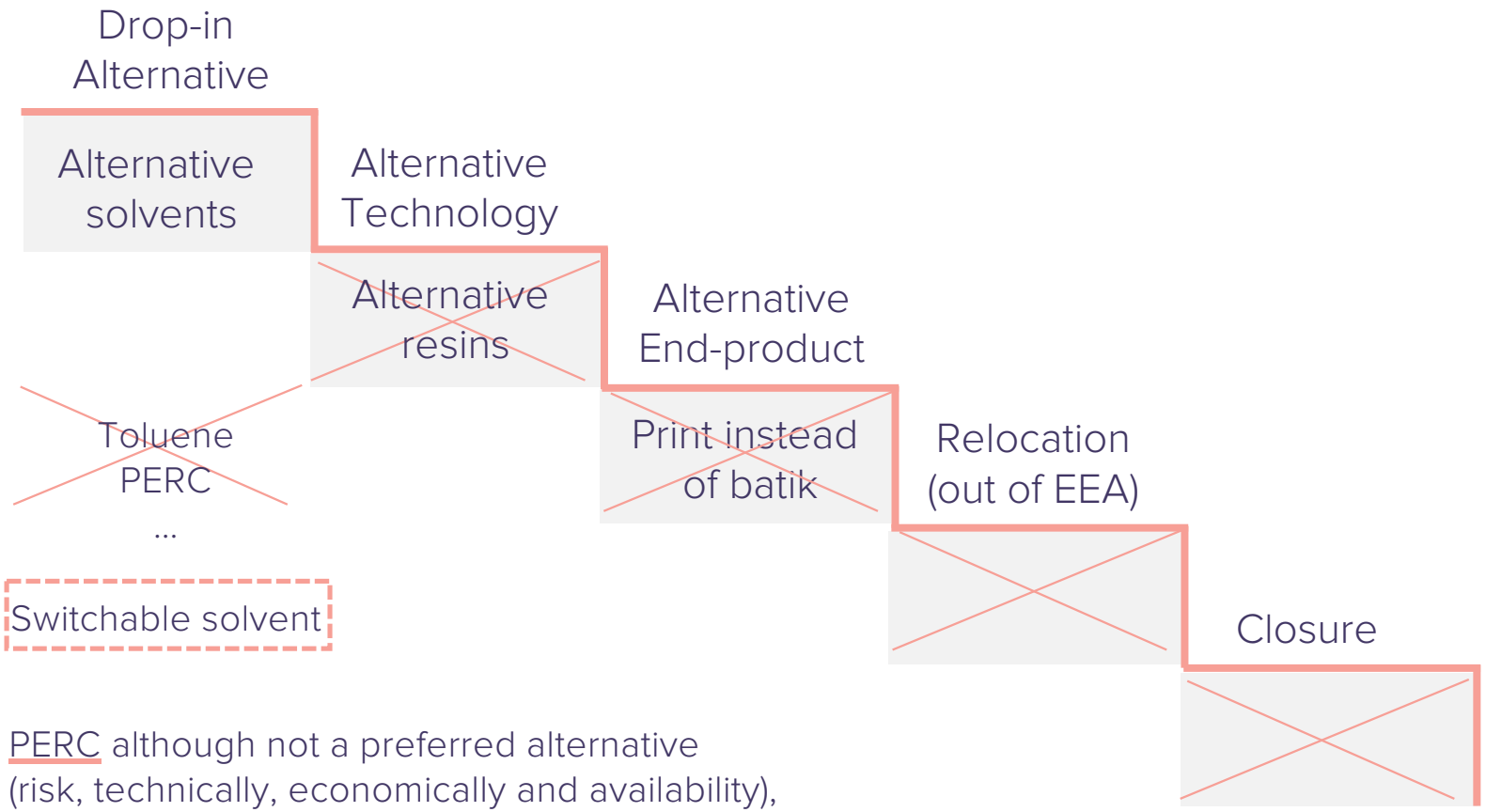
Acting ahead of regulatory requirement is effective

Trichloroethylene




Closed box in a closed box
ACTIVE CARBON FILTER
JAN 2015
IN
OUT
PROC 1
SEAL
TCE
H_2O
RINSING
1e WASHING
DE- WAXING UNIT
200 k€
0,5 ppm
DECREASE
0,06 ppm
3:100.000
4:1.000.000


< 10% of background conc.
1400 m
500 m
350 m
< 4:10.000.000



PERC although not a preferred alternative
(risk, technically, economically and availability),
the quickest and cheapest alternative in case of refused or even short term (4-7yrs) authorisation!
Thus, no or short-term authorisation would have resulted in substitution to PERC = regrettable

Switchable solvent = innovative, sustainable alternative
Risk reduction and reduction of energy consumption
Development time estimated at 12 yrs

Ongoing R&D

- Innovation to sustainable alternatives requires time
- Switchable solvents, but the applicant also continued R&D to other technologies in case switchable solvents would not work out
- Open minded to the best possible solution for applicant & society

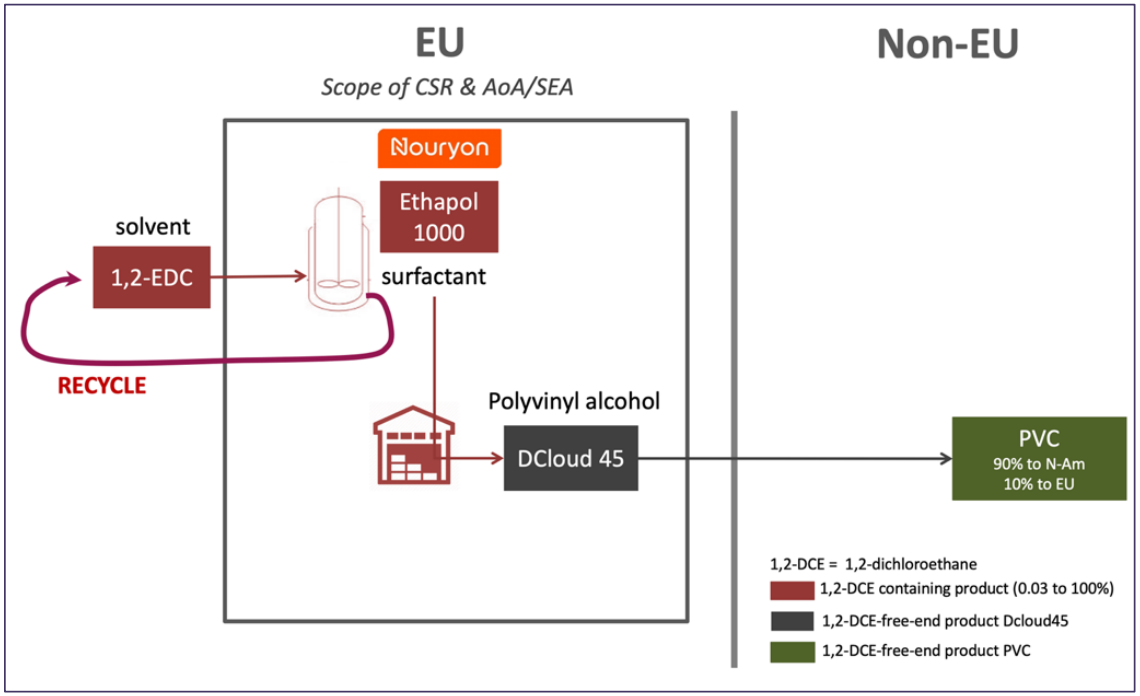
- Footnote: AA by downstream versus AA by Manufacturer of the substance
  - Manufacturer typically develops drop-in alternatives only (other solvents)
  - Conflict of interest: manufacturer or supplier high up in the supply chain is not interested in alternatives he cannot produce, e.g. new technologies at downstream user
  - Significant uncertainties in the dossier due to aggregation of information. This leads to shorter authorised periods.
  - Result: No time for development of innovative alternatives. In practice…a significant number of TCE users have in the meantime switched to PERC

Learning

Regulation is a good trigger for substitution.
But...Substitution under time pressure
leads to suboptimal substitution or - worst case –
to regrettable substitution.

Substitution from Trichloroethylen to Perchloroethylene is a regrettable substitution.
But unfortunately this is what happened in reality,
because the downstream users were not sufficiently involved in the AA process.

1,2-dichloroethane @ Nouryon



1,2-EDC as solvent in production of surfactant

1,2-EDC is recycled in the process

Surfactant (Ethapol 1000) is used to make DCloud45

DCloud45 is a PVA used in PVC

PVC is used in piping, cable insulation, blood bags, ...

DCLoud45 is **the only PVA**
with zero methanol & zero ethanol
Key to US PVC manufacturers for reasons of
(1) explosion safety, and
(2) to complywith US Clean Air Act on
methanol emission reduction obligations

€ HH during review period

= ca. 262€

0,0000168

total fatal cancers cases per year

No authorisation (NPV)

ca. 2.980.000€

Drop-in Alternative

~~Alternative solvents~~

Cyclohexane
possible in 6yrs
but not most sustainable!

Alternative Technology

Alternative chemistry

Water-based polymerisation
Innovative, sustainable
but takes more time, 9yrs
Preferred alternative

Alternative End-product

~~Alternative surfactant~~

Alternative to Ethapol1000, or
Alternative to DCloud45

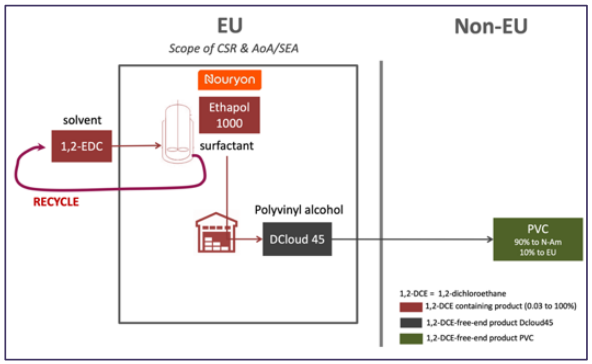
Relocation (out of EEA)

~~to Mexico site~~

= cheapest non suitable alternative
= *non-use scenario (= no authorisation)*

Closure

~~Closure~~



Koen Vanduffel, Nouryon

"If we would have received limited time, then we would have been forced to bet on the quickest horse."

= cyclohexane, i.e. the least sustainable alternative.

Because 9 years was granted, OK to innovate for a sustainable alternative.

Authorisation was granted until 22 Nov 2026.

Development was quicker than expected, Implementation now planned in 2022!

Learning

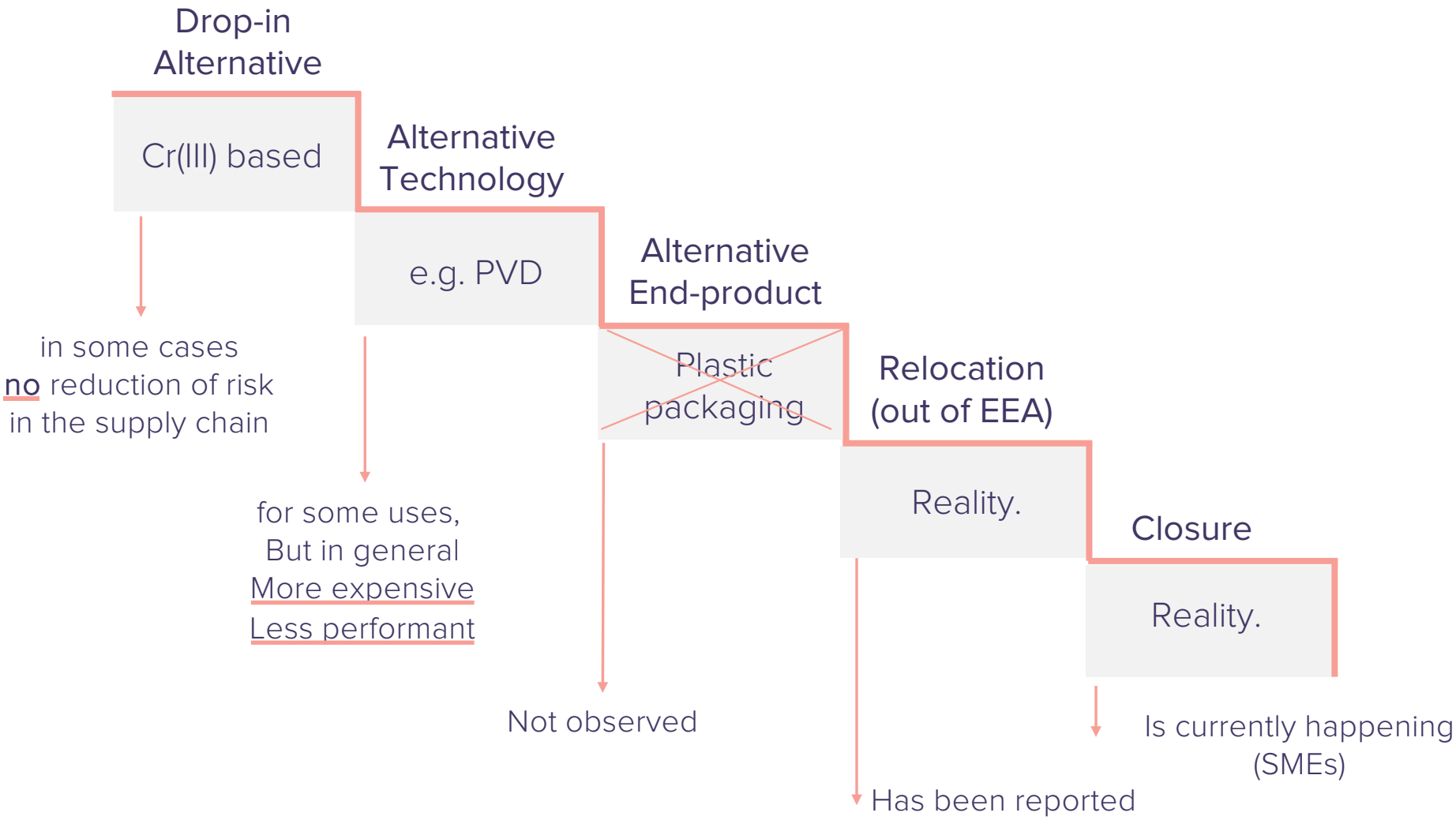
When sufficient time is granted,
then targeted R&D can lead to
an INNOVATIVE & SUSTAINABLE alternative

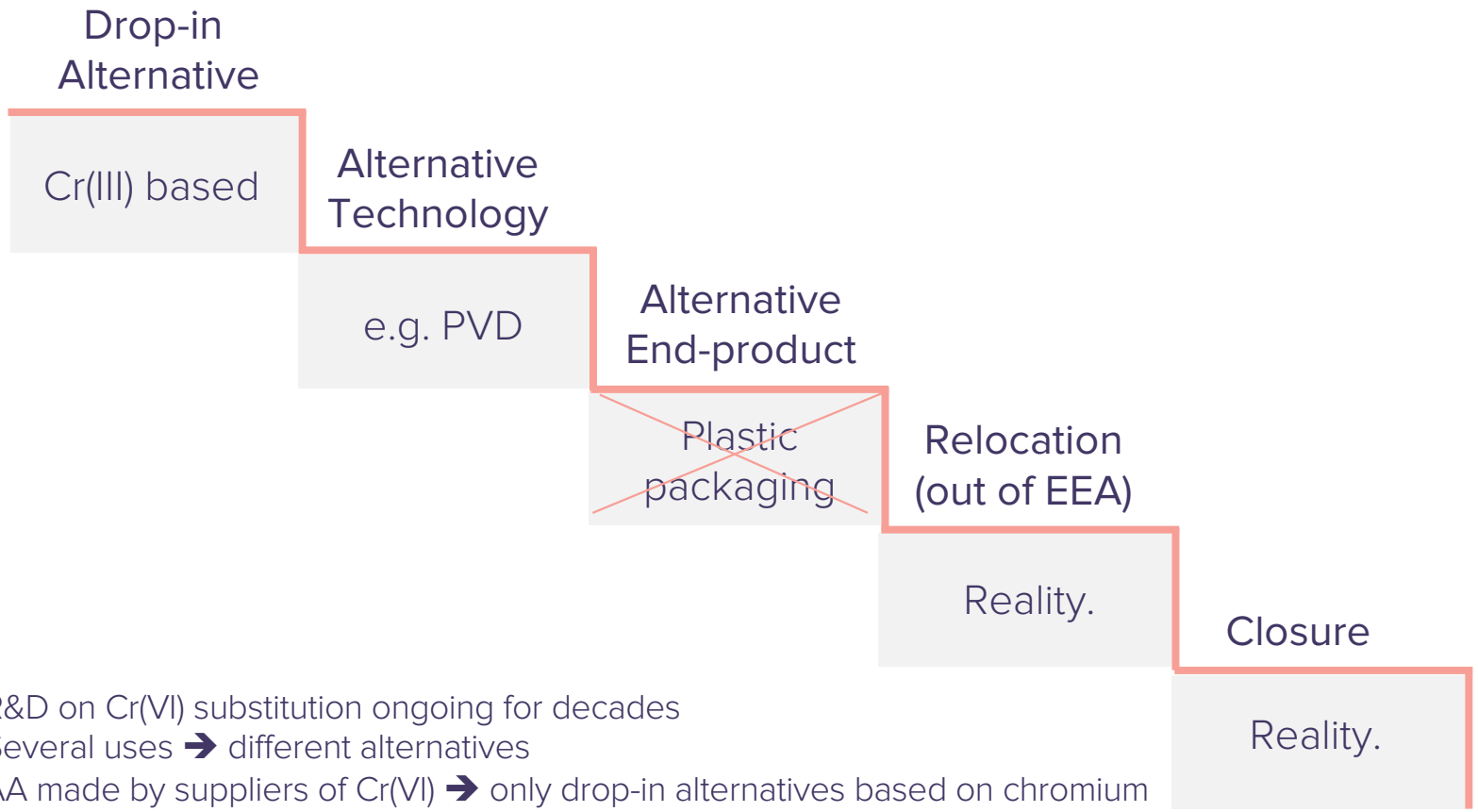
If the authorised time would have been limited to 6yrs,
then the applicant would have focussed its R&D on the quickest potential alternative,
which is the least sustainable one.

Granting the applicant more time, allowed them to develop alternatives in parallel.

Hexavalent Chromium

- Very large number of DUs
- Various uses for surface treatment
- Various end products
  - Automotive
  - Architecture
  - Can making
  - Riffle barrels
- Concern is workers exposure


Drop-in Alternative
Cr(III) based
in some cases no reduction of risk in the supply chain
Alternative Technology
e.g. PVD
for some uses, But in general More expensive Less performant
Alternative End-product
Plastic packaging
Not observed
Relocation (out of EEA)
Reality.
Has been reported
Closure
Reality.
Is currently happening (SMEs)



- R&D on Cr(VI) substitution ongoing for decades
- Several uses ➔ different alternatives
- AA made by suppliers of Cr(VI) ➔ only drop-in alternatives based on chromium
- Cr(III) still requires Cr(VI) in the supply chain (either in the production of Cr(III) compounds like Cr(III)sulfate, starting from sodium dichromate, or Cr(VI) release during mining)
- Innovative and sustainable alternative = chromium free
- Companies spent millions and substituted – with good intentions! - to Cr(III) as result of time pressure
- Substitution partially achieved, partially regrettable
- And what about the other substances in the process? Ni, borates, PFAS, ...
- Was it worth it?

Was it worth it?

Real life example: sum of 3 Cr(VI) authorisations

€ HH during review period

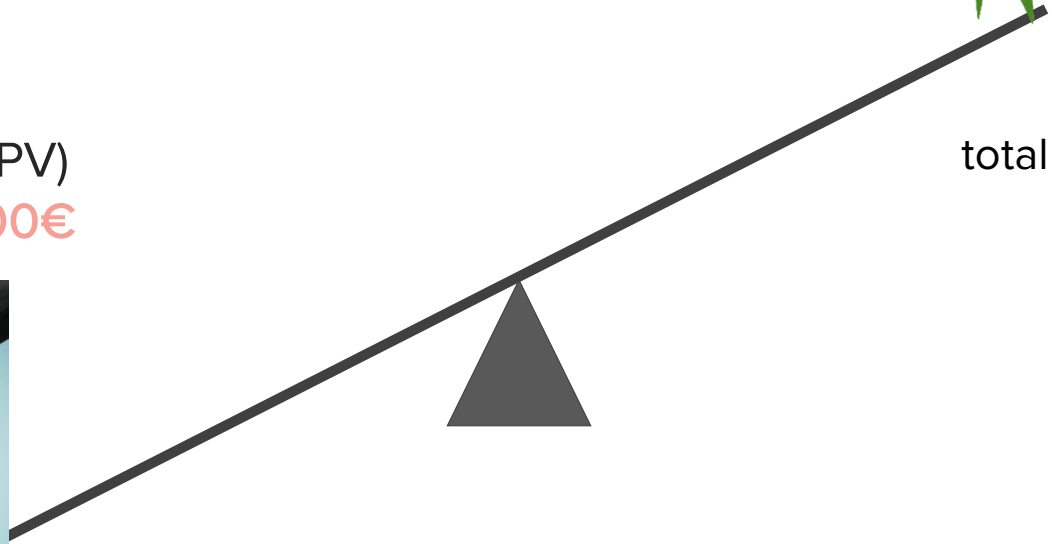
= ca. 225.000€

0,0056

total fatal cancers cases per year

Investment (NPV)

ca. 161.500.000€



Is this

190.000.000 € from the applicants,

money well spent for SOCIETY?

What if…ALTERNATIVE-ly?

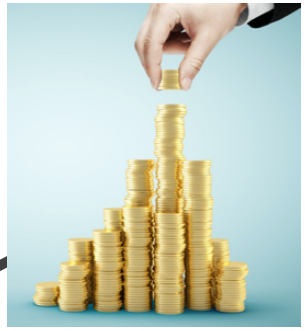

2010
2012
2017
Project by Lignaverda https://lignaverda.org/en/

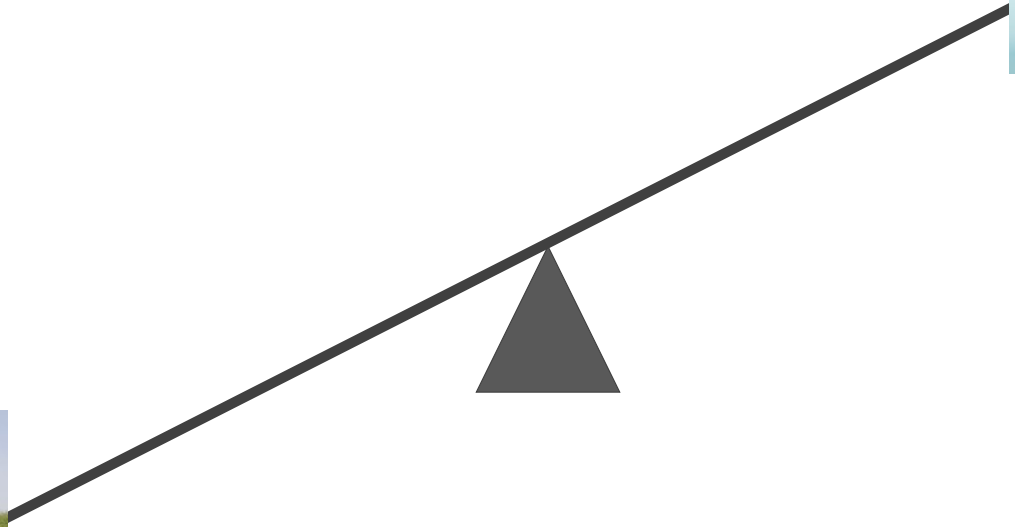
190.000.000€ Investment

Hectare trees	317.300	
Ton CO_2/yr	1.073.500	= 107.350 Belgians (CO_2 emission)
Cash crops/yr	5.288.333€	Gum, balanites oil
Grass/yr	3.807.600€	
Direct employment	380.000	= 1.331 villages
Indirect employment	380.000	

190.000.000€ Investment

Investment (NPV)
ca. 161.500.000€





471.000.000€ *

*NPV (4%) 20yrs
incl. cash crop, grass, CO_2 capture
HH cost of Cr(VI) use deducted

INDIRECT IMPACTS

PLANET

PEOPLE

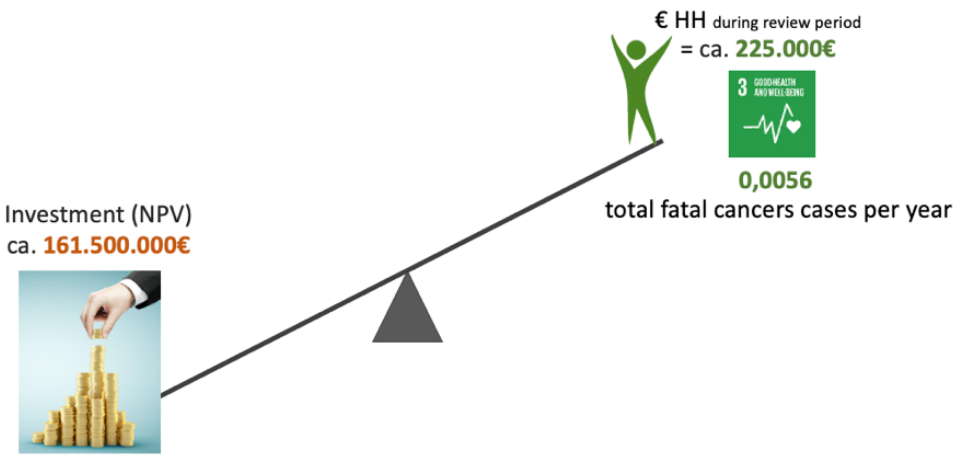
PROSPERITY

PARTNERSHIPS

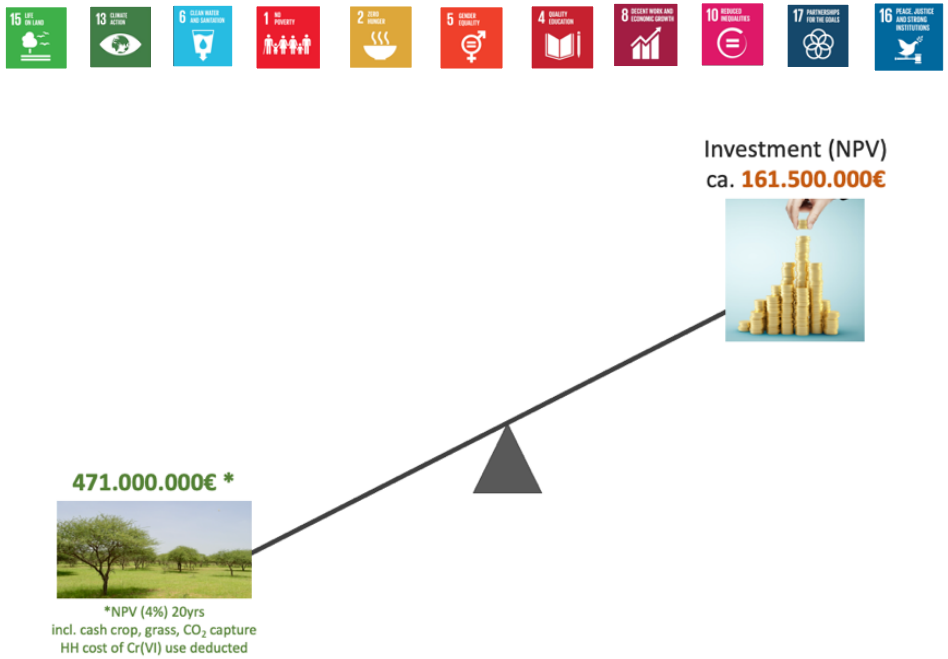
PEACE (STOP MIGRATION)

Alternatives Assessment of Investment

Alternative A: Substitute SVHC



Alternative B: Make dessert green



Learning

Regrettable substitutions in view of overall risk (Cr(III) still leads to Cr(VI) exposure higher up in supply chain), societal considerations & wasting resources

PRIORITY SETTING for substitution is key

First those with maximum positive impact for society

Substances not leading to exposure of general population should not be the first priority.

These can be tackled when the bigger problems are solved.

In the mean time the risk can be mitigated (e.g. Binding OEL)

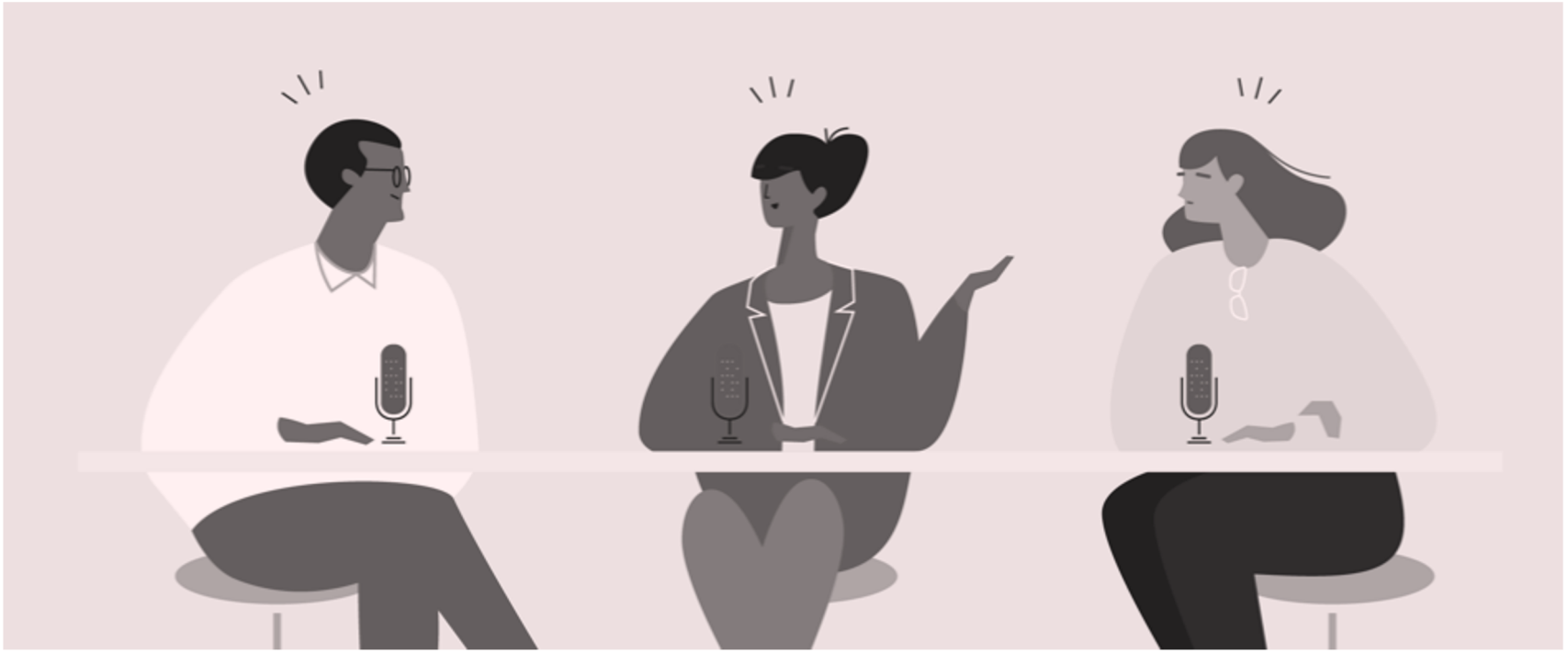
What can we CONCLUDE for companies outside EU?

Learning

- Regulation drives Innovation
- Proactive AA are more effective
- AA is multidimentional (tox, climate, circularity)
- Innovation requires TIME
- Innovation requires insight knowledge from the downstream user
- Innovation shall consider the entire life cycle, to avoid a shift of the risk
- A priority setting for substitution is key.

Optimal use of resources to maximize positive impact for society

QUESTIONS AND ANSWERS



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