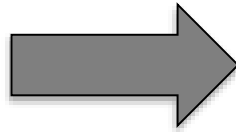




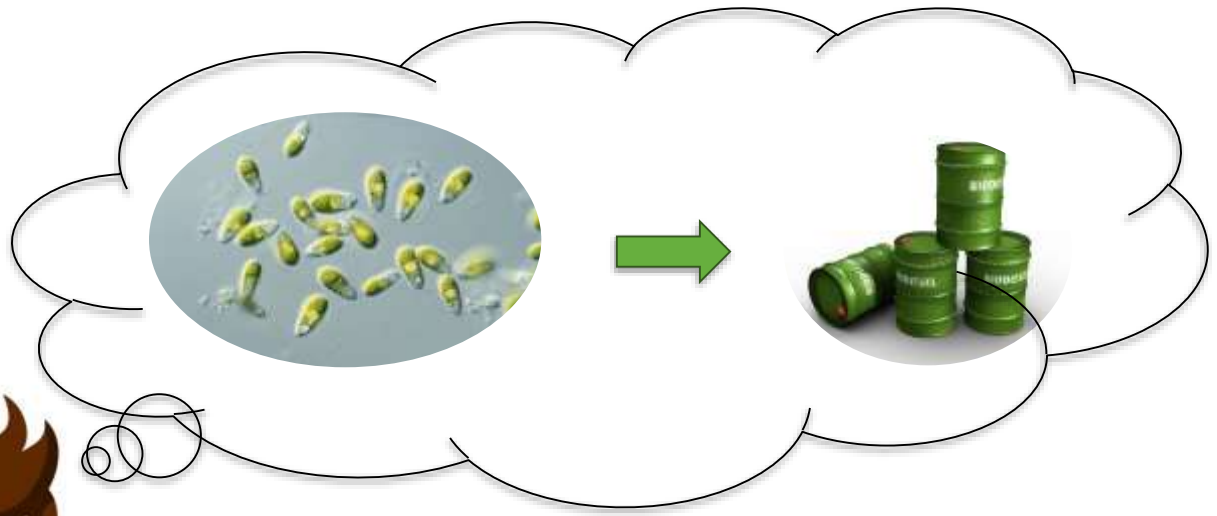
A SYSTEMATIC APPROACH TO AN ETEA DURING TECHNOLOGY DEVELOPMENT



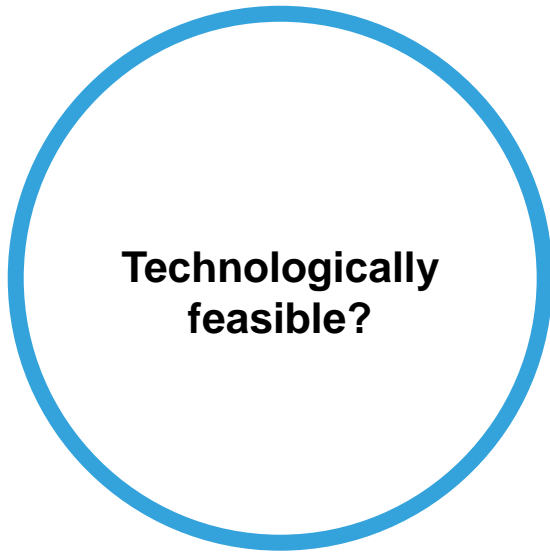
THOUGHT EXPERIMENT



YOUR TASK



WHAT INFORMATION DO YOU NEED?



WHAT INFORMATION DO YOU NEED?



Impact?



**Technologically
feasible?**

**Environmentally
sustainable?**

WHAT INFORMATION DO YOU NEED?



**Economically
profitable?**

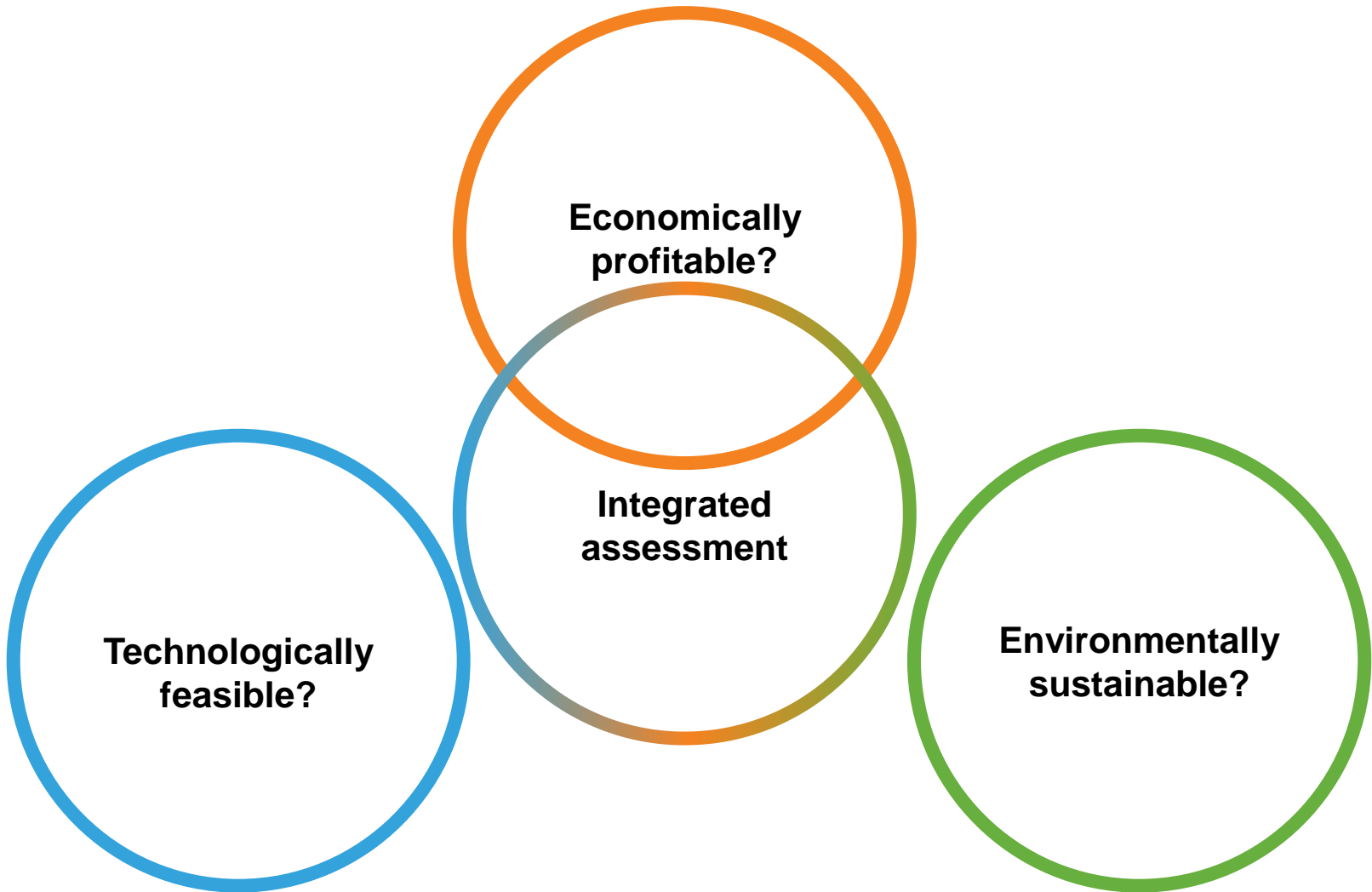
**Technologically
feasible?**

**Environmentally
sustainable?**

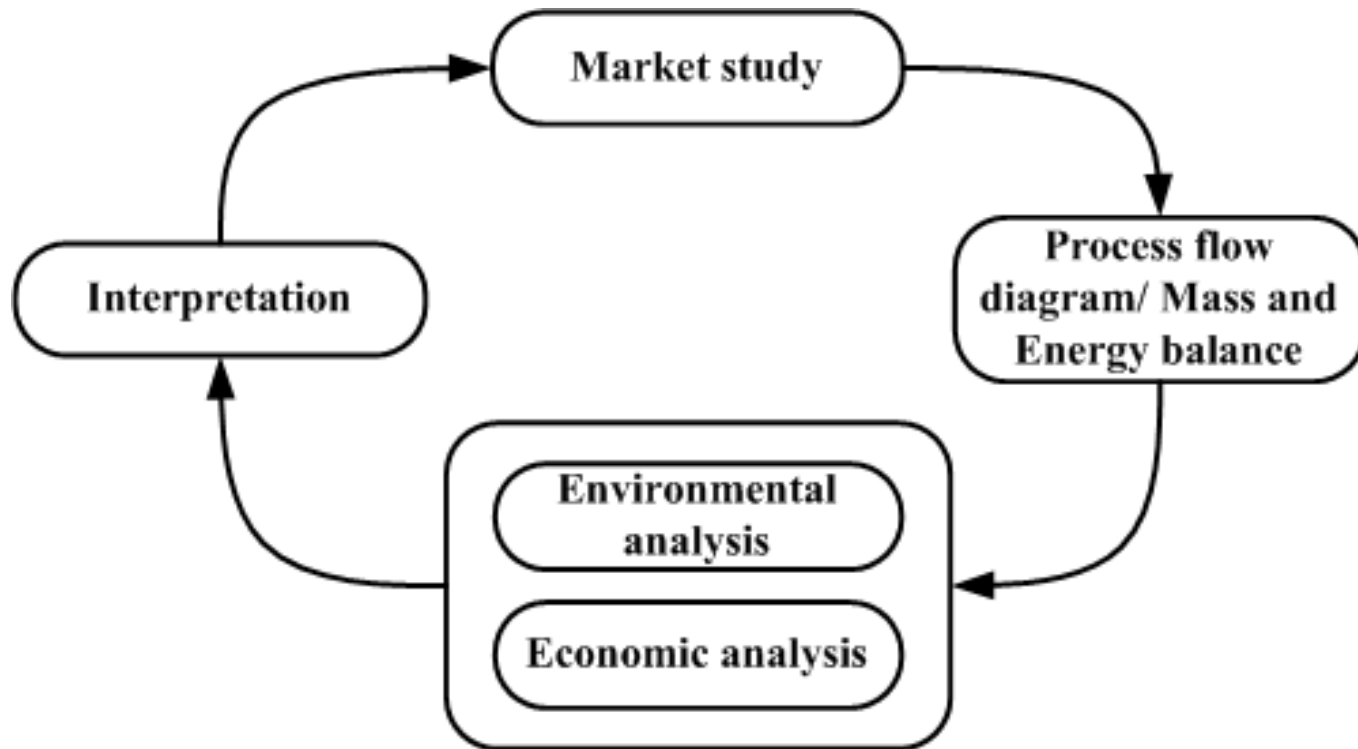
WHAT INFORMATION DO YOU NEED?



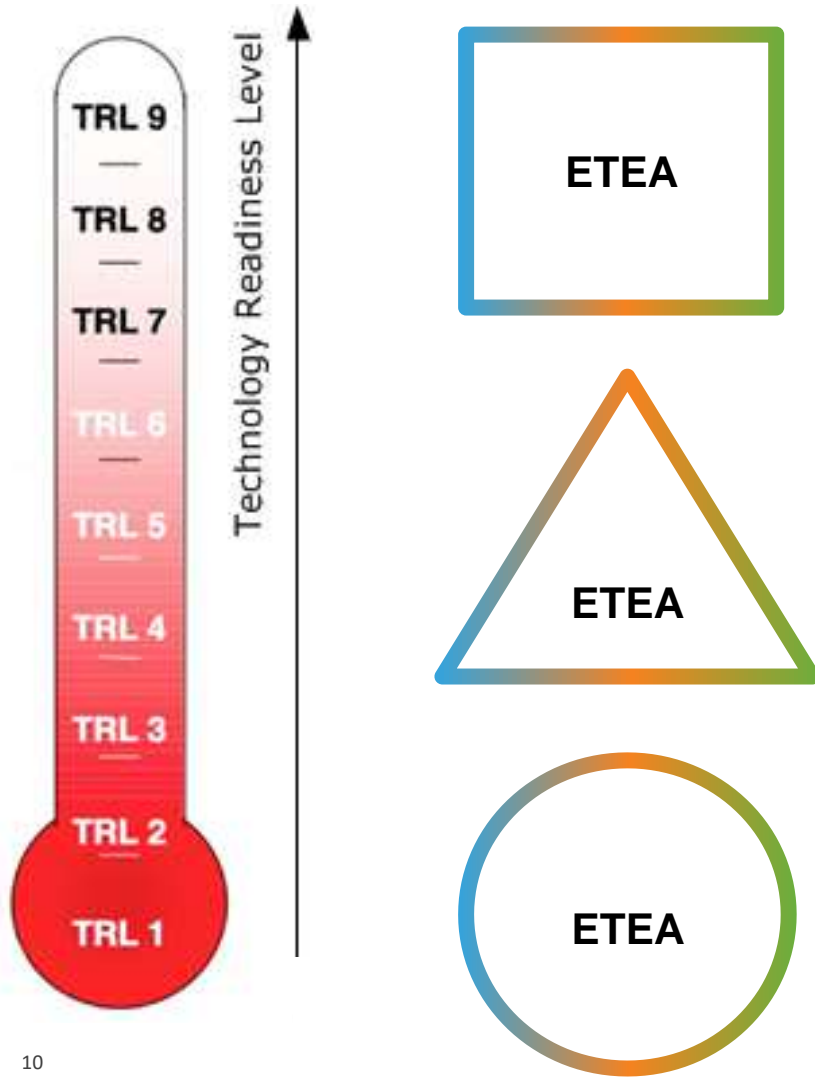
WHAT INFORMATION DO YOU NEED?



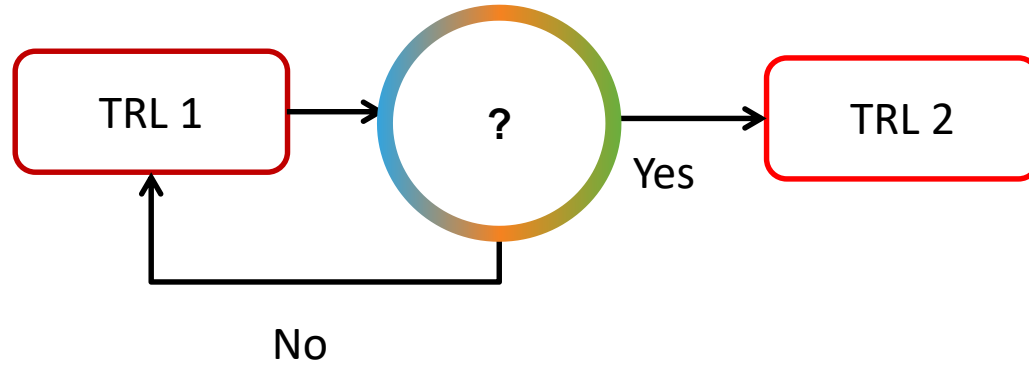
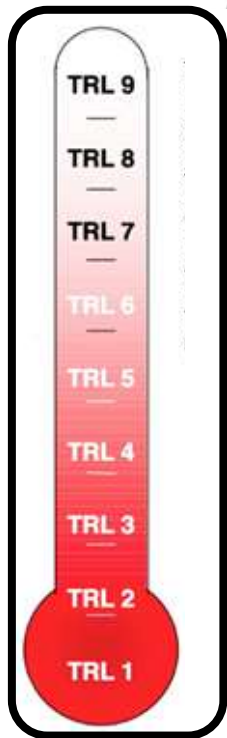
ENVIRONMENTAL TECHNO-ECONOMIC ASSESSMENT



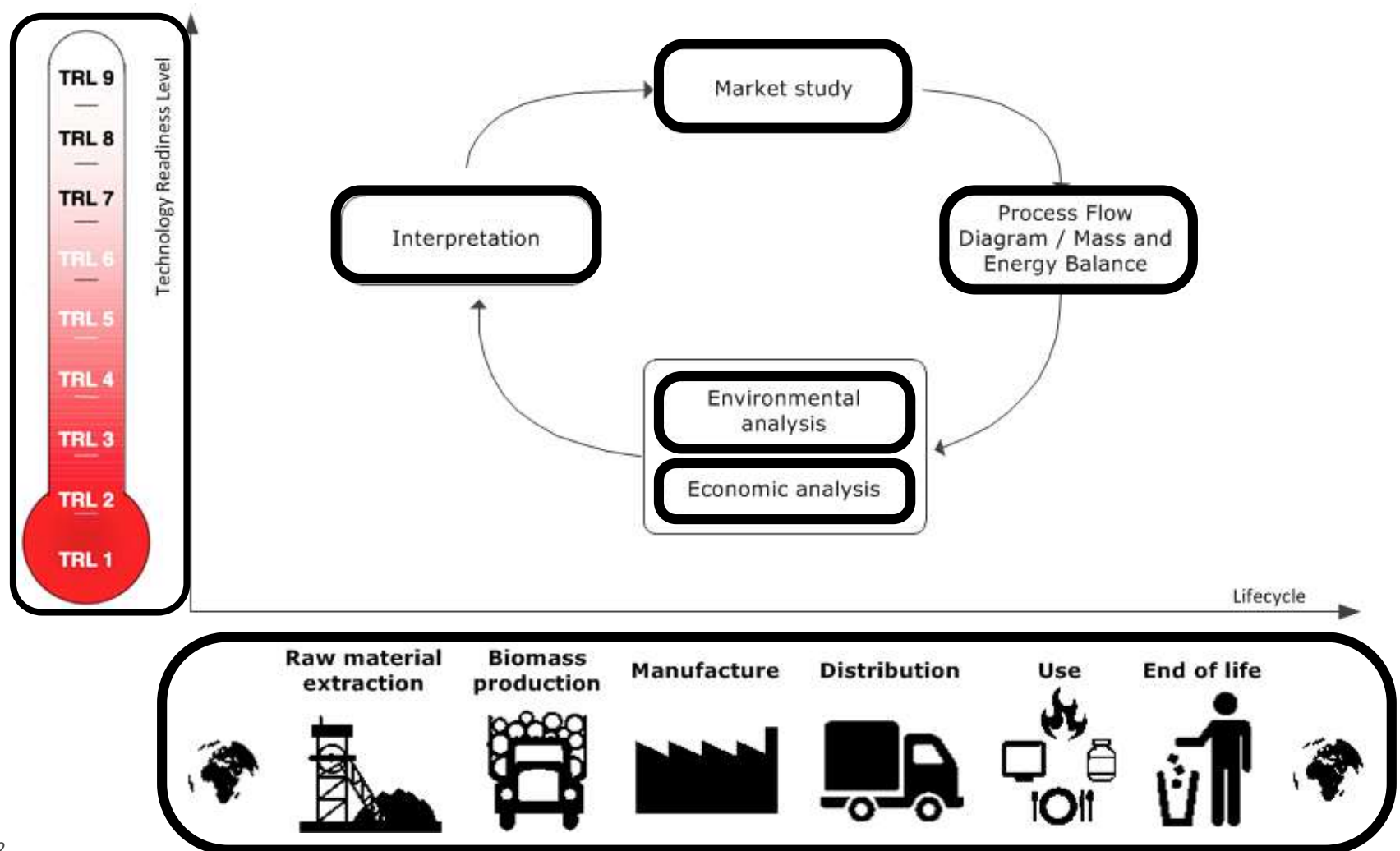
THOUGHT EXPERIMENT



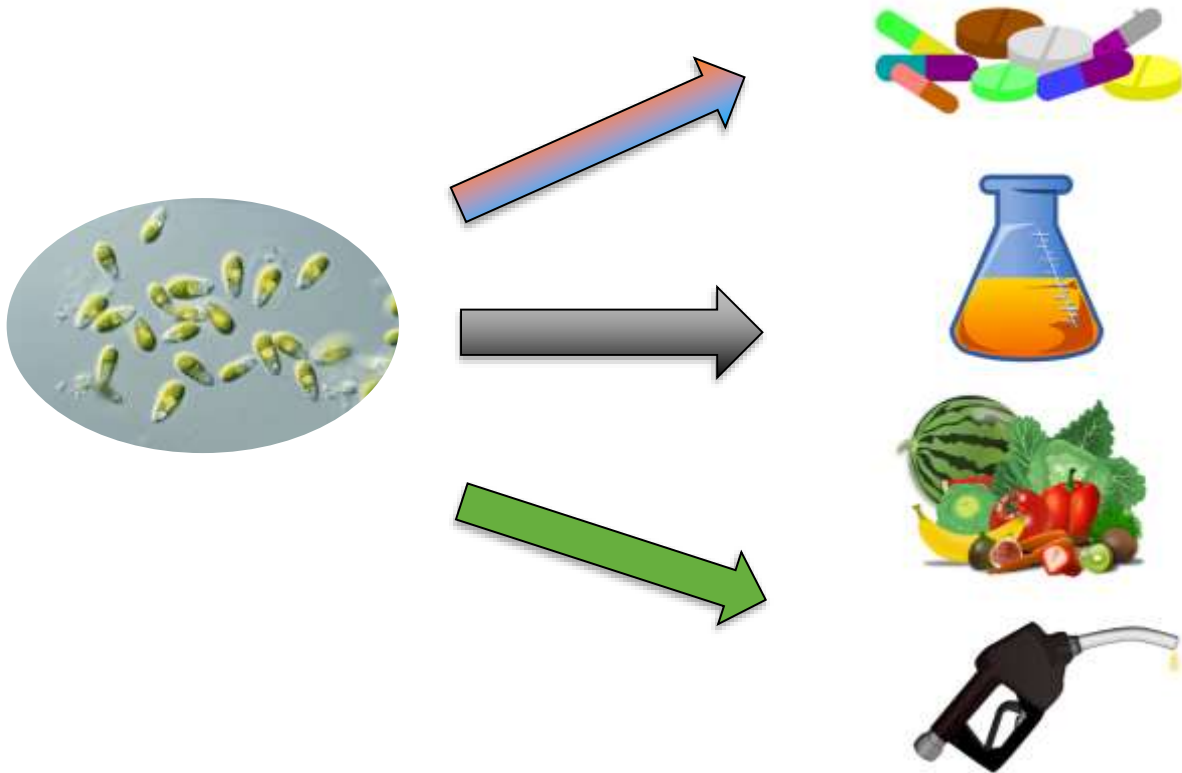
WE DEVELOPED A FRAMEWORK ON HOW TO PERFORM AN ETEA AT EACH TRL LEVEL



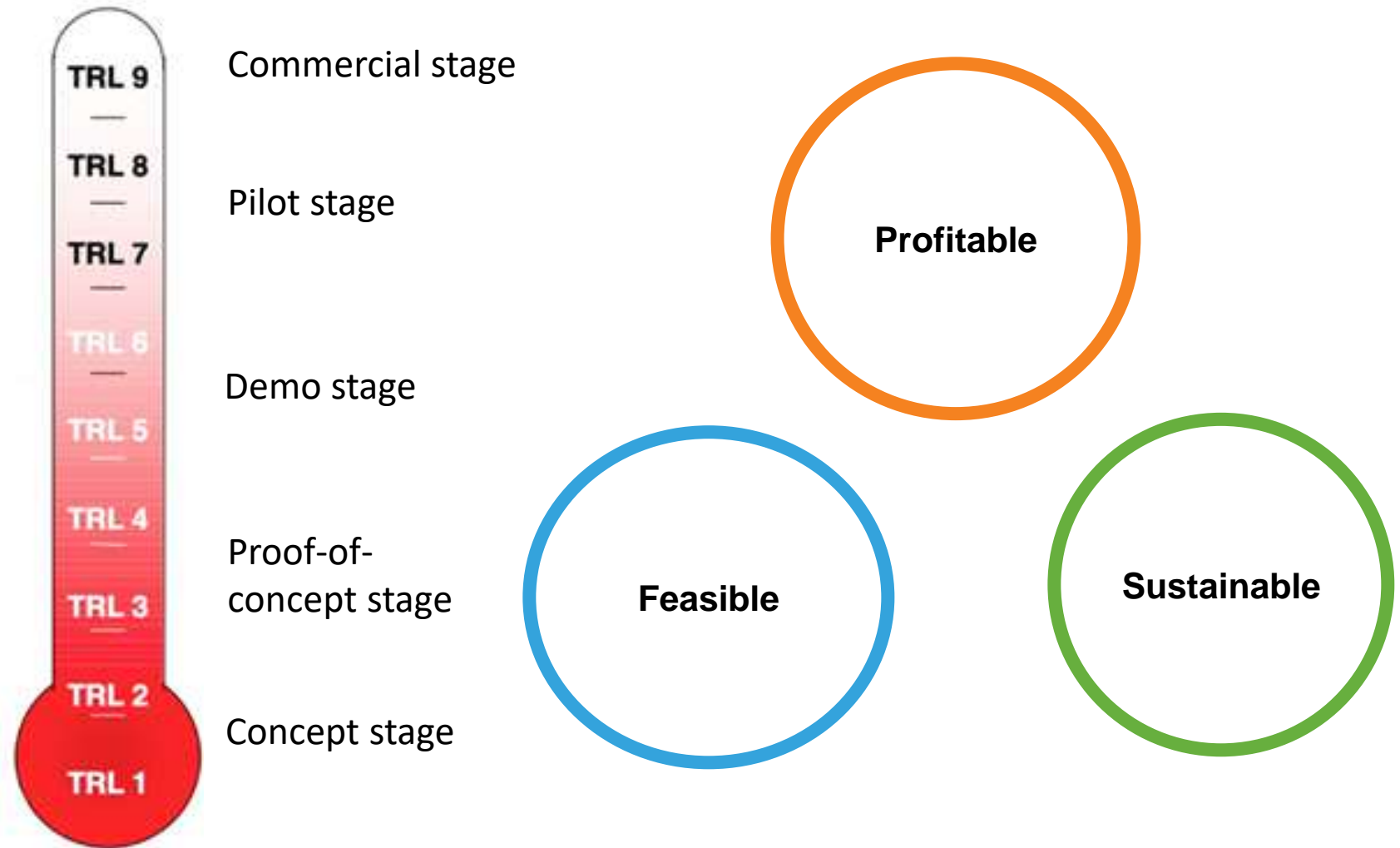
WE DEVELOPED A FRAMEWORK ON HOW TO PERFORM AN ETEA AT EACH TRL LEVEL



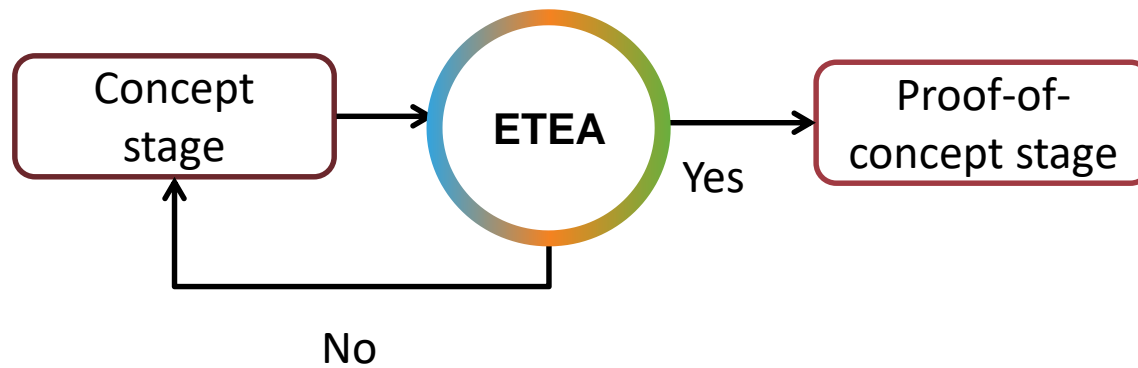
CASE STUDY ALGAE



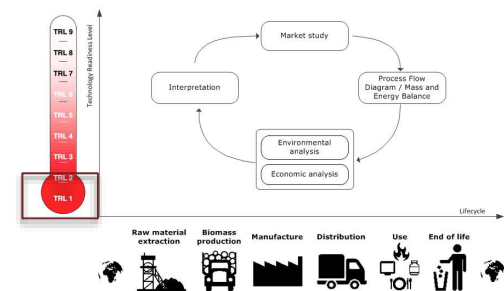
CASE STUDY ALGAE-BIOREFINERY









CONCEPT STAGE: DECISION

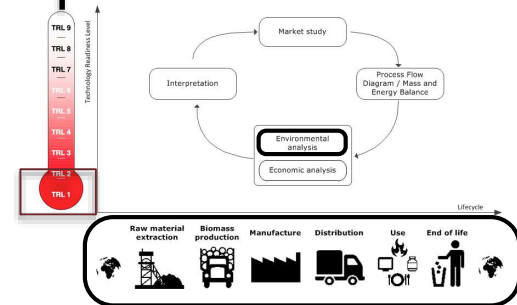


- Technology:** Expert judgement
- Economy:** Output (€) > Input (€)
- Environment:** Expert judgement









CONCEPT STAGE: ENVIRONMENTAL

	Specify: material/energy/...	Quantity	Resource efficiency	Emissions to air/soil/water	Energy intensity
					
					
					
					
					
					

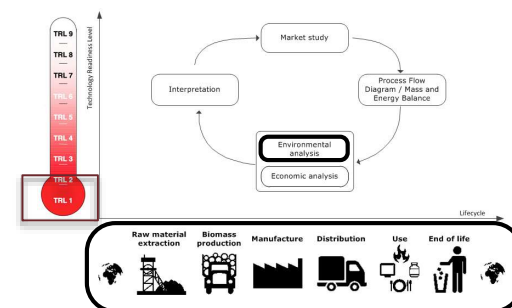


EXAMPLE: HOT SPOT ANALYSIS

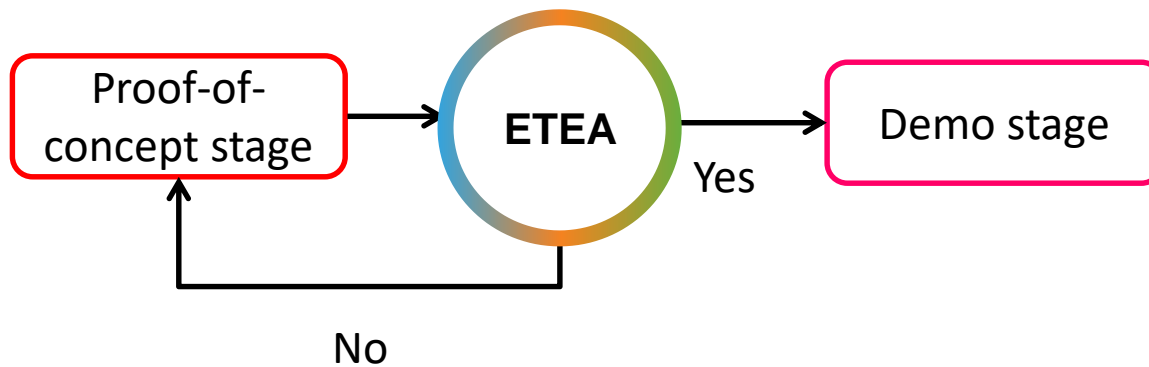
Betacarotene Absolute/ relative	Fill in	Quantity	Resource eff.	Emissions to air	Emissions to water	Emissions to soil	Energy intens.
	Raw material extraction						
	Material						
	Energy						
	Waste						
	Equipment						
	Transport						
	Relevance phase						
	Biomass production						
	Water						
	Salt						
	Fertilizer						
	Electricity						
	Heat						
	CO ₂						
	CH ₄ emiss.						
	Wastewater						
	Pond						
Harvester							
	Transport						
	Relevance phase						
	Manufacturing						
	Solvent						
	Energy						
	Waste						
	Dryer						
	Purificator						
	Relevance phase						
	Distribution						
	Pack. plastic						
	Plane						
	Boat						
	Train						
	Truck						
	Relevance phase						
	Use						
	Material						
	Energy						
	Relevance phase						
	End-of-Life						
	Landfill						
	Incineration						
	Recycling						
	Relevance phase						

Legend

Technological:	Small quantity	Medium quantity	Large quantity	Unknown	N/A
Environmental:	Small impact	Medium impact	Large impact	Unknown	N/A



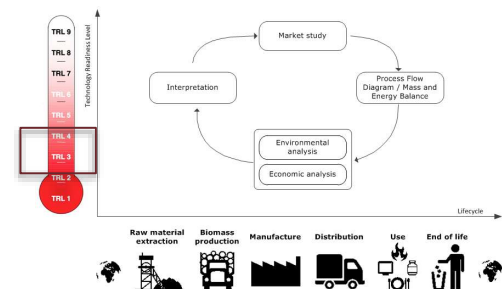
PROOF-OF-CONCEPT STAGE: DECISION



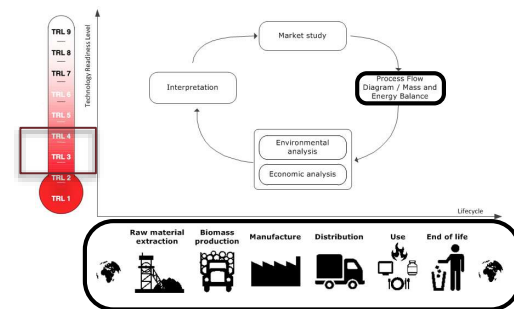
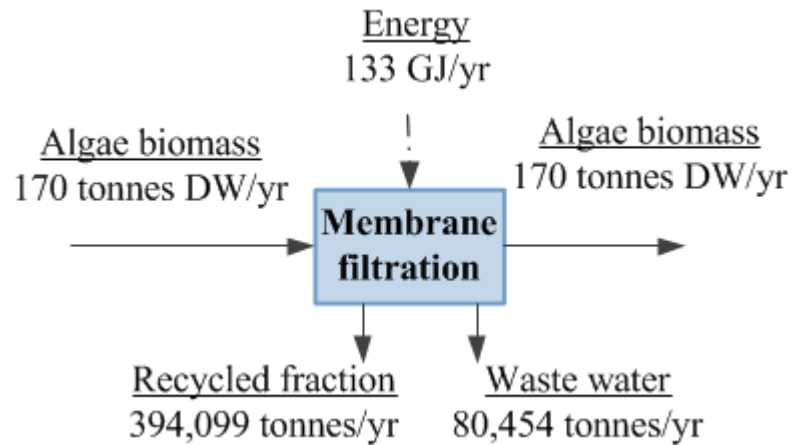
Technology: Feasible on projected industrial scale

Economy: NPV > 0, assumed improvement

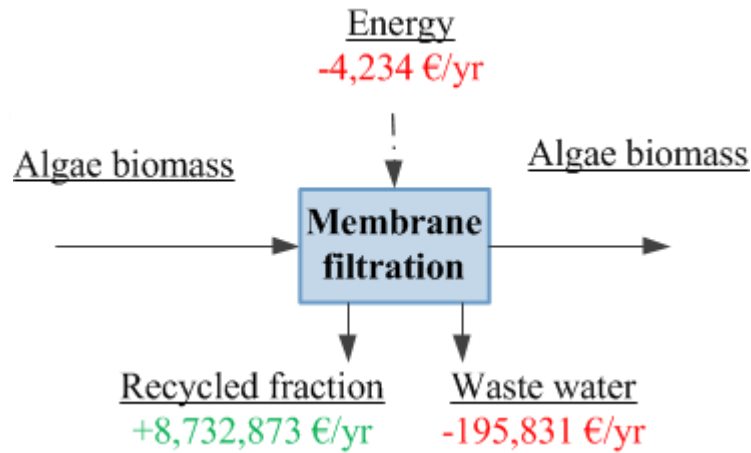
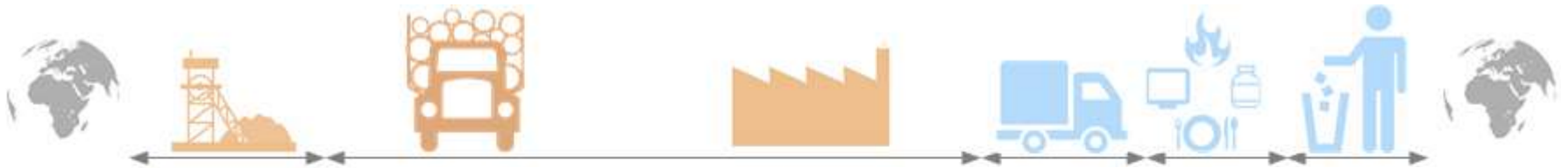
Environment: Impact technology < Impact reference, assumed improvement



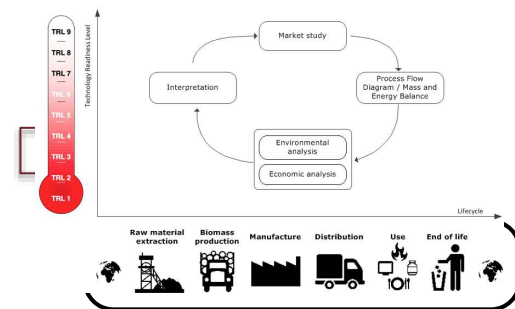
PROOF-OF-CONCEPT STAGE: PFD AND M&E BALANCE



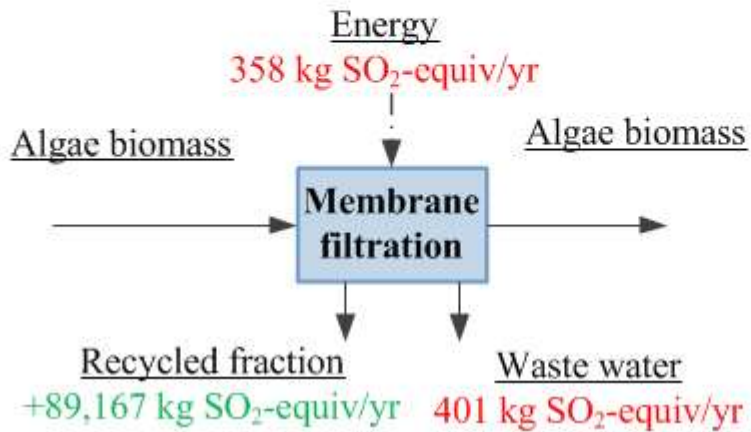
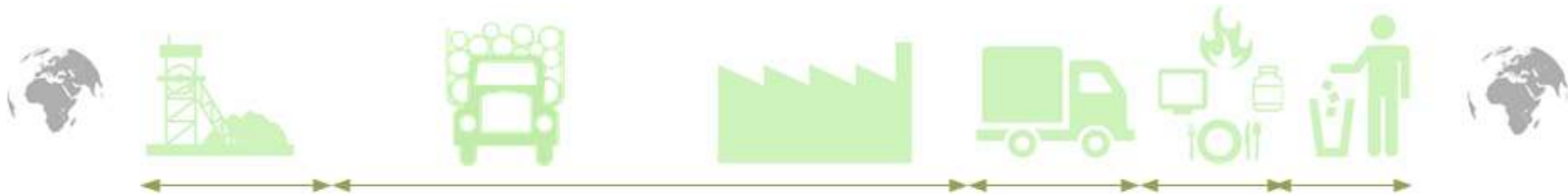
PROOF-OF-CONCEPT STAGE: ECONOMIC



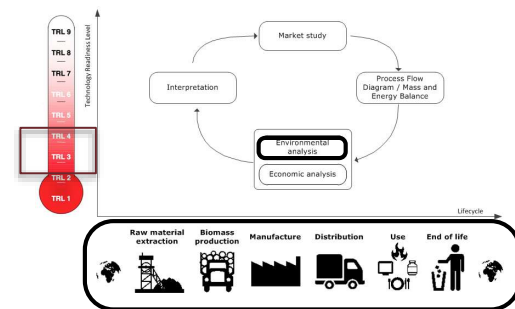
Equipment (economies of scale)
 Indirect costs



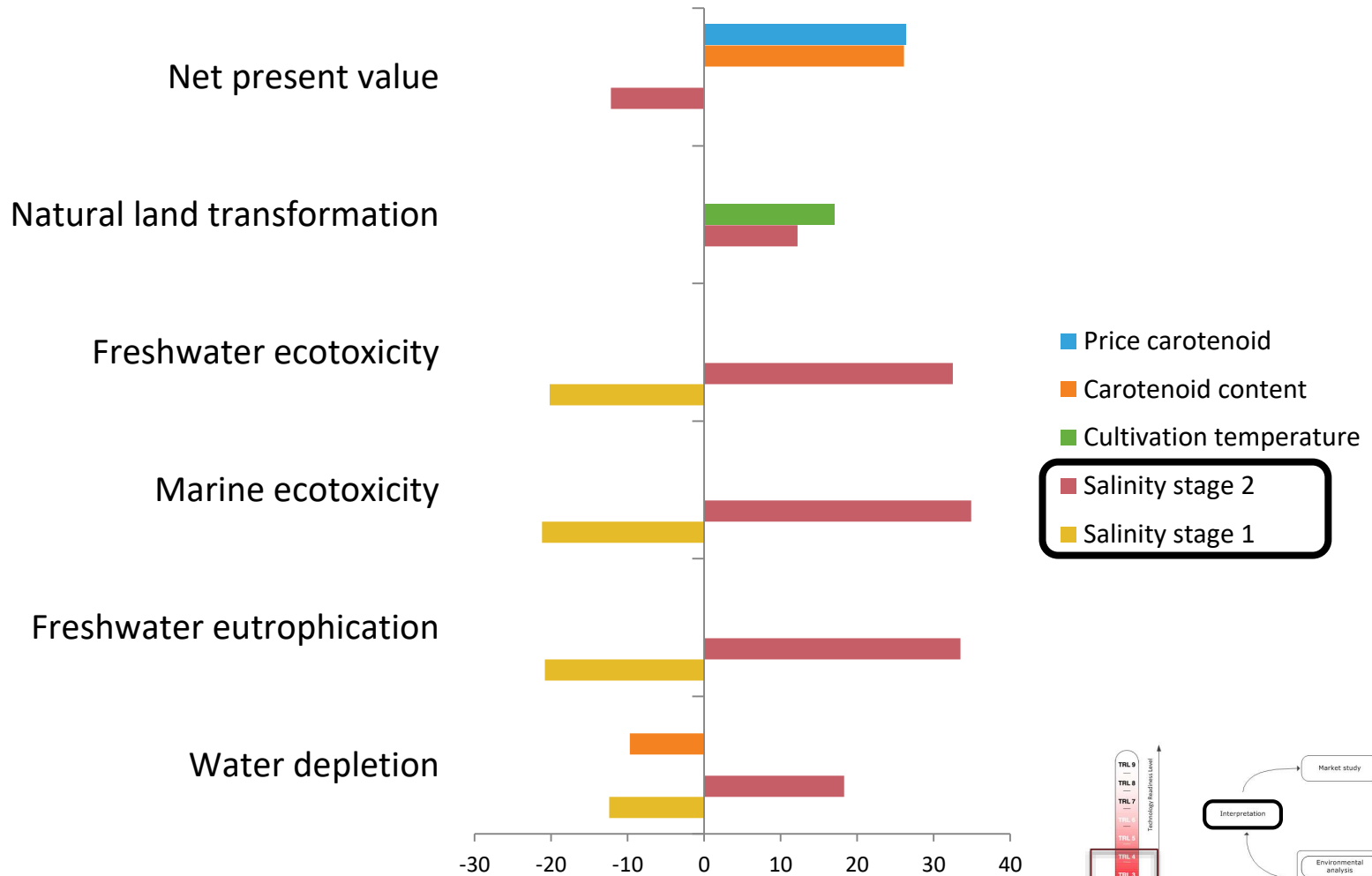
PROOF-OF-CONCEPT STAGE: ENVIRONMENTAL



Equipment (economies of scale)

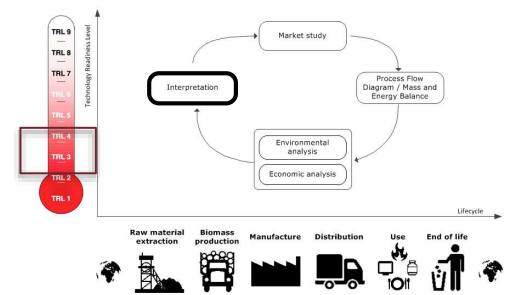


PROOF-OF-CONCEPT STAGE TRL: INTERPRETATION

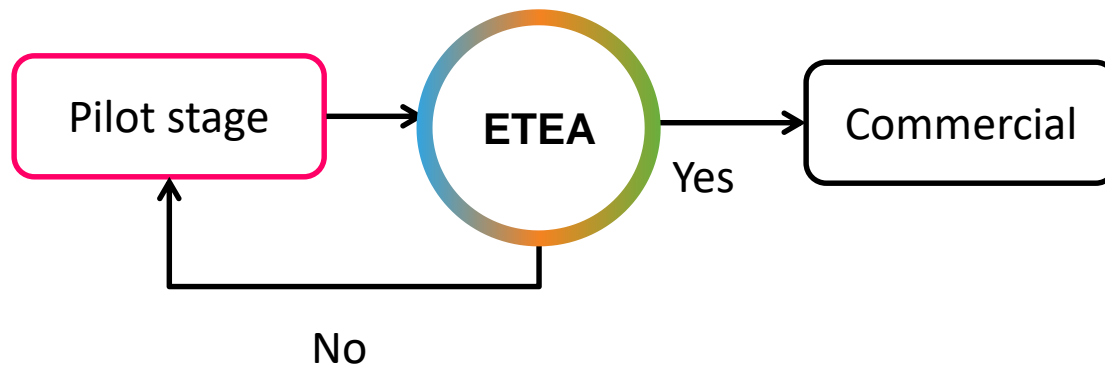


Salinity stage 2

Salinity stage 1



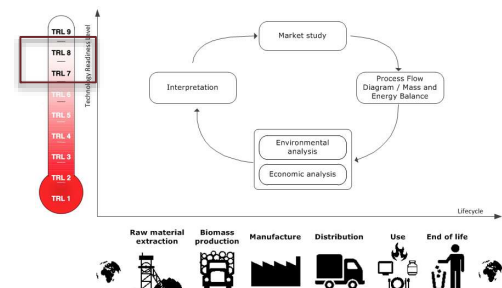
PILOT STAGE: OBJECTIVE



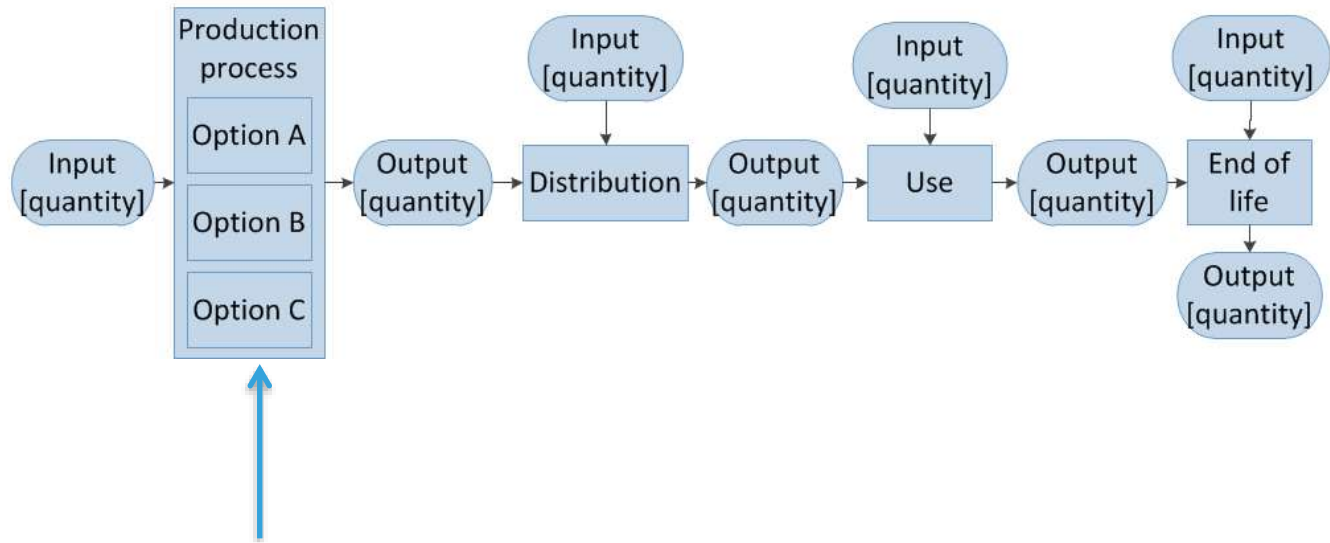
Technology: Technologically feasible

Economy: NPV > 0

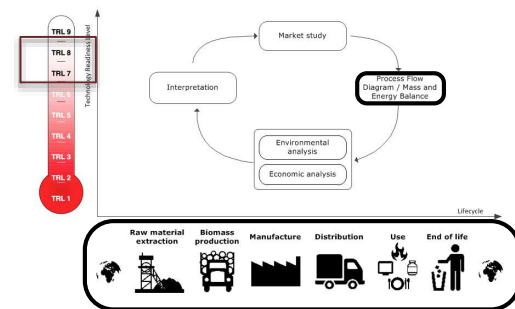
Environment: Impact technology < Impact reference



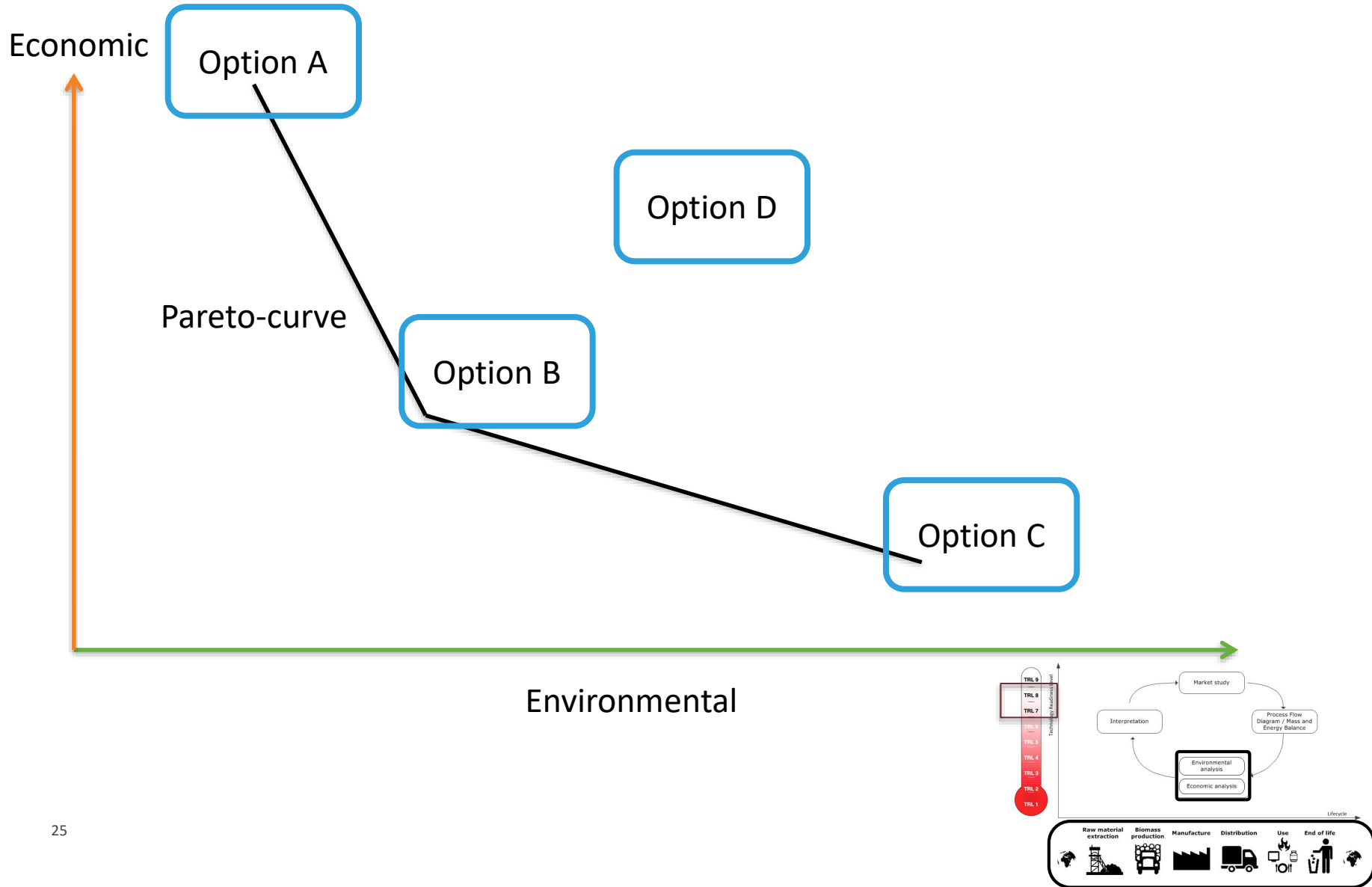
PILOT STAGE: PFD AND M&E BALANCE



Multiple options

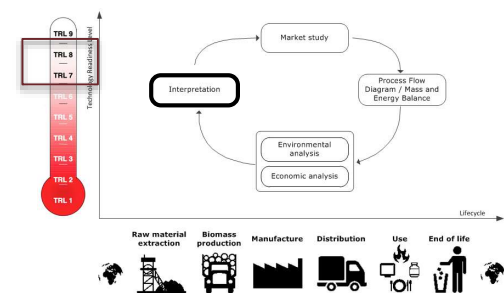
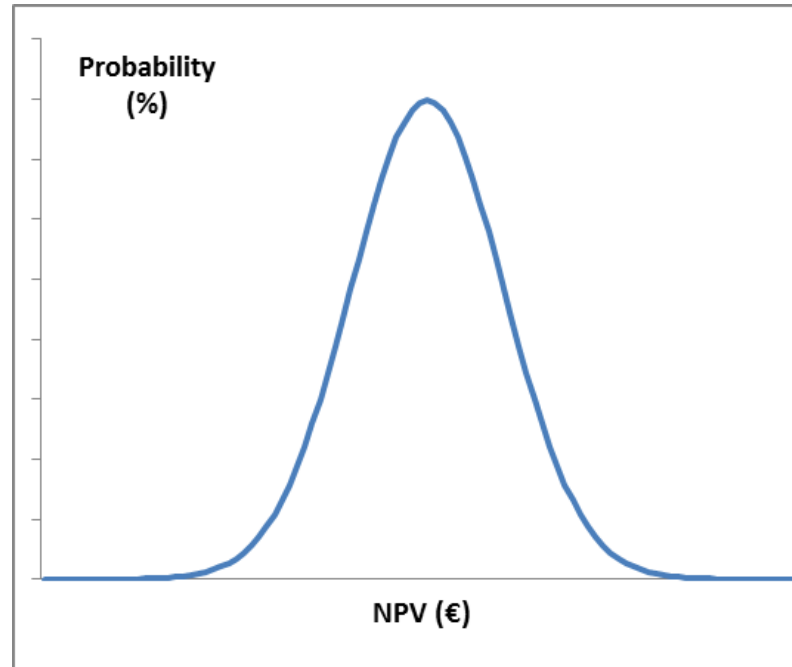


PILOT STAGE: MULTI-OBJECTIVE OPTIMIZATION

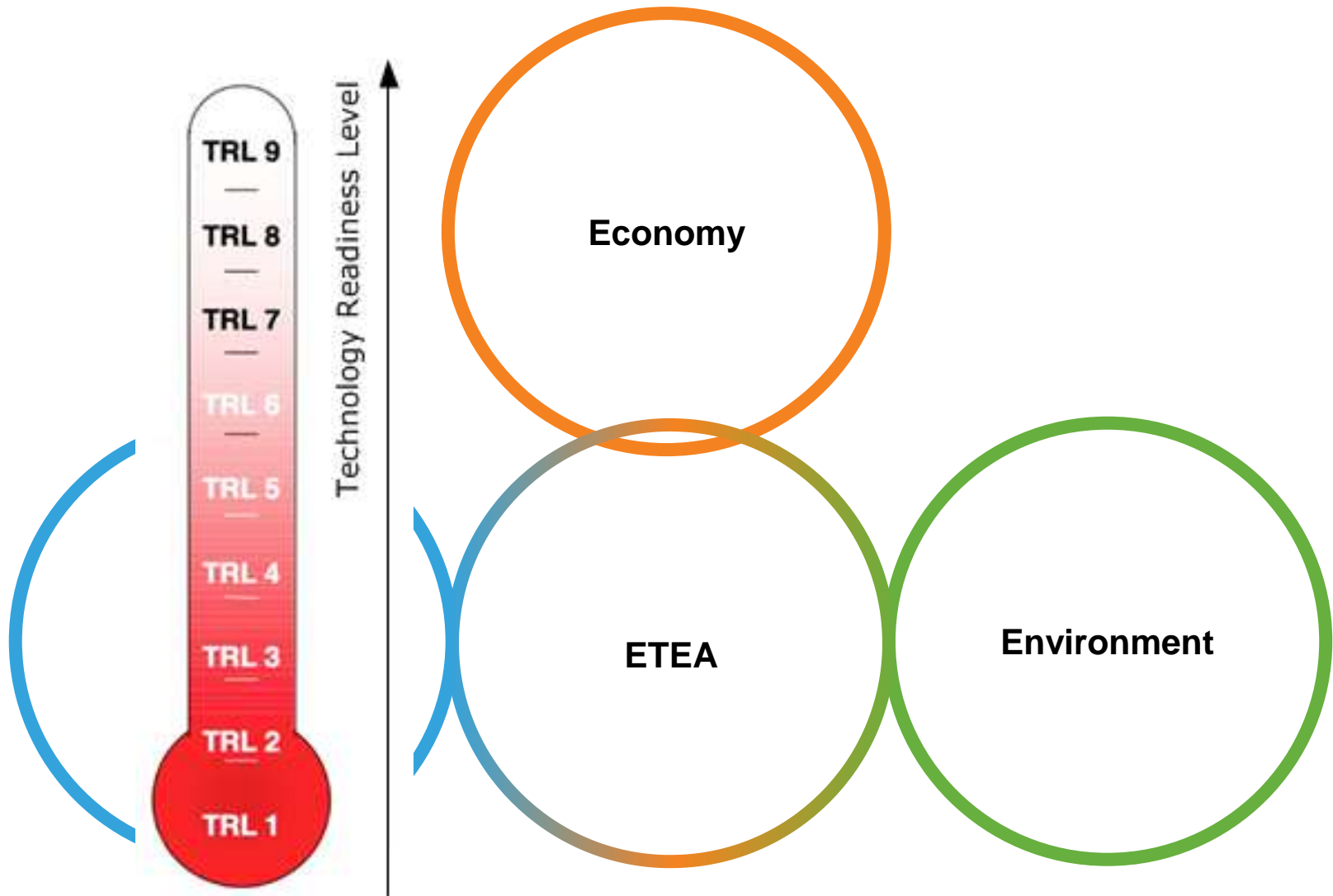


PILOT STAGE: INTERPRETATION

- Uncertainty analysis
- Data quality analysis



ETEA CAN GUIDE GOOD IDEAS TOWARDS COMMERCIAL TECHNOLOGIES



MORE INFORMATION?

Techno-economic assessments

Algae

Environmental TEA

Multi-objective optimization

Life cycle analysis



Gwenny Thomassen

UHasselt

gwenny.thomassen@uhasselt.be

(0032) 011/26 87 50

VITO

guinevere.thomassen@vito.be

(0032) 014/33 57 86