Royal Academy of Engineering | Enterprise Hub

SYSTEMIQ

Climate impact playbook

Contents

Climate impact at the Royal Academy of Engineering

Royal Academy of Engineering's Purpose/Mission

Engineers play a pivotal role in solving the urgent challenge of achieving net zero, driving innovations that reduce emissions and create sustainable industries. Earth is warming at an unprecedented rate: 1.1°C above pre-industrial levels.[1] Businesses are also facing heightened risks under frameworks like the UK Sustainability Reporting Standards (SRS) and in the future similar further regulations similar to Corporate Sustainability Reporting Directive (CSRD).[2] It's clear that innovative engineering solutions are essential.

The Royal Academy of Engineering Enterprise Hub is a cornerstone of the Academy's strategy to create a sustainable society and inclusive economy, reflecting its commitment to engineering innovation as a solution to achieving net zero. Engineers are at the forefront of this effort, leveraging their solutions-focused expertise to address one of humanity's greatest challenges. By supporting entrepreneurs to integrate decarbonisation into their business models, the Hub aims to enable innovators to adopt tools to master emissions accounting and build more planet conscious companies. This aligns with the broader shift towards mandatory transition plans and circular economy practices. By empowering engineering innovation, we aim to shape a resilient, inclusive, and climate-conscious future for all. And **contribute to a resilient, climate-conscious economy**, supporting the UK's ambition for net zero by 2050 and establishing the country as a global leader in climate action.

What do we want to achieve through the Enterprise Hub?

- **Strengthen the Academy's and engineers' role in systems decarbonisation** by helping early-stage tech companies understand, measure, and articulate their climate impact.
- **Identify and promote impactful climate solutions** that will inform the Academy's strategy and enhance its role in the climate transition.
- **Support companies in navigating regulatory changes** like the SDR in the UK and CSRD if expanding globally , ensuring they meet sustainability standards and align with long-term climate goals. (Source LSEG)[3]
- **Foster innovation** by empowering entrepreneurs to embed sustainability into their business models, making data-driven decisions to reduce their carbon footprint and better R&D efforts.
- **Create a stronger link between the Academy's mission and Enterprise Hub outcomes**, ensuring alignment between the strategy and tangible climate action.

Our impact approach

Why climate impact?

Ambition: engineers play a critical role in designing and implementing solutions to achieve net zero. Assessing your solution's climate impact can guide your strategy and decarbonisation pathways, create commercial value, and drive sector-wide impact in your industry.

Funding: investors increasingly prioritise climate impact and emission contribution by a technology, making it a competitive differentiator for securing investment.

Climate risk mitigation: evaluating climate risks ensures resilience, helping your business adapt to future regulatory and environmental challenges.

Credibility: articulating and attributing potential emissions reduction needs to be done carefully to avoid criticism and greenwashing.

Objective

The impact framework is a 'business model canvas for climate impact assessment'. Its purpose is to guide engineers/startups to ask the right questions to enable them to assess how their solution contributes to the decarbonisation challenge.

Four pillars of the impact framework and key steps

1. Global challenge	2. Climate solution	3. Sustained impact	4. Externalities
What is the system/sector's decarbonisation challenge?	What is the company's role in catalysing climate-positive systems change?	How does the solution scale commercially or enable others to scale for greater climate impact?	What are the material positive and negative externalities?
Key steps: 1. Describe the problem 2. Estimate the size of the climate opportunity 3. Present your theory of change	**Key steps:** 1. Describe the solution 2. Explain its additionality	**Key steps:** 1. Describe how you're positioned to capture value from impact 2. Address the scalability of the solution	**Key steps:** 1. Identify material indicators

How to use this guide

Climate impact

Impact pillar	Key steps
1. Global challenge	For each pillar, you will find a series of key steps to follow to help build a robust impact narrative for your business.
2. Climate solution	
3. Sustained impact	
4. Externalities	

Playbook

Guiding questions	Metrics	Tools
Ask yourself the guiding questions to test your thinking about your company's climate impact potential.	Find standard indicators and metrics that can be used as KPIs to strengthen your climate impact narrative.	Use the tools, methodologies, frameworks, and resources included in the guide as support and example.

Principles

While climate assessments are more of an art than a science, there are some commonly accepted principles to ensure credible and robust estimates of climate impact:

- **Transparency**: always state assumptions upfront and clearly lay out the approach taken, complete with methodological choices made, such that a third party can easily follow and challenge choices made.
- **Consistency**: ensure that choices and assumptions are aligned with past decisions. If the choice or assumption is new, record it adequately for use in future assessments. The ultimate goal is to perform assessments that can be compared.
- **Conservatism**: where choices must be made, err on the side of caution and opt for conservative estimates given the inherently speculative nature of the exercise.

Global challenge

The global climate challenge is one of the most pressing issues of our time, with widespread effects on ecosystems, communities, and economies. For businesses, this challenge presents both risks and opportunities. Every industry contributes to emissions in different ways, and understanding how your innovation/ startup fits into this global issue is essential for mitigating climate risks and aligning with climate goals such as the Paris Agreement. The **Paris Agreement** is a legally binding international treaty on climate change adopted in **2015** by 196 countries at COP21[4] in Paris. Its goal is to **limit global warming to well below 2˚C, preferably to 1.5˚C**, compared to pre-industrial levels by reducing greenhouse gas emissions. These initiatives and their influence is an opportunity to make meaningful progress toward net zero emissions, companies need to assess their specific role in the decarbonisation landscape and identify opportunities for transformation.

Our planet's climate is changing and warming is accelerating Earth's average surface temperature in 2024 was the warmest on record, according to an analysis led by NASA scientists.[5] Global temperatures in 2024 were 2.30 degrees Fahrenheit (1.28 degrees Celsius) above the agency's 20th-century baseline (1951–1980), which tops the record set in 2023 and In 2022, after UK temperatures exceeded 40˚C for the first time, a study by World Weather Attribution at Imperial found that climate change made the extreme heat about 2˚C hotter and 100 times more likely (Source – Imperial University & World weather attribution).

Addressing the climate and ecological emergency is an opportunity to **create a fairer, healthier, more resilient and more prosperous society** and a way to contribute to achieving UK's net zero goals by 2050. Those most affected by climate change need more of a say in how we respond, and our actions to mitigate climate change must be aligned with goals for public health improvement, green growth and the reduction of social vulnerability. This section focuses on understanding the emissions challenge within your system or sector to refine your decarbonisation strategy. Begin by articulating the key climate problem and the broader system your solution addresses. Estimate the scale of emissions and the reduction potential your innovation offers. Identify the specific emissions sources your solution targets and quantify its impact where possible. Then, present your theory of changemapping how your solution contributes to sector-wide decarbonisation. Finally, assess your sector's transition pathway, highlighting both risks and opportunities to scale sustainable impact.

> Those most affected by climate change need more of a say in how we respond, and our actions to mitigate climate change must be aligned with goals for public health improvement, green growth and the reduction of social vulnerability

1. Global climate challenge

What is the system/sector's decarbonisation challenge?

In this section, show a clear understanding of the **size and state of the emissions problem in the system/sector**, which will help to focus strategy on tackling the **most pressing decarbonisation challenges**.

Key steps	Guiding questions	Metrics	Tools
1a. Describe the problem	What system/sector's emissions problem is the solution trying to solve? Is this a mitigation or an adaptation challenge? Does the solution solve multiple sectoral or system decarbonisation challenges?	**Total addressable emissions (TAE)**	List of key climate solutions Overview of sector's emissions How to calculate TAE Mapping the sector's decarbonisation pathways
1b. Estimate the size of the climate opportunity	What is the state and size of the emissions problem? Or the cost of climate adaptation, if relevant?		
1c. Present your theory of change	What is the system/sector's decarbonisation pathway, including key climate risks and opportunities (e.g. regulation changes, carbon price, resource scarcity etc)?		

1a. Describe the problem

Articulate the climate problem and the system(s) your solution addresses

Guiding questions

What system/sector's emissions problem is the solution trying to solve?
Is this a mitigation or an adaptation challenge?
Does the solution solve multiple sectoral or system decarbonisation challenges?

Tools

Map your solution within a decarbonisation system. The solution themes provide examples of breakthrough technologies that are likely to have a role in the decarbonisation challenge.

Systems	Energy	Mobility and transport	Food, Ag., and land use
Solution themes and sub-themes	Decarbonisation of power	Low-carbon mobility	Low-carbon Ag. and land use
(non-exhaustive)	Renewable power generation Microgrids and off-grid solutions Grid flexibility, resiliency, and energy storage Grid, utility, and user analytics Advanced energy technology (next-gen solar, SMR fission, fusion, deep geothermal)	Electric vehicles Next-generation batteries and fuel cells Charging infrastructure, analytics, and energy services Micro-mobility Fleet and freight decarbonisation (aviation, shipping, ports, etc.)	Alternative proteins Sustainable timber/ forestry Methane inhibitors Low-carbon fertilisers GMO and crop resilience Food waste reduction Precision agriculture, vertical farms, yield enhancements

Systems	Industry, manufacturing and circular resource management		Built environment
Solution themes and sub-themes	Decarbonisation of industry	Circular products and packaging	High-efficiency buildings
(non-exhaustive)	Green cement and CO_2 negative aggregates Green iron and steel Green chemicals Decarbonisation of industrial heat processes Industrial energy efficiency solutions	Waste sorting and recycling tech Sustainable packaging Additive manufacturing and process optimisation Sustainable fashion Circular products, reverse logistics, upcycling, and the sharing economy	Building energy efficiency and HVAC controls Building electrification (e.g. heat pumps) Green construction materials Efficient construction technology and processes

Decarbonisation system | Solution theme | Solution sub-theme

1b. Estimate the size of the climate opportunity

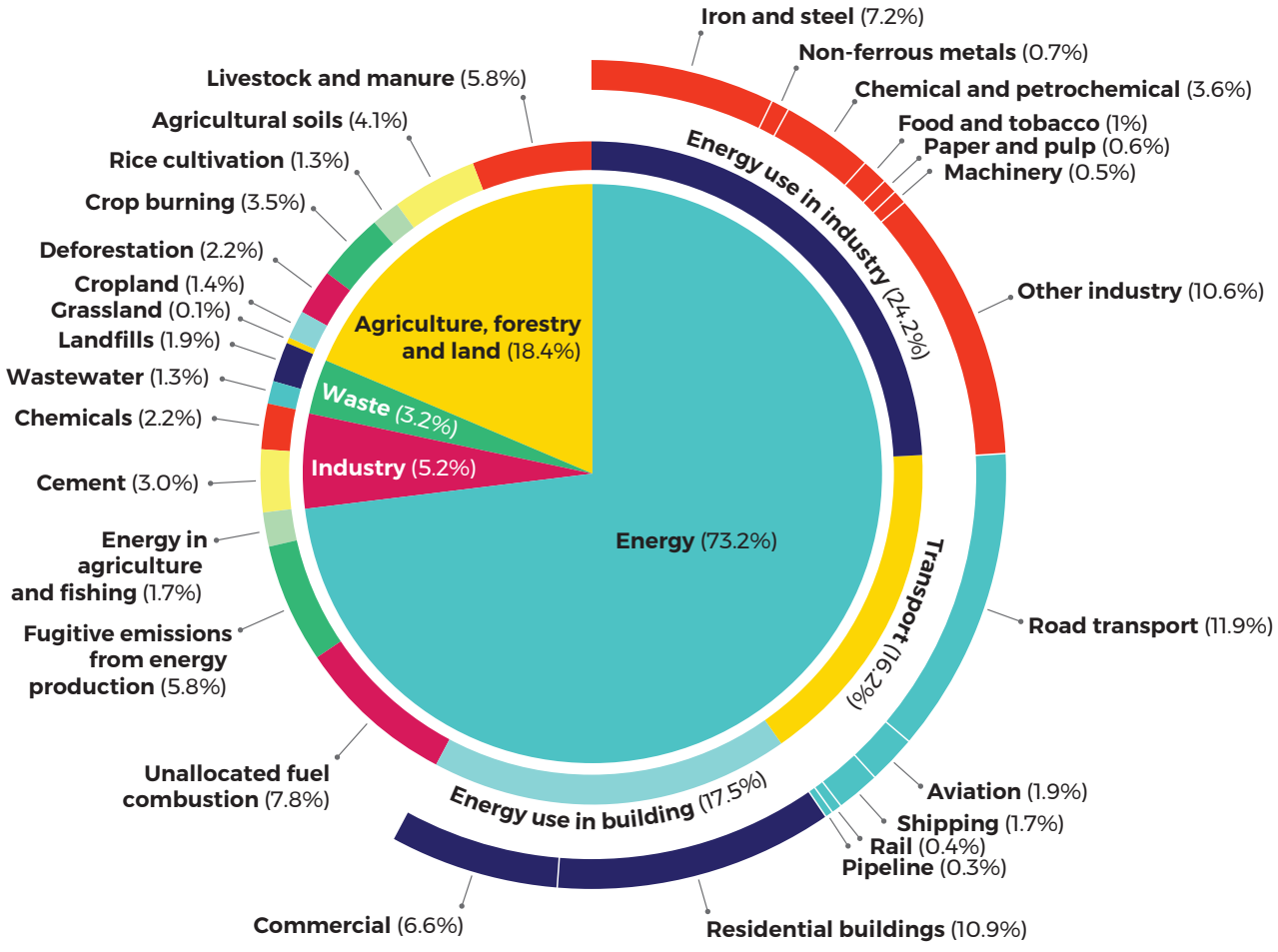
Identify the emissions reduction opportunity the solution addresses

Guiding questions

What is the size of the emissions problem that your solution is addressing?
Or the cost of climate adaptation, if relevant?

Resources

Illustrate current emissions being produced by the sector/sub-sector.



Source: SYSTEMIQ, WRI (2018) CLIMATE Watch
Energy Transition Commission, Circle Economy (2022), Circularity cap report, FOLU (2019) Growing better

Other sources of information on climate emissions:

General
IEA – Emissions by sector[6], ETC – Keeping 1.5˚C Alive[7], SYSTEMIQ[8], WRI (2018) CLIMATE Watch, Circularity cap report, FOLU (2019)[9], Circle Economy (2022)[10]

By sector
Renewable energy[11], Clean electrification[12], Transport (electric vehicles[13], aviation[14], shipping[15], trucking[16])
Industry: (aluminium[17], steel[18], cement[19], chemicals[20]), Agriculture[21], forestry and other land, Plastics[22]

Metric

Total addressable emissions (TAE)
A term to reference the emissions opportunity available for a product or service. It helps articulate the size of the greenhouse gas (GHG) problem the company's solution is addressing.

Tools

How to calculate TAE

1. What are the current emissions being produced by the sector/sub-sector that the solution addresses?

Note: solutions can operate across multiple sectors/sub-sectors

- The emissions TAM for the entire space(s) (tCO_2e)
- % emissions lying in Scope 1, 2 and 3

2. What is the forecast emissions growth of the sector/sub-sector(s) in which the solution operates (in a business as usual (BAU) scenario)?

- Forecast emissions TAM for the entire space into the medium to long term
- If there is no BAU emissions growth forecast, a BAU market size forecast could be used as a proxy growth factor to extrapolate from present day emissions for the sector/subsector(s)

3. What % of the market could this technology capture (and therefore decarbonise)?

- % market share of the solution can be multiplied by emissions TAM of the space to estimate emissions TAM of the company itself (tCO_2e)

EXAMPLE
A new bioplastic using food waste as feedstock to replace virgin plastic

1. Current emissions in the plastic sector: 1.1 Gt CO_2e
2. Forecast emissions: 1.3 Gt CO_2e by 2026
3. Starch-blend bioplastics are expected to have a 0.1% market share in 2026

TAE = 1.3 Mt CO_2e in 2026

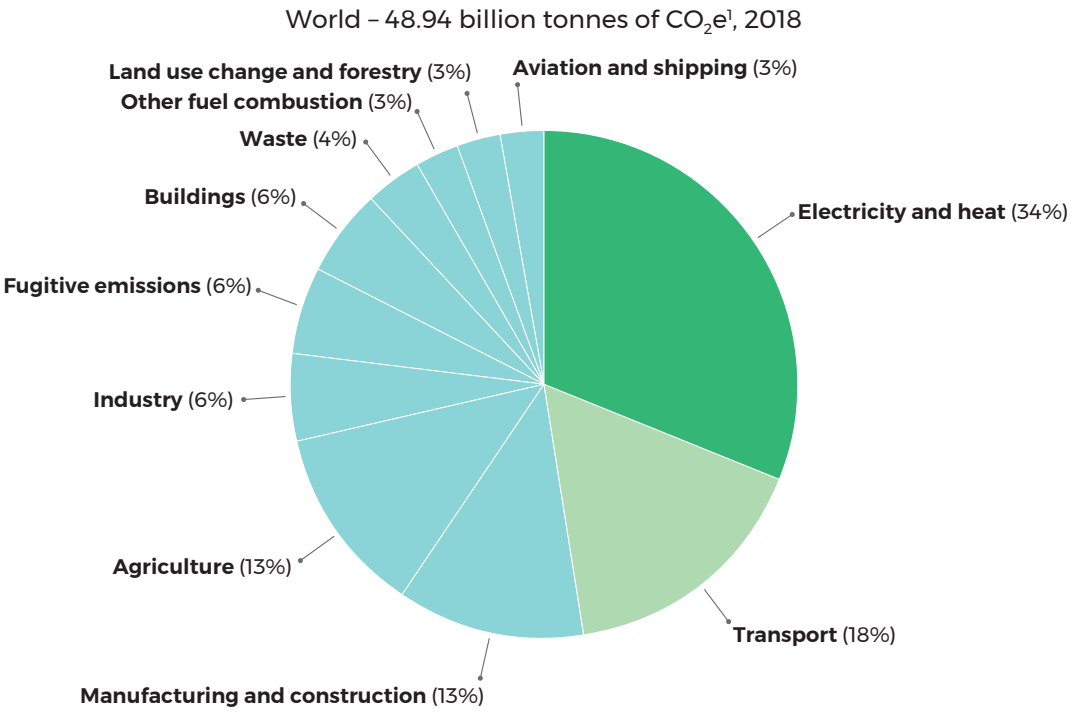
Tools

Pitch deck example

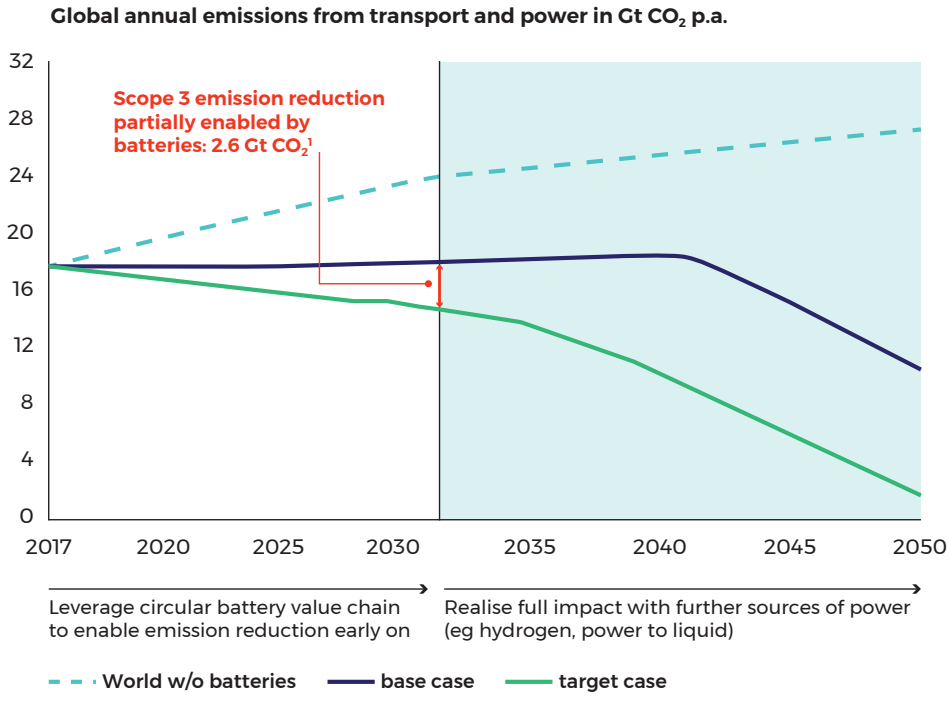
A battery company presents the size of the climate opportunity in the power and transport sector.

Batteries are a key technology to decarbonise the transport a power sector

The transport and power sector contributes **47% (24 btCO$_2$e)** to global GHG emissions.



Batteries could reduce **emissions by 2.6 GtCO$_2$e** in these sectors to support a Paris aligned decarbonisation pathway



1c. Present your theory of change

Identify your sector's pathway to understand the scale and means of decarbonisation, and address the climate risks and opportunities on this journey

Guiding questions

What is the system's decarbonisation pathway, including key climate risks and opportunities?

Tools

Highlight your solution's contribution to the sector's decarbonisation pathway

Decarbonisation pathways are science-based trajectories to achieving net zero, which identify both the sector's largest emissions sources and paths to mitigating them.

1. Which sector does your solution contribute to?
High climate impact solutions contribute to the sectors that require deep decarbonisation.

2. Can you illustrate the sector's pathway to net zero?
Sector-specific pathways highlight the technological milestones required to transition to net zero.

Example:	2020	2030	2040	2050
EVs Pathways Emissions	Vehicle range increases **7.2GT**	Battery manufacturing improves **5.7GT**	Heavy duty vehicles electrify **2.7GT**	All vehicles sold globally are EVs **0.7GT**

3. Can you identify your solution's contribution to the sector's decarbonisation pathway?
If the solution pertains to any of the milestones identified, this can emphasise the importance of scaling the solution.

Example: the IEA transport pathway shows that by 2030, 60% of global car sales will be electric vehicle (EVs). This supports the business case for companies in the car battery manufacturing space.

4. What are the climate risks and opportunities on this pathway?
Examine the physical and transitional risks and opportunities that may affect the industry and your solution, both positively and negatively.

After assessing the market opportunity and understanding the environmental challenges your business faces, it's time to present your theory of change. This is where you clearly articulate the pathway through which your business will drive decarbonisation. A theory of change outlines the steps your business will take to reduce emissions, integrate climate resilience, and contribute to the broader environmental goals, such as the global 1.5˚C target.

This step is critical because it connects your business's operations to tangible, measurable outcomes that reduce climate impact. It's not only about innovating but strategically shaping your processes and products to ensure that every decision supports your environmental objectives. By presenting a clear theory of change, you can also showcase how your efforts tie into broader sectoral decarbonisation goals, strengthening your position with investors, customers, and stakeholders.

Key areas for consideration include the following:

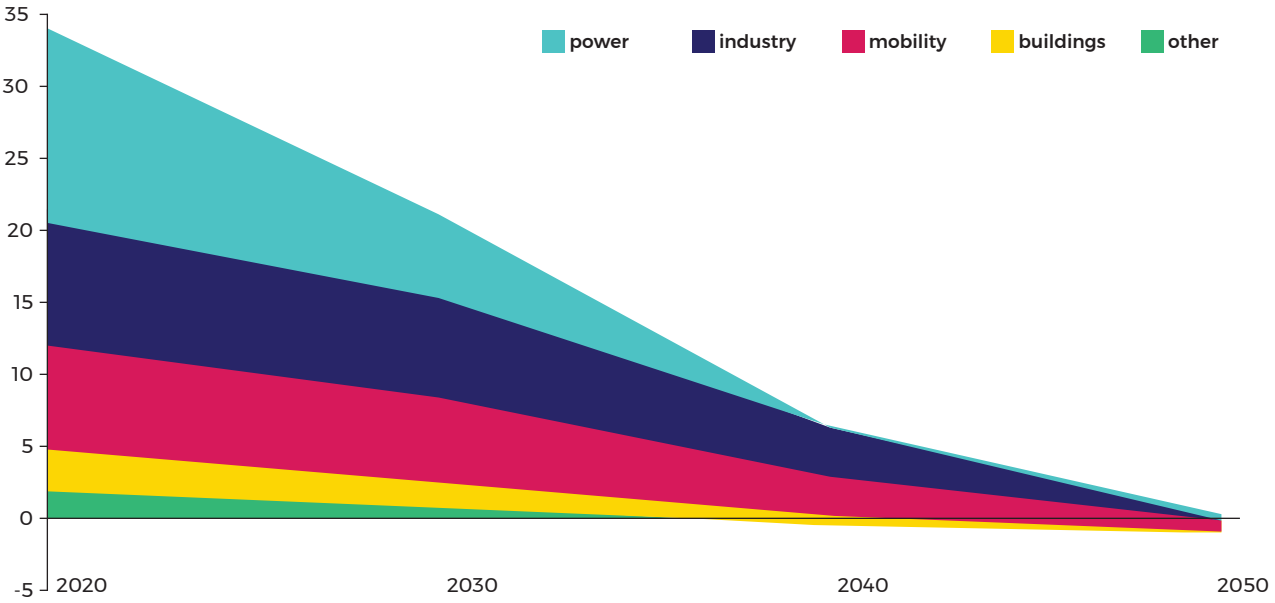
- **Materials**: evaluate the environmental footprint of the raw materials you use and explore alternatives that are more sustainable or have a lower carbon footprint.
- **Research and development**: invest in R&D to improve the energy efficiency of your processes and products. Developing more sustainable technologies can dramatically reduce your long-term carbon emissions.
- **Product lifecycle**: review your product's entire lifecycle – from design, manufacturing, and packaging to usage and disposal – and identify opportunities for carbon reduction at each stage.
- **Supply chain**: work with suppliers who align with your sustainability goals, ensuring that the materials you source are produced with low emissions and minimal environmental impact.
- **Energy sources**: transition to renewable energy sources for your operations, where feasible, to reduce your reliance on fossil fuels and lower your carbon footprint.

By identifying these changes and implementing them into your theory of change, you can develop a climate-conscious product that not only meets market demand but also actively works towards reducing emissions. This approach will not only strengthen your sustainability credentials but also help you meet investor expectations and regulatory requirements while fostering long-term business growth in a decarbonised economy.

> It's not only about innovating but strategically shaping your processes and products to ensure that every decision supports your environmental objectives

Resources

The IEA's projection highlights key milestones in the pathway to net zero[10]



- No new sales of fossil fuel boilers
- Universal energy access
- Most appliances and cooling systems best in class
- 50% buildings retrofitted to zero-carbon levels
- More than 85% of buildings are zero-carbon ready
- No new unabated coal plants approved for development
- All new buildings are carbon ready
- 50% heavy truck sales electric
- 50% fuels used in aviation are low-carbon
- More than 90% of heavy industrial production is low-emissions
- No new oil and gas fields approved for development
- 60% of global car sales are electric
- No new ICE car sales
- 90% of existing capacity in heavy industries reaches and of investment cycle
- Almost 70% of electricity generation globally from solar PV and wind
- Clean technologies in heavy industry demonstrated at scale
- All industrial electric motor sales
- Net zero electricity globally
- 1020GW annual solar and wind additions
- Overall net zero emissions electricity in advanced economies
- Phase-out of all coal and oil power plants
- Phase out of coal in advanced economies

Net Zero by 2050: A Roadmap for the Global Energy Sector[23]
SBTi Sector Guidance[24]
MPP Sector Transition[25]
Keeping 1.5°C Alive: Closing the Gap in the 2020s[26]
TCFD (2017) TCFD Disclosure Framework[27]

Resources

Climate risks and opportunities

Physical risks and opportunities

- **Acute** – increased severity of extreme weather events (e.g. cyclones, hurricanes, or floods)
- **Chronic** – longer-term shifts in climate (e.g. sustained higher temperatures) that may cause sea level rise or chronic heat wave

Transition risks and opportunities

- **Policy and legal** – carbon pricing, energy efficiency, promoting sustainable land-use
- **Technology** – renewable energy, battery storage, energy efficiency, and carbon capture and storage
- **Market** – shifting supply and demand for commodities
- **Reputation** – changing customer or community perceptions

Climate solution

In the next part of the assessment you'll focus on the specific role your engineering solution plays in reducing emissions or enabling broader climate positive impact. It's essential to assess how your product or innovation directly or indirectly contributes to reducing carbon emissions, either by removing CO_2 from the atmosphere or by avoiding future emissions. This may involve understanding the technology you've developed, its scalability for a wider impact, and how it fits within larger efforts to drive decarbonisation within your technology's sector or beyond.

Key to this assessment is identifying your solution's additionality, the extra environmental benefits that wouldn't have occurred without your intervention. Additionally, consider the emissions reduction potential (ERP), which measures the capacity of your innovation to either directly or indirectly reduce or cut emissions over time. This can be measured quantitatively through emissions data, or qualitatively by answering the assessment questions in the following sections.

Being able to clearly articulate how your solution contributes to climate-positive impact not only enhances its value proposition for your customers and investors but also helps establish its credibility in a marketplace increasingly focused on measurable, data-backed climate impact and innovation outcomes.

> It's essential to assess how your product or innovation directly or indirectly contributes to reducing carbon emissions, either by removing CO_2 from the atmosphere or by avoiding future emissions

2. Climate solution

What is the company's role in catalysing climate-positive systems change?

In this section, determine your **solution's role in reducing (removing or avoiding) emissions**, either through direct or enabled impact. Impactful climate solutions should be able to explain its additionality and emissions reduction potential (ERP), either quantifiably or qualitatively.

Key steps	Guiding questions	Metrics	Tools
2a. Describe the solution	How does the company reduce emissions (directly or by enabling other sectors/ technologies)? Can the material sources of emissions and reductions be quantified? What are the first and second order effects?	**ERP or lifecycle emissions (LCE) per unit/absolute or direct/indirect**	How to calculate ERP – decision tree, guidelines and cases Solution benchmarking Marginal abatement cost curves Sectoral market maturity 'S-curve' analysis
2b. Explain its additionality	How does the company catalyse climate-positive systems change through influencing e.g. end-user behaviour, decision-making, cost, further investment, availability, policy/regulatory change? How will the solution help accelerate the 'S-curve' or help other sectors/ technologies do so?		

2a. Describe the solution

Be able to identify the emissions that can be mitigated or avoided by using your solution, or the contribution to climate adaption.

Guiding questions

How does the company reduce emissions (directly or by enabling other sectors/technologies)?

Can the material sources of emissions and reductions be quantified? What are the first and second order effects?

Metric

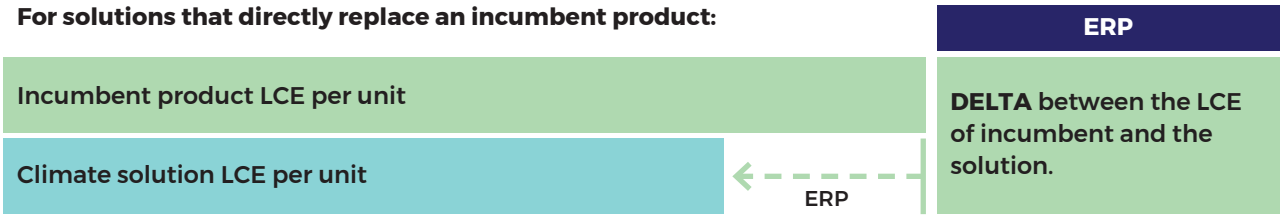
ERP refers to the potential climate impact of a solution. It can be calculated or qualitatively assessed to help understand how much of the emissions TAM your solution could capture if grown to scale i.e. the company's contribution to the decarbonisation challenge.

Tools

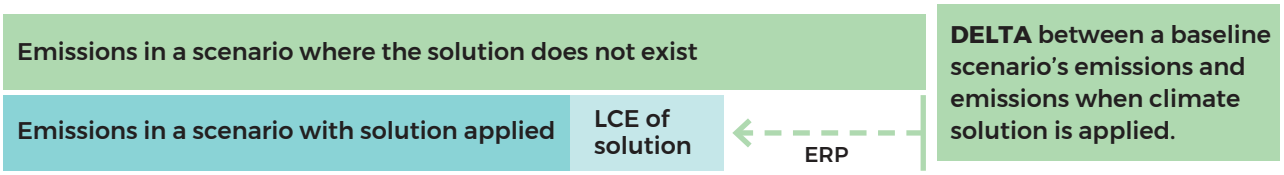
How to calculate ERP

ERP compares the potential GHG emissions reduction enabled by a solution across its entire value chain, relative to an incumbent product or process (the 'counterfactual scenario') in tons of CO_2e.

For solutions that directly replace an incumbent product:

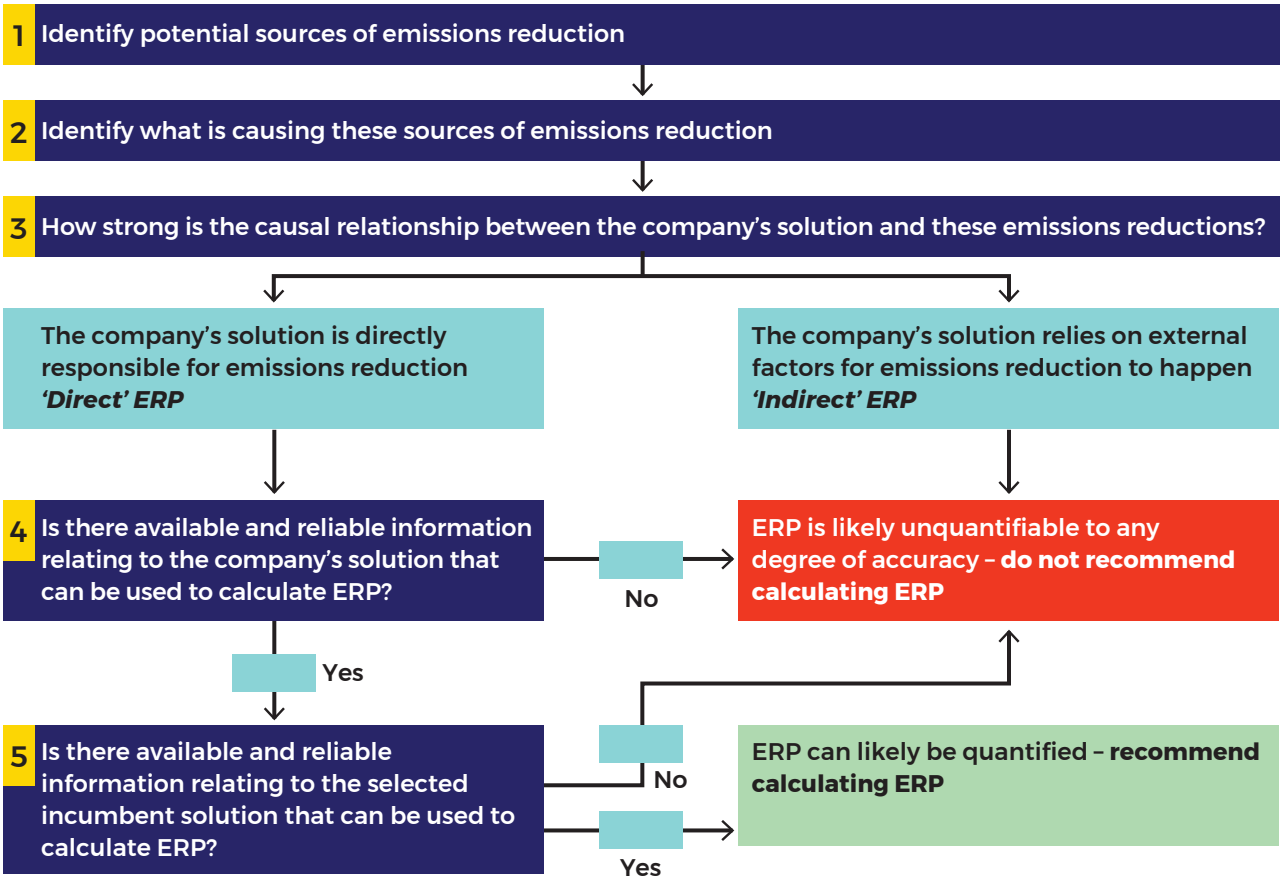


For solutions that make a process/product more climate efficient:



Tools

How to calculate ERP – decision tree: how to decide whether a company has a robustly quantifiable ERP. Calculating ERP is only recommended for companies with clear sources of ERP and reliable information backing these up. For companies without these, a qualitative assessment of ERP drivers will be of more value.



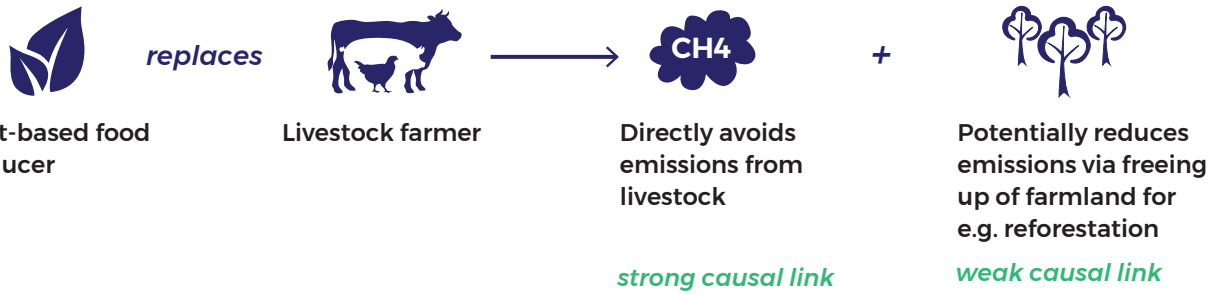
1. Companies **often have more than one source of ERP** – complete the remaining steps of this assessment for each source of emissions identified.
2. Example: solar-powered lamps sold into markets dominated by kerosene lamps; grid-balancing software that allows greater utilisation of renewables.
3. Example: a software solution that improves traceability and visibility of emissions in company supply chains; the potential for more sustainable land use as a plant-based meat alternative takes market share from animal-based products.
4. Key criteria for selection of an incumbent solution to baseline against are detailed in the following pages.

Tools

How to calculate ERP – key considerations when calculating ERP

1. How strong is the causal link between solution and emissions reduction?

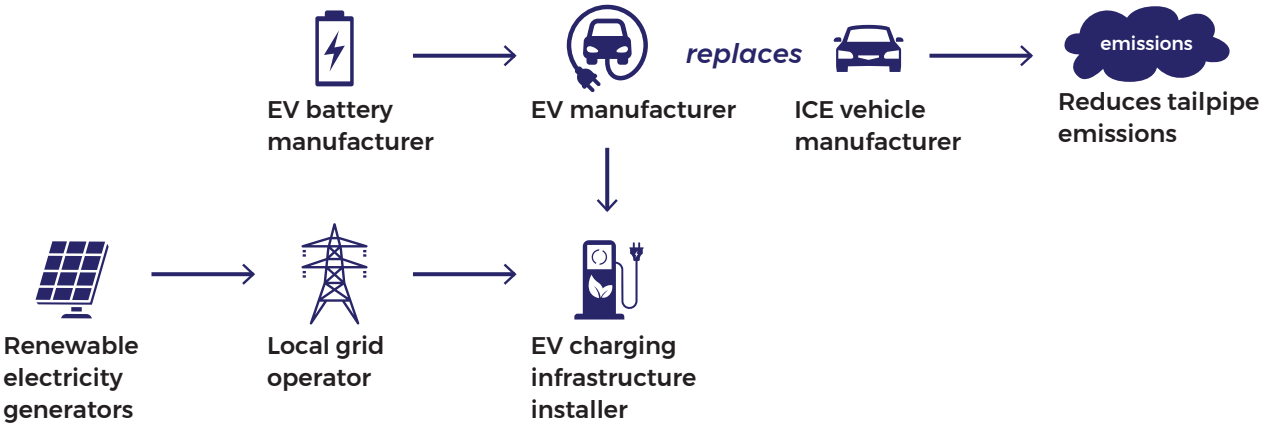
Example: alternative protein company taking market share from animal-based foods producer.



The stronger the causal link; the easier it is to attribute ERP to the solution.
It is quite common for a solution to have multiple sources of ERP.

2. How is impact being attributed across the value chain?

Example: the electric vehicle (EV) value chain.



Within a given value chain there are often multiple players who contribute to a solution which reduces emissions. There is **currently no consensus** on how to attribute ERP to these different players e.g. full ERP to all players, regardless of 'double counting' vs splitting total ERP between the players. Any assumptions should be clearly explained.

Tools

How to calculate ERP – key considerations when calculating ERP

3. Should attribution be given in the short-term or over the solution's entire lifecycle?
Example: plant-based protein vs solar panels.

Solution	Longevity of emissions reduction	Most relevant attribution method
	Y1 Y2 Y3 Y3 ...	
Plant-based food producer	Plant-based proteins have a very short lifecycle as they are typically consumed shortly after creation	Short-term (e.g. per product)
Solar panel manufacturer	Solar panels have long lifecycles and have emissions reduction impact over multiple years	Long-term (e.g. full lifecycle)

4. How do you select the right incumbent to baseline against?
All sources of ERP need to be considered in comparison to an assumed counterfactual scenario in which the solution does not exist (e.g. a BAU scenario where an incumbent solution(s) does not lose market share).

The incumbent should fit the following criteria:
- Clear market leader (e.g. majority market share)
- Best performing climate solution that is currently commercially viable
- Can be directly replaced by the new solution
- There is reliable data on its emissions

Resources

WRI[28]

GHG Protocol Prime Coalition[29]

Tools

How to calculate ERP

Example: Company A produces growth media, which is a necessary ingredient to produce cultivated meat. The company's ERP is derived from emissions reduction beyond its value chain as their product enables the replacement of traditional meat, which is emissions intensive, with cultivated meat.

Identify causal link between solution and emissions reduction

Stem cells + Growth media + Bioreactor = Cultivated meat

- Cultivated meat industry is expected grow at a rate of almost 52% a year between 2023 and 2030, taking its total value past $370 billion, and its market share in the global meat market is projected to be 1.3% in 2027. This 1.3% represents 104 million people globally.[30]
- The company predicts a market share of 15% of the growth media market. This means that it could influence the uptake of cultivated meat for **15.6 million people** (15% of 104 million).[31]
- An average person in the world consumes approximately 40 kg of meat a year. This means that the company could increase the uptake of cultivated meat by **624 million kg per year** (15.6mm x 40kg).[32]
- Current average meat diet consists of 20.7% beef, 36.7% chicken, 34.9% pork and is replaced 1:1 in kg for cultivated meat.[33]
- The climate impact of cultivated meat is estimated to be 1.9 kgCO_2e per kg. This is **0.9203 kg** less than a meat diet and therefore represents the company's ERP per kg. This assumes no change in the current climate impact of beef, chicken and pork, although this will likely change because of technological changes, consumer pressure and regulations.
- As it replaces 624 million kg of meat per year, the company's **total ERP is 574255 tCO_2e per year**.

State assumptions

Note

Full attribution is given to the company since growth media is a necessary ingredient to produce cultivated meat. However, it is noted that other key actors exist in the value chain e.g. cultivated meat processors.

Explain the attribution across the value chain

2b. Explain its additionality

Establish how your solution could improve current technologies or deliver new technologies catalytically in terms of emissions reduction.

Guiding questions

How does the company catalyse climate-positive systems change through influencing e.g. end-user behaviour, decision-making, cost, further investment, availability, policy/regulatory change?

How will the solution help accelerate the 'S-curve' or help other sectors/technologies do so?

Tools

Market/solution benchmarking exercise | Example: Ecovadis

Key product features	Ecovadis distinctiveness/ offering	Alternative offerings
Supplier engagement and rating	● **Superior supplier engagement capabilities**. Already 12k companies rated on Carbon, 7000 companies reporting GHG metric. **Detailed and robust ratings**.	◑ Other market offerings have similar supplier engagement capabilities but scale of network appears to be smaller and lag behind in quality of carbon accounting companies developing capabilities and deployment.
Measurement tools	◑ Integrated scope 1 & 2 emission accounting tool. Company in conversation with several carbon accounting solution providers to offer scopes 1–3 through third party relationships.	● Several carbon accounting service providers (consultants and SaaS) developing robust carbon accounting tools and advances data analytics capabilities.
GHG management and improvement	◑ Ecovadis provides recommendations and improvements plans to suppliers and monitors their performance.	◑ Direct competitors have similar or limited capabilities. However, other players in the supply chain decarbonization space developing more robust carbon management capabilities.
Building capacity	◑ Company developing e-learning modules for suppliers.	● Carbon accounting service providers developing robust training modules and offer consulting service that help build capacity.

● Distinctive and market leading ○ Not distinctive

continues over...

Identify elements of the solution that are distinctive and/or market leading when compared with alternative solutions.
Companies can use this to make the case that without their solution, the market the solution if for would not benefit in the same way as with their solution (e.g. via greater decarbonisation).

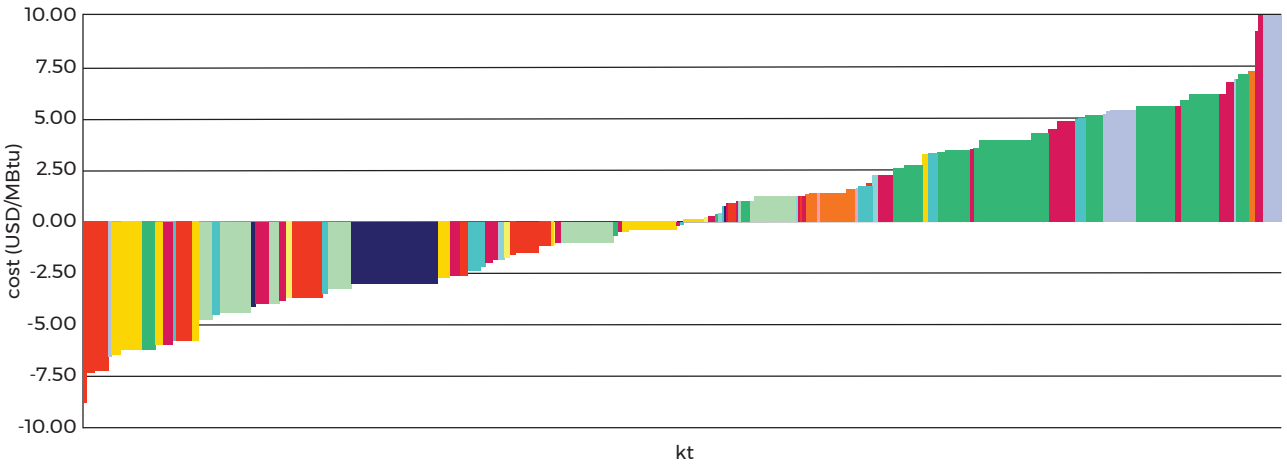
Tools

Key product features	Other competitors and initiatives
Supplier engagement and rating	Bloomberg, MSCI, SUSTAINALYTICS, CDP, CO2 AI
Measurement tools GHG management and improvement Building capacity	Watershed, Palantir, Ecometrica, SAP, Normative

Tools

Marginal abatement cost curves (MACCs)

Example: the IEA's oil- and gas-related methane emissions by mitigation measure, 2019.



Abatement technologies

Replace existing devices	early replacement of devices; replace pumps; replace compressor seal or rod; replace with instrument air systems; replace with electric motor
Install new devices	vapour recovery units; blowdown capture; install flares; install plunger
Leak detection and repair	upstream LDAR; downstream LDAR
Other	other

Present the costs associated with different climate solutions alongside their emissions reduction potential.

Entrepreneurs can use these graphs to convey the cost-effectiveness of their solution as it compares to alternative abatement measures (in $/ton of CO_2 terms).

Resources

IEA – Methane Tracker[34]

Guiding questions

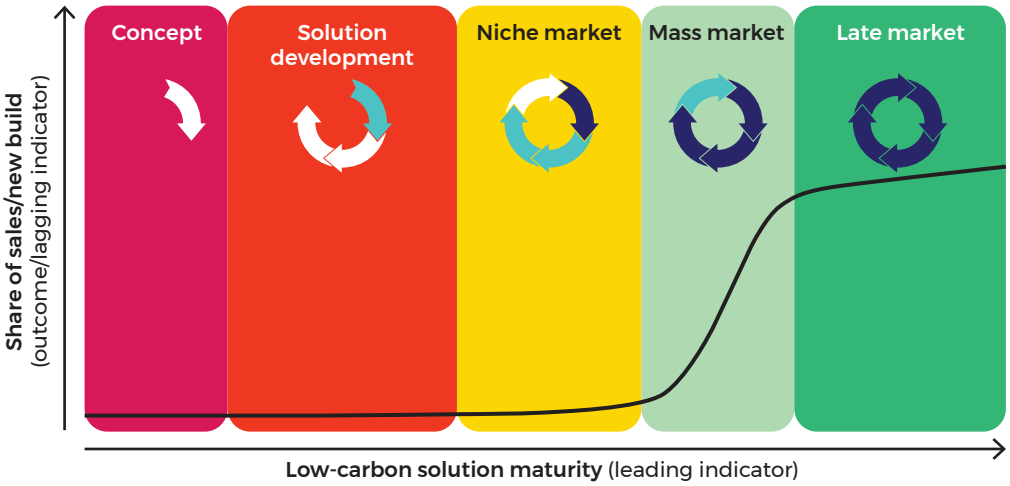
How does the company catalyse climate-positive systems change through influencing e.g. end-user behaviour, decision-making, cost, further investment, availability, policy/regulatory change?

How will the solution help accelerate the 'S-curve' or help other sectors/technologies do so?

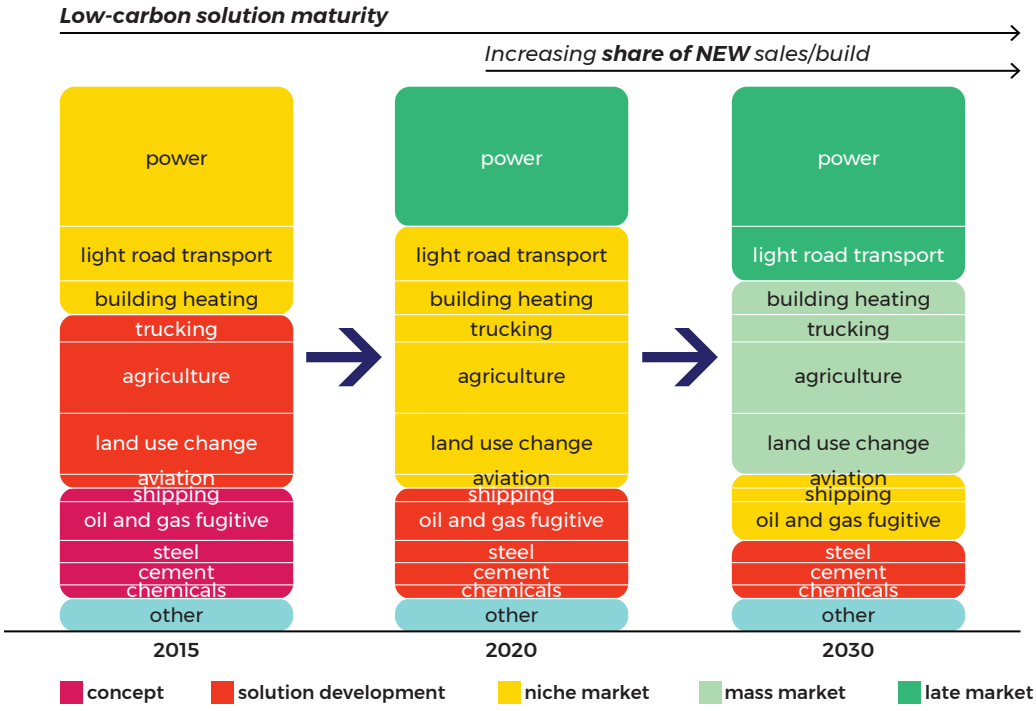
Tools

Sectoral market maturity S-curve analysis

When **tipping points are crossed, markets can swing rapidly** with each market creating improvements. This enables a shift from niche to mass market, with a solution scaling rapidly.



By 2030, low-carbon solutions could be competitive in sectors representing nearly three quarters of global emissions.



Illustrate how your solution contributes to market tipping points that scale the solution/ sector, and the role in driving decarbonisation. The S-curve shows the stage of development – and market penetration – of a technology.

Resources

The Paris Effect

Guiding questions

How does the company catalyse climate-positive systems change through influencing e.g. end-user behaviour, decision-making, cost, further investment, availability, policy/regulatory change?

How will the solution help accelerate the 'S-curve' or help other sectors/technologies do so?

Tools

Sectoral market maturity S-curve analysis – example market tipping points by sector

Identify how your solution contributes to market tipping points e.g. drive down costs, improve solutions, align regulation, increase social acceptance and other factors, which drives mass adoption and climate impact.

	Emissions sector sample	**Market tipping point**
Market tipping point pre-2030	Power	(1) **Solar/ wind < than coal/ gas**; (2) solar/ wind new < gas operating; (3) solar/ wind + storage < coal/ gas; (4) **solar/ wind + storage new < coal/ gas operating.**
	EVs	EVs surpass petrol and diesel vehicles in **key consumer criteria**, including cost (**sticker price parity**), range, convenience.
	Aviation	**Short- and medium-haul**: passenger-km cheaper in electric vs kerosene-fuelled flights. **Long-haul**: policymakers **set regulations for Sustainable Aviation Fuels to scale**, e.g. 10% blending mandates by 2030 (scaling as costs decline).
	Shipping	Declining costs of sustainable fuels combine with **regulation to create premium markets**.
	Alternative proteins	**Cost per kg alt protein** < cost per kg meat + need for **consumer acceptance** (convenience and cultural shift).
Tipping point post-2030	Steel	**Premium for green steel declines** to become < **carbon price impact** *and/or* mandate for **green steel procurement** scales market.
	Cement	**Breakthrough green technologies** enable premium for green cement to become < **carbon price impact** *and/or* mandate for **green cement procurement** scales market.

Sustained impact

As part of the Academy's mission to support engineers in scaling innovative solutions for a sustainable future, this section focuses on how your climate innovation can achieve sustained growth while decoupling from emissions. This is essential in ensuring that the commercial success is aligned with environmental responsibility. Your innovation has the potential to scale without increasing its carbon footprint, demonstrating that growth and decarbonisation can go hand in hand.

As part of this process, you'll use assessments, and key questions to focus on scaling your solution and ensuring you can capture the full value from your climate impact. The goal here is to:

- How does the solution scale commercially or enable other to scale for a greater climate impact.
- Identify how key climate risks and opportunities will affect the company's viability and/or create commercial value
- Understand your carbon footprint, its projection as you grow and set targets
- Assess the potential market opportunities that align with decarbonisation efforts
- Capture the value your solution brings in both financial and environmental terms.

3. Sustained impact

How does the solution scale commercially or enable others to scale for greater climate impact?

In this section, demonstrate how **growth is decoupled from emissions** and how the company will **capture value from climate impact**. Successful climate solutions will need to scale up to have the greatest impact and do this in a commercially viable way.

Key steps	Guiding questions	Metrics	Tools
3a. Describe how you're positioned to capture value from impact	Identify how key climate risks and opportunities will affect the company's viability and/or create commercial value	**GHG footprint** **Net zero targets**	Scenario analysis Carbon management – footprinting and projected ERP Setting targets
3b. Address the scalability of the solution	Understand your carbon footprint and set targets How can this solution be scaled in a way that a) leads to sustained impact, and b) ensures growth is decoupled from emissions?		

3a. Capturing value from impact

Identify how key climate risks and opportunities will affect the company's viability and/or create commercial value.

Guiding questions

How is the company well positioned to capture value from impact?
How do expected changes affect the company's business viability or create opportunity?

Tools

Scenario Analysis

1. How is your company addressing future climate risks and opportunities (identified in Q1.c.)?
Scenarios are descriptions of hypothetical, plausible futures (not forecasts) that help companies understand the implications of climate change for your business and to prompt longer-term strategic thinking about risks and opportunities. Applying future scenarios for your business can help you test strategic resilience and response options.

2. Complete a social, technology, economic, environmental, and policy (STEEP) analysis to identify relevant drivers
Qualitative assessments identify and describe the drivers, constraints, assumptions, and logical relationships that lead to and define that hypothetical future.

Social
- Social/lifestyle factors
- Demographic patterns
- Health and education trends
- Civil stability and tensions

Technology
- Basic research trends
- Emerging technologies
- Technology diffusion

Economic
- Macroeconomic trends
- Microeconomic trends
- Regional/national variations
- Financial capital trends
- Trade rules/protectionism

Environment
- Ecosystem trends
- Climate/weather trends
- Pollution
- Recycling
- Energy
- Waste disposal
- Land Use

Political
- Policies Laws/regulations
- Court decisions
- Political attitudes

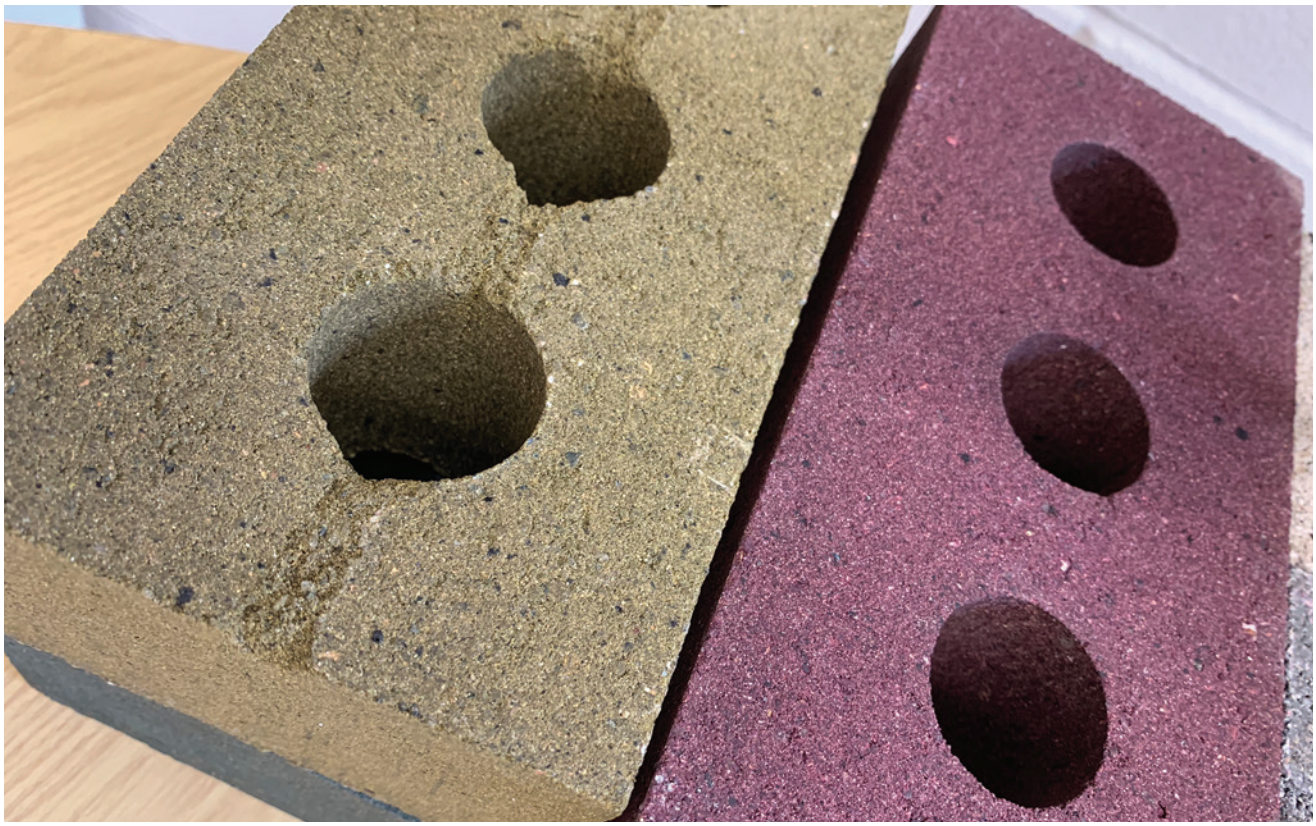
Tools

Example:
Kenoteq produces bricks using recycled construction waste. The production of its bricks requires lower emissions compared to traditional bricks as they don't use virgin cement, a highly carbon intensive material, and do not require high firing temperatures. The company is well placed to capture value from the changing political landscape as governments increasingly develop policies and regulations for the building and industry sectors to meet Nationally Defined Contribution (NDC) targets, and to align to decarbonisation pathways such as IEA's Net Zero pathway where 85% of buildings are to be zero-carbon-ready by 2050. Changing regulations on embodied carbon in construction presents a climate opportunity for Kenoteq as it increases demand for low-carbon alternatives for new and retrofitted buildings. Kenoteq is also sheltered from a potential carbon price as it does not rely on virgin concrete, and the solution has lower emissions. Therefore, concrete bricks could increase in price, which could create a cost advantage for Kenoteq.

Furthermore, as the population and rate of urbanisation continues to grow, the demand for infrastructure is also increasing, so Kenoteq is well positioned to capture this demand driver to maximise its climate impact.

Resources

TCFD Scenario Analysis Guidance Senses Toolkit



3b. Scaling your solution

Understand your carbon footprint, its projection as you grow and set targets

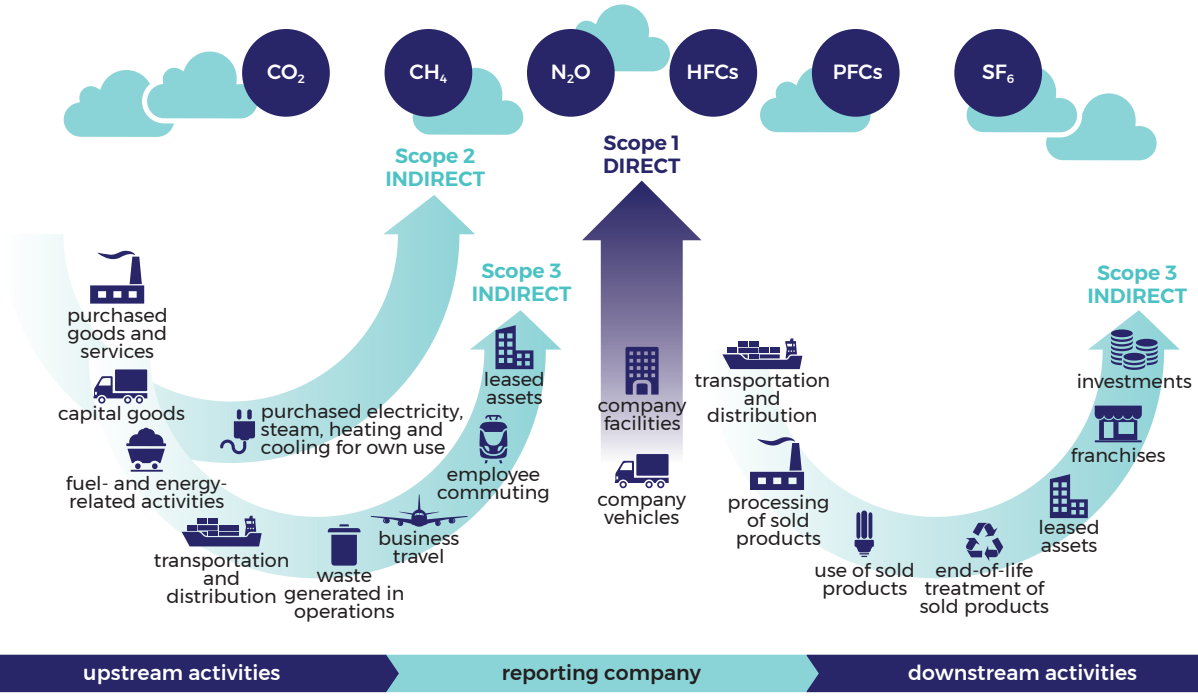
Guiding questions

How can this solution be scaled in a way that leads to sustained impact?
How can this solution decouple emissions from growth?

Tools

Carbon management

Understand your company's carbon footprint using emissions scopes



Emissions scopes are found in the GHG Protocol. The GHG Protocol establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions.[35]

Scope 1: covers direct emissions from owned or controlled sources.
Scope 2: covers indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed. This includes the emissions generated from the usage of electricity in the buildings your organisation owns or occupies.
Scope 3: covers all other indirect emissions that occur within an organisation's wider value chain.

Tools

Carbon Management

1. Calculate your company's carbon footprint

Boundaries

An emissions inventory must cover **>95%** of company-wide **Scope 1 and 2** emissions and a **complete Scope 3 screening**. The inventory must cover all relevant classes of GHGs.

Data collection

Data availability, quality, and reliability may be a challenge for Scope 3 emissions. Companies should start by considering the **15 distinct categories of Scope 3 emissions** (GHG Protocol).

Emissions factor

Define emissions factor for each source of emissions to calculate the tonnes of CO_2 emitted (tCO_2e). For example, Scope 2 (emissions from electricity use, can be converted from MWh based on the local electricity grid factor.

Calculation

A basic footprint can be conducted with a carbon calculator spreadsheet or an internationally recognised standard (see adjacent). Companies may also choose to contract a third-party carbon footprinting source.

2. Calculate the expected emissions growth relative to ERP and company growth

How can you maximise your ERP?

Consider how ERP could increase as your business scales. For example:

- Increasing emissions TAM
- Factors that increase market share
- Reducing LCE e.g. process/sourcing improvements
- New business model e.g. licensing the technology

What are the potential rebound effects?

Emissions increase may occur from the increased use of a solution, the growing LCE of its production, the development of new processes etc, which reduces the solution's expected ERP. Therefore, it is important to address how these rebound effects could be mitigated.

Resources

Several free tools can help with introductory carbon footprinting

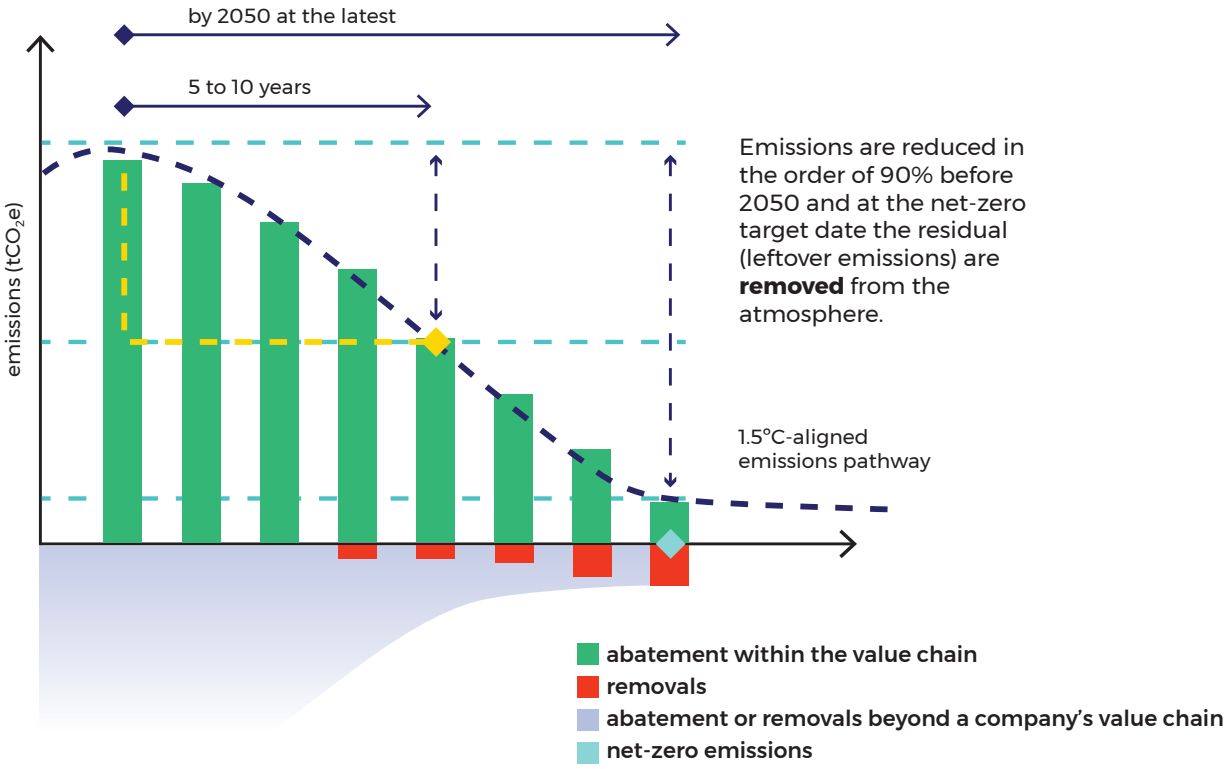
Tools

Setting Targets

Consider setting a net zero target as you grow

Science-based targets help companies determine **how much** and **how fast** they need to reduce GHG emissions to align with efforts to limit warming to 1.5˚C.

The Science Based Targets Initiative (SBTi) has become a global standard for emissions reduction targets, enabling companies to set ambitious and credible targets based on the latest climate science.



The SBTi Net-Zero Standard seeks to standardise 'net-zero' claims with a focus on deep decarbonisation

- A net zero pathway informs the rate of emissions reduction and/or removal to limit global warming to 1.5˚C. The SBTi is a credible framework for companies to get to net zero.
- The new eligibility criteria states if three or more conditions are true from the following, your company is eligible to pursue **SBTi's SME Pathway**.[36] If your company has <250 employees or turnover of < €50 million+ or < €25 million+ in assets , and are not in mandatory FLAG sector.
- To align with a 1.5˚C temperature pathway, the Science Based Targets Initiative (SBTi) recommends a 4.2% annual reduction in emissions from 2018 to 2030. This is based on the latest climate science from the IPCC Special Report on 1.5˚C.
- SME Scope 3 targets will not be validated so the company can focus on Scopes 1 and 2. However, it must still commit to measure and reduce Scope 3 emissions.
- As your company grows, SBTi's sector guidance will need to be followed.

Externalities

As your climate solution scales, it is essential to assess its full impact—including both the **material positive and negative externalities** that may arise. Externalities refer to the unintended consequences of a business's activities that affect other parties, either contributing positively to sustainability or creating challenges that must be managed. A **holistic approach** to impact means recognising and addressing these trade-offs early, ensuring your solution remains credible, scalable, and aligned with long-term sustainability goals.

Neglecting environmental impact can lead to **financial penalties, investor disinterest, and regulatory backlash**. For instance, in 2024, the UK water regulator Ofwat fined water companies **£157.6 million for missing environmental targets**, with Thames Water facing a **£57 million penalty** (Reuters).[37] Beyond legal risks, companies that fail to manage their externalities may struggle to secure funding, as investors increasingly prioritise businesses with transparent sustainability metrics. Showcasing, how in the long-term neglecting climate impact can potentially lead to financial penalties, investor disinterest, and regulatory backlash.

Moreover, being proactive about managing externalities can help avoid the risk of **greenwashing** and build credibility. Greenwashing is where companies claim environmental benefits without substantiated impact. Greenwashing is increasingly scrutinized by both investors and consumers, and failing to manage externalities can significantly damage a startup's reputation. For example, a recent report by the **European Commission** found that over 40% of green claims made by companies were misleading or unsubstantiated, underlining the importance of transparency and accountability in the climate sector. (Source: EU Commission study- **Consumer protection: enabling sustainable choices and ending greenwashing, 2023)**.[38]

By addressing the externalities of your innovation, will help you future proof your business from risks but also unlock the full potential of your climate-positive impact. This can drive long-term value creation and establish your startup as a leader in the sustainable business landscape. Some of the guiding questions in this section are:

- What are the material positive and negative externalities?
- Demonstrate an understanding of holistic impact by considering positive and negative trade-offs

4. Externalities

What are the material positive and negative externalities?

In this section, highlight the material indicators for the **positive and negative trade-offs** as your solution scales. Understanding and measuring externalities will enable them to be managed and creates accountability for the company to all stakeholders.

Key steps	Guiding questions	Metrics	Tools
4a. Identify material indicators	What are the material trade-offs on other environmental impacts? How should they be measured?	**Impact metrics**	How to select relevant impact metrics

4a. Understanding materiality

Demonstrate an understanding of holistic impact by considering positive and negative trade-offs.

Guiding questions

What are the material trade-offs on other environmental impacts and how should they be measured?

Tools

How to choose impact metrics

Choosing the right impact metrics is critical to ensuring:

- negative environmental impacts of the solution are identified, understood, and can be managed/minimised
- the full range of co-benefits of the solution are properly recognised and can be maximised
- the impact narrative of the solution is holistic, relevant, and compelling.

1. Are the metrics material?
Materiality is defined by the GRI (Global Reporting Initiative) as "those topics that reflect its most significant impacts on the economy, environment, and people, including impacts on human rights".

2. Does the metric align with your solution's theory of change?
i.e. the core types of impact the solution is set up to achieve.

3. Select metrics
Using metrics from recognised standards and frameworks will help the company prepare for future reporting requirements (see examples on the following page).

Why is this relevant?
As ESG regulations increase in scope and scrutiny, growing numbers of corporates will be required to disclose sustainability performance data. For climate-focused entrepreneurs who supply these corporates with goods/services, setting up early to understand and track the right impact metrics will help **secure new business as well as new funding**. It will also minimise potential disruption as the solution scales and comes into scope of compulsory reporting, thereby **future-proofing operations**.

The **Sustainable Finance Disclosure Regulation (SFDR)** requires European **investors to report on how ESG factors are integrated** at an entity and fund level. This will inform how funds are labelled, in terms of their focus on sustainability (Articles 6, 8, or 9), with implications for attracting investment.

Metric

Select metrics

Example impact topics and metrics sourced from existing standards and frameworks

Topic	Example metric
Air quality	Tons of pollutants emitted
Water management	% of freshwater recycled
Waste management	Tons of waste generated and % of which are hazardous
Biodiversity	% of terrestrial acreage restored after disturbance
Workforce health and safety	Total recordable incident rate for full-time employees
Product efficiency	Average operating lifetime of product
Product innovation	% of products that qualify for positive industry certification
Product end-of-life management	% of products sold that are recyclable or reusable
Transparency and integrity	Monetary losses as a result of legal proceedings associated with price-fixing
Supply chain	Suppliers' social and environmental responsibility audit
Gender equality and equity	% difference between average earnings of male and female employees
Physical risks	% of business activities vulnerable to physical risks

Resources

SASB (Sustainability Accounting Standard Board)
Suggests disclosure topics and metrics by sub-sector.

ISSB climate exposure draft
Proposes requirements for measuring and disclosing climate-related risks and opportunities by industry; uses SASB metrics

SFDR (Sustainable financial disclosure)[39]
Lists indicators of potential negative impact, for consideration by investors and investees.

IFRS climate disclosures prototype
Suggestions to the ISSB for climate-related disclosures for corporate (and other)

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