Turning Climate Strategy into Action

How telecom leaders can build the business case for carbon reduction measures

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Introduction

Who is this handbook for?

This handbook has been developed for practitioners within telecommunications companies who are involved in seeking funding for carbon reduction measures and projects. This involves developing a business case: a document which provides the information necessary for decision makers to make an investment decision.

A core part of a business case is the financial and strategic appraisal of carbon reduction measures, demonstrating the rationale for investment – this is the focus of this handbook.

The wider objective of this handbook is to enable telecommunications companies to operationalise their Climate Transitions Plans: turning ambition and strategy into fundable initiatives, which when implemented, will deliver both decarbonisation and value to the company. This document therefore serves as a supplement to the GSMA's recently published **Climate Transition Planning Guidance for Telecommunication Companies**.

Why is this handbook needed?

When it comes to allocating funding and gaining investment approval, decarbonisation initiatives often compete with other priorities and projects. The need to demonstrate value from climate investment is essential. In some cases, this value is explicit and tangible (such as cost savings), but in many cases it requires analysis that is not typically undertaken – such as the value of avoiding climate-related risks or capturing future opportunities. It is therefore important that teams responsible for developing business cases can use financial tools and frameworks and effectively communicate the financial implications of measures being proposed.

How does this handbook support business case development?

This handbook follows on from the GSMA's **Achieving Climate Targets** guidance and explains how to decide which carbon reduction measures should be prioritised for near-term implementation and build a robust financial and strategic appraisal for the selected measures. It is designed to provide industry practitioners with context-specific practical guidance and best practice to support the business case development process.

The handbook is structured into four sections, each one building on the one before, starting with how to prioritise carbon reduction measures and concluding with strategic considerations that can reinforce a business case. Practitioners will be able to use the methods covered within this handbook when developing a business case for investment.

The sections and content of this handbook are as follows:

Section 1: Feasibility Prioritisation and screening of carbon reduction measures	Methods for evaluating and prioritising carbon reduction measures prior to deeper financial evaluation: • Guidance on screening measures based on technology maturity and integration complexity • Understanding, creating and using MACC analysis
Section 2: Fundamentals Financial appraisal of carbon reduction measures	Methods and frameworks for calculating the financial impact of carbon reduction measures, and standard metrics for evaluating and comparing investments: • Creating a cash flow analysis • Interpreting and using financial metrics: Payback, Return on Investment (ROI), Net Present Value (NPV), Internal Rate of Return (IRR)
Section 3: Scenario building Integrating climate risks, opportunities and dependencies	Approaches and methods for integrating strategic elements into the financial evaluation of carbon reduction measures, including climate-related risks and opportunities: • Building the optimistic case – Identifying climate transition risks and opportunities and quantifying the impact on the business case • Building the pessimistic case – Identifying dependencies and quantifying the impact of the business case
Section 4: Extending value Incorporating non-financial benefits	Identifying additional areas of strategic value created by carbon reduction measures, and how to link them into the business case: • Identifying and incorporating non-financial benefits into the business case

The outputs from the above methods can be incorporated into a **business case document**, which typically includes additional elements, such as: a problem statement and definition of objectives; description of the project and solution being proposed; and operational considerations, such as implementation risks and planning. The table below illustrates the elements of a typical business case and where the methods covered within this handbook can be used.

Key elements of a business case	Purpose
Problem statement	Clearly defines the issue or challenge that the business case aims to address by succinctly explaining the context and why action is needed.
Project objectives and rationale	Outlines what the project seeks to achieve and why it is important, such as the goals and desired outcomes.
Evaluation of options and recommended measures	Overview of how the measures were selected to develop a business case. **Covered in Section 1: Feasibility – Prioritisation and screening of carbon reduction measures**
Description of the project	Provides a detailed overview of the proposed solution, such as the scope, technical specifications and implementation approach.
Financial appraisal	Demonstrates the financial viability and impact of the project. **Covered in Section 2: Fundamentals – Financial appraisal of carbon reduction measures**
Climate-related value creation	Highlights the value generated by the project in terms of climate impact. **Covered in Section 3: Scenario building – Integrating climate risk and dependencies into the business case**
Linkage to wider corporate goals and strategy	Connects the project to the company's strategic objectives. **Covered in Section 4: Extending value – Incorporating non-financial considerations**
Risk assessment and management	Identifies and addresses other general implementation risks to the project, including their potential impact and proposed mitigation strategies.
Implementation plan	Details how the project will be executed, such as timelines, milestones, resource requirements and governance requirements.

1 Feasibility – Prioritisation and screening of carbon reduction measures

A company may identify a wide range of carbon reduction measures across its operations and value chain. However, before conducting a detailed financial appraisal for each measure, it is useful to first prioritise them given the limited time and resources. Two methods that enable effective prioritisation are:

- **Technical and financial screening:** This uses available information to assess the viability and suitability of implementation from a technical and financing perspective.
- **Marginal Abatement Cost Curve (MACC) analysis:** This is used to assess the relative cost-effectiveness of a set of measures being considered.

Effective prioritisation is a necessary early step to determine which measures merit further analysis and development of a full business case. Each method is discussed further in the sections below.

1.1 Technical and financial screening

Carbon reduction measures should be screened for technology maturity, integration complexity and the nature of the investment before conducting a full business case assessment. This can be done qualitatively, using available market information and inputs from internal stakeholders.

Technical screening: assessing technology maturity and integration complexity

When screening carbon reduction measures, it is important to consider the technology maturity and how complex it will be to integrate the measure into operations. Key questions that can guide prioritisation include:

Technology maturity

- Is the technology proven and commercially available, or is it still emerging?
- Has it been deployed at scale or only in pilots?

Integration complexity

- Can the technology be integrated into existing infrastructure and operations easily, or does it require considerable operational changes?
- Does the technology require specific skill sets to operate and maintain? Are these skill sets available internally, or would they need to be outsourced? Would the company need to appoint dedicated personnel to manage this solution?

Preference should be given to measures that rely on commercially available technologies and can be integrated more easily into operations. Measures that rely on technologies that are not yet commercially available and that are complex to implement can first be implemented as pilot projects to build capacity and demonstrate proof of concept, before rolling out the measures at scale.

Financial screening: Investment type and funding preferences

When evaluating carbon reduction measures, it is important to consider the type of investment and the source of funding. Two guiding questions can help prioritisation:

Type of investment: Is it a large upfront investment or mainly operational expenditure?

Funding source: Can the measure be funded internally, or will it require external funding?

Companies often have different funding preferences that influence prioritisation. Some may avoid increasing operational costs and favour capital investments, while others may prefer measures that rely on operational expenditure to reduce upfront commitments.

When a measure can be funded internally, approval is typically faster and simpler. Low-cost measures, such as minor to moderate energy efficiency upgrades often fall into this category, making them attractive for short-term implementation. In contrast, capital-intensive projects that require substantial upfront investment, such as major energy efficiency network or data centre upgrades or large scale on-site solar PV and battery system installations, may need external financing and involve longer approval processes.

1.2 Marginal Abatement Cost Curve analysis

A key tool to screen and prioritise carbon reduction measures is a Marginal Abatement Cost Curve (MACC) analysis.

A MACC analysis compares the relative emissions reduction potential and cost for a selected range of carbon reduction measures. It assesses which ones deliver the greatest emissions reductions for each dollar invested and where the largest overall abatement opportunity lies.

The analysis can be done using high-level or estimated financial costs/savings and emission reduction projections. Ranking carbon reduction measures based on abatement cost (or saving) enables initial prioritisation and selection of the most promising ones for more detailed business case development.

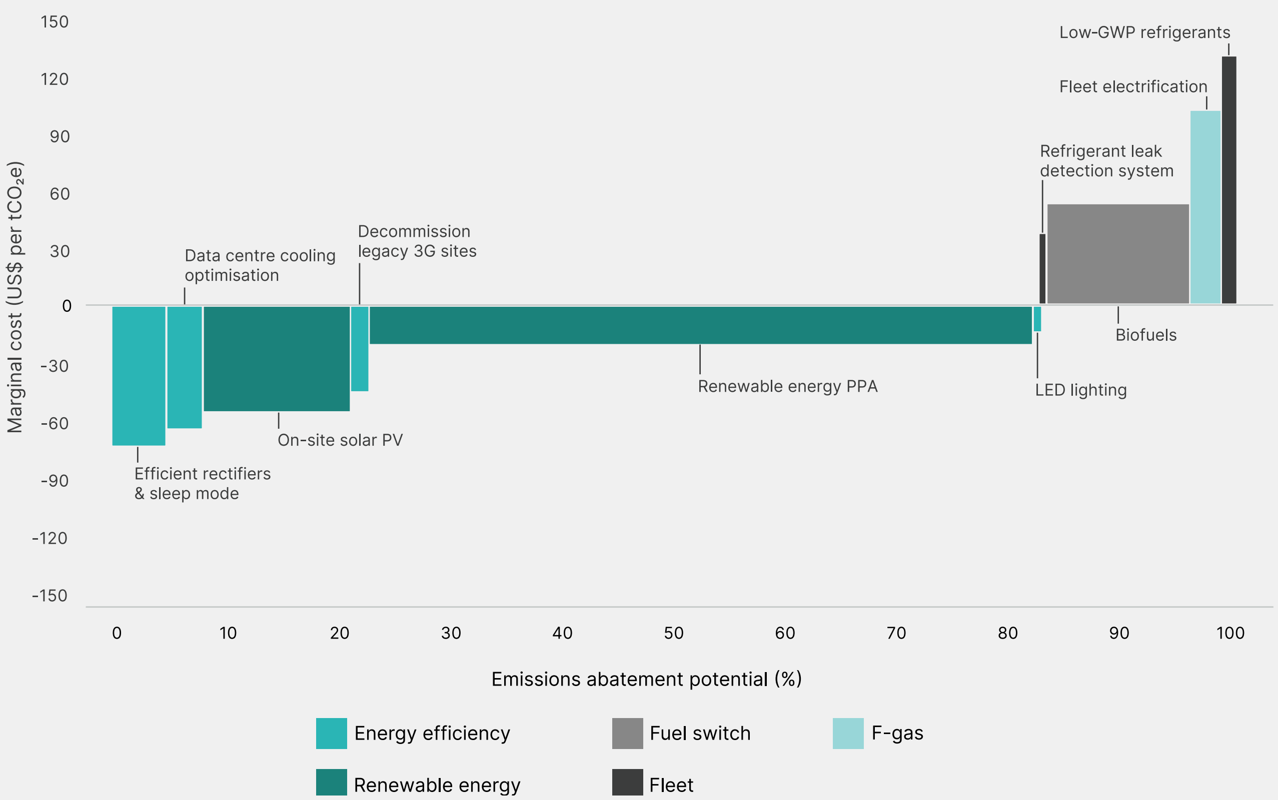
Interpreting a MACC chart

As shown in Figure 1, the vertical position of the bars represents either relative costs or savings. Bars above the x-axis reflect **net costs** and bars below the x-axis indicate **net savings**. The higher or lower the bar, the greater the cost or saving per tonne of CO_2e reduced.

The horizontal width of each bar represents **carbon reduction potential**, which is the total emissions reduction expected to be delivered by the measure over a defined time-frame or over the project's lifetime. Wider bars illustrate measures with higher emissions reduction potential. **Together, the measures account for the total emissions reduction over a defined time horizon.**

The ranking of measures in the MACC chart from left (least cost or greatest savings) to right (highest cost) reflects relative cost-effectiveness of measures. All costs are consolidated over the defined time horizon.

Figure 1 Illustrative* MACC analysis for Scope 1 and 2 carbon reduction measures



* The MACC chart uses hypothetical data and is included only as an illustration and should not be used for decision-making.

How to conduct a MACC analysis

To conduct a MACC analysis, the following inputs and assumptions must first be defined:

- **Time horizon:** The period over which carbon reduction measures will be implemented. This can be a defined period, such as 15 years, or to a target year, such as 2030 or 2050.
- **Abatement potential:** The expected emissions reduction of each measure, measured in tCO_2e over the selected time horizon.
- **Costs and savings:** High-level estimates of implementation costs and operational savings for each measure, used to calculate the net costs or net savings.

Once these inputs have been determined for each carbon reduction measure, the following can be calculated:

- **Marginal abatement cost:** Divide each measure's net cost or savings by its carbon reduction potential to derive the **cost per tCO_2e**. This value is plotted on the y-axis of the MACC chart.
- **Relative abatement potential:** Calculate each measure's share of the total emissions reduction potential across all measures. This percentage defines the width of the block along the x-axis of the MACC chart.

How to use the outputs of a MACC analysis

The outputs of a MACC analysis can be used to prioritise interventions in a structured way based on their carbon reduction potential and relative net saving or cost. Using these two indicators, carbon reduction measures can be prioritised as follows, and are referenced on the MACC chart in **Figure 2** in either dark green, light green, light grey or dark grey.

1. **Net saving, high carbon reduction potential (light green bars)**
   These appear on the negative side of the y-axis and have wide bars on the x-axis. They deliver the greatest emission reductions and net savings and should be high-priority measures.

2. **Net saving, low carbon reduction potential (dark green bar)**
   These measures also fall on the negative side of the y-axis but have narrow bars, indicating smaller carbon reduction potential. They can be considered early as quick wins, especially if they are easy to implement and demonstrate short-term progress.

3. **Net cost and high abatement potential (light grey bars)**
   These measures appear on the positive side of the y-axis with wide bars, reflecting significant carbon reduction potential, but at a net cost.

   While some of these initiatives are evaluated as having a net cost, they may be essential for long-term decarbonisation. If so, they should be treated as strategic, long-term priorities to be monitored. Where the net cost appears to be relatively small, companies can explore ways to reduce these and/or integrate strategic benefits into the financial assessment (such as mitigating transition risks, a key focus of **Section 4**). Such measures may become cost saving as technology prices decline or alternative business models develop.

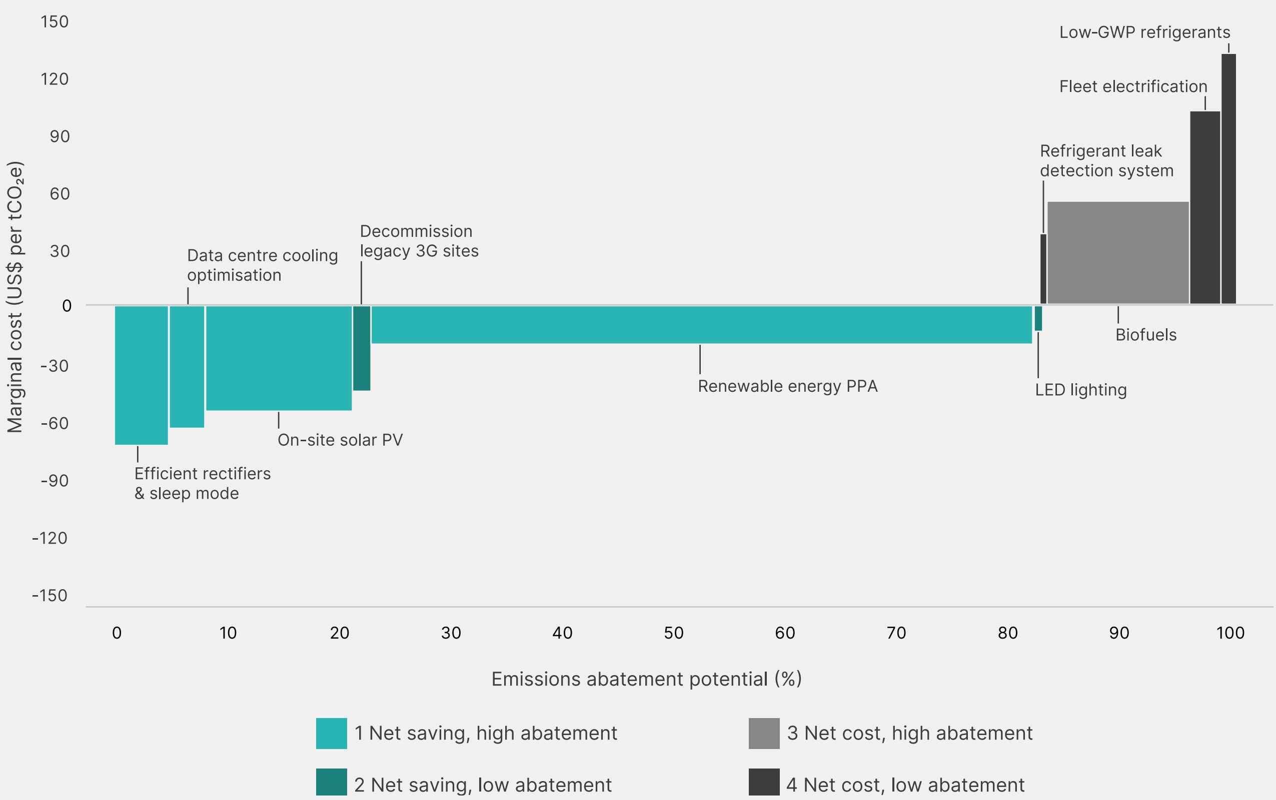
Key considerations for these measures include the following:

- **Cost trajectory:** Measures in this category may become more affordable over time as research advances and technologies mature. Monitoring market trends is essential to understand potential cost reductions and plan accordingly.
- **Strategic considerations:** Look beyond immediate costs and consider broader benefits, such as regulatory compliance, reduced transition risks and co-benefits like improved energy security and resilience. These factors can help justify the investment.
- **Alternative business model or funding options:** Explore alternative business models, such as options that reduce upfront capital requirements, such as "as-a-service" models, which shift costs from capital expenditure to operational expenditure. This can make implementation more feasible.

4. Net cost and low abatement potential (dark grey bars)

These measures are shown as narrow bars on the positive side of the y-axis. They offer limited carbon reduction at a net cost and should be considered for implementation at a later stage, once other interventions have been implemented, or if the cost trajectories of the measures change or other alternative business models or funding options become available.

Figure 2 Visual representation of how measures can be prioritised using a MACC analysis



2 Fundamentals – Financial appraisal of carbon reduction measures

Following prioritisation and shortlisting of carbon reduction measures (see **Section 1**), this section focuses on the fundamentals of financial assessment needed for developing a business case. It introduces the method of cash flow analysis and calculation of financial metrics used by decision makers to assess the financial attractiveness and viability of a particular project.

The real-world application of methods covered within this handbook are illustrated by using worked examples.

A specific example – implementing a **hybrid diesel–solar PV (photovoltaic) and battery system for an off-grid base station** – is addressed within the chapters.

Two additional worked examples are provided in the appendices to demonstrate how the same principles apply in other contexts. These are:

- **A physical Power Purchase Agreement (PPA)**
- **A device circularity and refurbishment programme**

These additional worked examples include full input assumptions, financial modelling considerations and additional guidance specific to each measure.

2.1 Cash flow analysis

To understand the financial impact of a project, it is important to clearly establish how money moves through an investment over time. A cash flow analysis provides this by mapping all expected cash inflows and outflows across the project lifecycle. This includes both capital cost (CAPEX), operational cost (OPEX), cost of goods and services (COGS) and any revenue that will be derived from a project. A robust cash flow analysis lays the foundation for assessing further financial performance metrics (discussed in **Section 2.2**).

Before conducting a cash flow analysis, it is important to define the measures being compared:

- **Business-as-usual (BAU):** The current technology, process or business model in use. **This will be referred to in this section as the "BAU case"**.
- **Carbon reduction measure:** The proposed measure, such as a new technology, process, or business model that will reduce emissions. **This will be referred to in this section as the "Solution case"**.

A cash flow analysis is typically performed for both cases to understand the financial impact of implementing the measure versus maintaining the status quo.

We illustrate this method by applying it to a worked example: **a hybrid diesel–solar PV and battery system for an off-grid base station**. In this scenario, we define the "BAU case" and "Solution case" as follows:

BAU case
Off-grid base station site powered by a diesel generator

Solution case
Base station powered by a hybrid diesel-solar PV and battery system

The following steps are used to calculate cash flows for the BAU case and the Solution case:

Step 1
Determine input assumptions

Step 2
Map out cash outflows and inflows over the project timeline

Step 3
Determine the annual net and cumulative cash flows

Step 1: Determine input assumptions

Input assumptions in a cash flow analysis are the key values and parameters that underpin the financial model, enabling projections of cash inflows and outflows over the project's duration. These input assumptions typically include:

- **Cash outflows**, which include costs such as CAPEX, OPEX, cost of goods, etc. Common types of CAPEX and OPEX to consider are shown in **Table 1** below.
- **Cash inflows**, for example from revenue generated over the project's duration.
- **General assumptions**, which could include financial parameters, such as discount rate, inflation rate and escalation rates for specific costs (e.g. electricity, fuel, materials). Additionally, project-specific performance or technical assumptions, such as power consumption or volumes of goods purchased or sold, may also be included as parameters since they may impact costs.

Top tip

The discount rate will vary by country and company. The Finance department will be able to advise on appropriate discount rates to use to align with internal policies.

For projects with longer time frames (typically beyond 10 years), discounting can significantly diminish future cash flows, making the choice of the discount rate particularly important. Consult the finance team to agree what discount rates should be used across the near- and long-term.

Input assumptions should be defined for both the BAU case and the Solution case. Cash inflows and outflows are typically calculated on an annual basis. **It is important that all assumptions are clearly documented within the business case so that they may be reviewed by decision makers.**

Table 1 Common types of capital and operational expenditure

Capital expenditures typically include:	Operational expenditures typically include:
• Cost of equipment or technologies, such as solar PV panels, batteries, vehicles • Replacement of equipment at end-of-life • Replacement of components that extend asset life • Implementation costs • Professional fees, such as legal reviews of PPAs, engineering design for new systems	• Energy costs, such as fuel and electricity • Maintenance and servicing • Equipment cleaning • Spare parts • Transportation costs • Disposal costs • Labour for operating the system • Other services that are outsourced (e.g. repairs)

When building a cash flow analysis, it is important to account for expected changes in key cost drivers. Operational expenditure, such as energy prices, maintenance and logistics costs, are not expected to remain the same over the duration of the project. Factors, such as inflation, technology learning rates, current regulations (e.g. energy or carbon taxes, removal of subsidies), should be accounted for as far as possible. This can be done by applying standard escalation factors or inflation rates to these costs in future years. These escalations can be calculated separately and then added to the total operational costs.

Certain assumptions are inherently uncertain. To increase confidence:

- **Use multiple data points:** Triangulate internal forecasts with reputable external outlooks, market data, and historical trends.
- **Document sources and rationale:** State why each assumption is reasonable and how it was derived.
- **Engage internal experts:** Validate assumptions with Finance, Engineering, Operations and Procurement.

Companies will generally use standard factors for business planning purposes, which you can obtain from the Finance department. **In Section 3 we will examine how you can change assumptions and develop scenarios.**

For example, if fuel prices are projected to increase by 5% annually, adjust the cost assumptions for fuel for the subsequent years accordingly for both the BAU case and the Solution case (**Table 2**).

Top tip

1. Validate forecasts with sources:

Internal teams

- Finance team: discount rates, inflation
- Technical/Operations/Engineering team: performance and technology trends

External sources

- Market data: macroeconomics, energy prices, technology outlooks

2. Where there is low confidence in assumptions, or where key assumptions may change, explicitly state this and accompany it with a sensitivity analysis by modelling outcomes under different parameter values. This helps illustrate how the results change when assumptions vary. **See Section 3 for further guidance on uncertainties and scenarios.**

3. Model the change in diesel price separately to other cost escalations, as the cost of diesel will likely not be aligned to CPI inflation. The future diesel outlook can be informed by historical trends and market outlook of future oil prices.

Table 2 Incorporating expected changes to fuel costs

Year	Fuel price escalation (%)	Fuel price (US$)
1	-	1.35
2	5%	1.42
3	5%	1.49

If the project involves future capital expenditure, such as the replacement of certain equipment, include these costs in the analysis in future years. Prices for capital expenditure should also be adjusted for inflation. You may also consider applying a deflation factor for certain technologies that are expected to get cheaper. For example, battery costs are expected to decline over time, so any future capital outlay for batteries could reflect this trend. **Table 3** below shows common cost categories and how their costs are typically expected to change over time.

Table 3 Common cost categories and typical changes to costs

Cost category	Driver of change	Typical trend
Electricity prices	Annual tariff escalations, market volatility	Volatile
Fuel prices	Global supply and demand fluctuations	Volatile
Input materials (e.g. steel)	Commodity market dynamics	Variable
Replacement equipment	Technology learning rates vs inflation	Costs may decline over time

When applied to the example Solution case of a hybrid diesel-solar PV and battery system, input assumptions can be defined for the BAU case and the Solution case as shown in **Table 4**.

Appendices 1 (page 51) and **2** (page 58) illustrate how this is applied in the context of additional carbon reduction measures (Physical PPA and Device Circularity).

Table 4 Diesel generator worked example input assumptions[1]

Type	Input	Description	Value
General assumptions	Inflation	Annual CPI inflation applied	4%
	Discount Rate	Annual discount rate used to discount future cash flows	10%
	Duration	Duration of the project	20 years
	Cost of diesel	Cost of diesel per litre at Year 1	$1.35
Business-as-usual	CAPEX	Diesel genset, replaced every five years	$5,000
		Cost of diesel generator in Year 7	$6,580
		Cost of diesel generator in Year 12	$8,005
		Cost of diesel generator in Year 17	$9,740
	OPEX	Annual diesel consumption costs	$6,765
		Annual maintenance and diesel transport costs	$588
Solution case	CAPEX	Solar PV system	$10,588
		Batteries, replaced every eight years	$15,882
		Cost of battery at Year 8	$14,118
		Cost of battery at Year 16	$11,765
		Diesel genset, replaced every 10 years	N/A – already in place
		Cost of generator in Year 7	$6,582
		Cost of generator in Year 17	$9,700
	OPEX	Annual diesel consumption costs	$2,705
		Annual maintenance and diesel transport costs	$441

1 All values used are illustrative, representative inputs used solely for demonstration. Actual values will differ by country and company context.

Step 2: Map out cash outflows and inflows over the project timeline

Once the various input assumptions have been determined, map the expected cash outflows and inflows across the years they are expected to occur.

The initial investment (or outlay) should be added in Year 0 rather than Year 1 in a cash flow projection. This is because Year 0 represents the starting point, i.e. the moment you commit funds to begin the project or investment. This is typically before any operations or revenue generation starts.

Table 5 illustrates cash outflows mapped out across 10 years for the hybrid diesel-solar PV and battery system, incorporating inflation and market adjustments. **Appendix 2** provides a worked example including cash outflows and inflows.

Table 5 Annual cash flow for the BAU case and the Solution case over a 10-year period

Period	BAU case		Solution case	
	CAPEX	OPEX	CAPEX	OPEX
Year 0			26,470[b]	
Year 1		7,353		3,146
Year 2	5,000[a]	7,647		3,271
Year 3		7,953		3,402
Year 4		8,271		3,538
Year 5		8,602		3,680
Year 6		8,946		3,827
Year 7	6,580[a]	9,304	6,580[c]	3,980
Year 8		9,676	14,118[d]	4,139
Year 9		10,063		4,305
Year 10		10,466		4,477
Year X...				

Appendices 1 (page 51) and **2** (page 58) illustrate how this is applied in the context of additional carbon reduction measures (Physical PPA and Device Circularity).

a Diesel genset replacement cost
b Cost of solar PV panels and battery system installation
c Genset replacement costs
d Battery replacement costs

Step 3: Determine the annual net and cumulative cash flows

Once the expected cash outflows and inflows have been mapped for both the BAU case and the Solution case, the annual net and cumulative cash flows can be determined.

Annual net cash flow = Difference between the net costs of the BAU case and the Solution case (the savings or income achieved from the project each year).

Cumulative cash flow = Previous cumulative net cash flow + net cash flow in current period.

The net cash flow forms the basis for further financial evaluation using metrics, such as NPV, IRR, ROI and payback period, which will be explained in **Section 2.2**.

Top tip

Use dynamic models that allow for easy updates as underlying assumptions, data inputs or parameters may need to change with iterations and over time.

Table 6 illustrates how the annual net and cumulative cash flows were calculated using the annual cash flows. Appendix 2 provides guidance on calculating annual net and cumulative cash flows when the BAU case and the Solution case have distinct cash inflows and outflows.

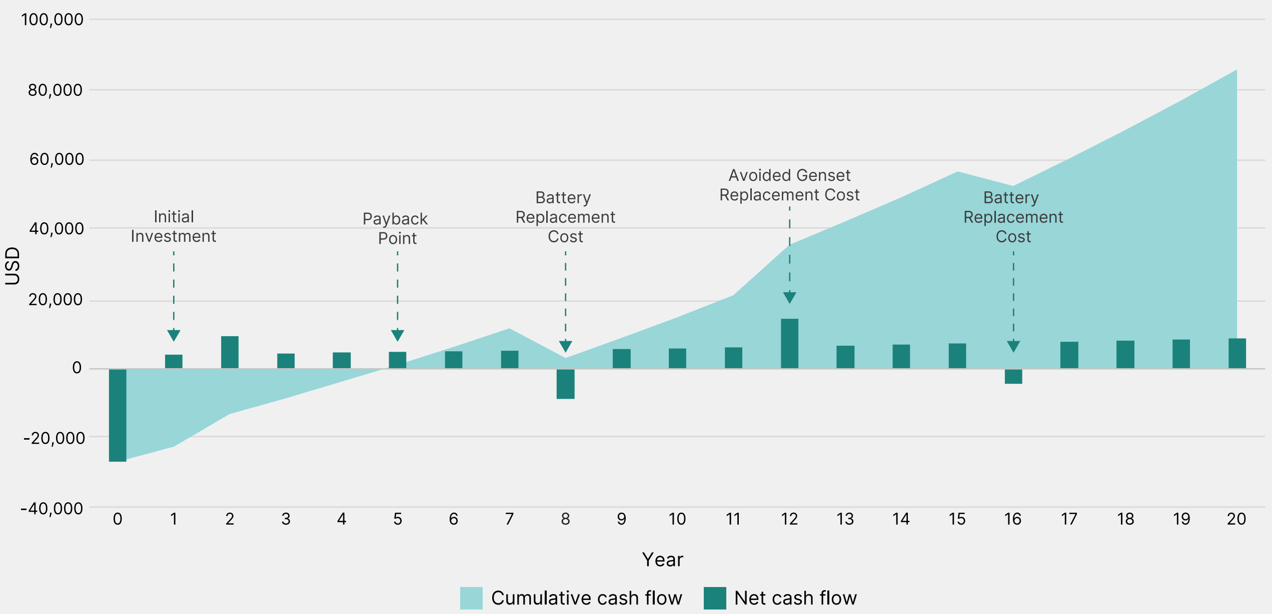
Table 6 Annual net and cumulative cash flow

Period	BAU case		Solution case			
	CAPEX	OPEX	CAPEX	OPEX	Net cash flow	Cumulative cash flow
Year 0			26,470		-26,470	-26,470
Year 1		7,353		3,146	4,207	-22,263
Year 2	5,000	7,647		3,271	9,376	-12,887
Year 3		7,953		3,402	4,551	-8,336
Year 4		8,271		3,538	4,733	-3,604
Year 5		8,602		3,680	4,922	1,318
Year 6		8,946		3,827	5,119	6,437
Year 7	6,580	9,304	6,580	3,980	5,324	11,760
Year 8		9,676	14,118	4,139	-8,583	3,179
Year 9		10,063		4,305	5,758	8,937
Year 10		10,466		4,477	5,988	14,926

The outputs of the cash flow analysis can be graphically represented by using net cash flow and cumulative cash flow (**Figure 3**). As indicated in the chart below, the initial investment costs of the hybrid diesel-solar PV and battery system create an initial cash outlay (represented by a negative value in Year 0), which is gradually recuperated through savings on diesel, logistics and maintenance costs and fewer replacement requirements of diesel gensets in subsequent periods. The future replacement costs of batteries result in a negative annual cash flow at the replacement year, however the reduced requirement to regularly replace diesel generators, increases cash flows.

Appendices 1 (page 51) and **2** (page 58) illustrate how this is applied in the context of additional carbon reduction measures (Physical PPA and Device Circularity).

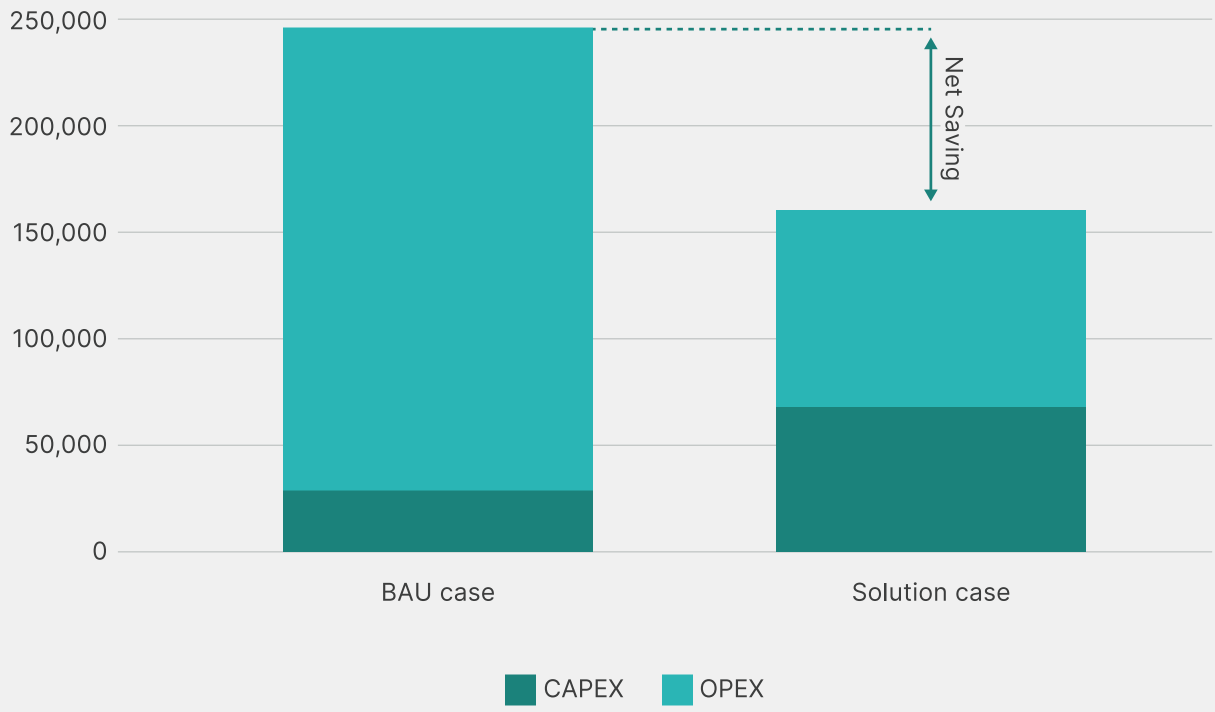
Figure 3 Illustration of net cash flow and cumulative cash flow for the hybrid diesel–solar PV and battery system worked example over a 20-year period



For carbon reduction measures, savings often come from reduced operational costs due to energy savings. In this example, the Solution case will benefit from an OPEX reduction due to avoided energy and maintenance costs, however the total capital expenditure will be higher. Despite this, there will be a net saving due to the large operational savings over the lifetime of the project. This is illustrated in **Figure 4**.

Net saving = Total cost of BAU case − Total cost of Solution case

Figure 4 Estimated net savings from the comparison of the BAU case and the Solution case



2.2 Financial metrics

Cash flows need to be evaluated using financial metrics to provide useful information for investment decision-making. This section outlines four common financial metrics that provide different insights into profitability, risk, and return: Net Present Value (NPV), Return on Investment (ROI), Internal Rate of Return (IRR) and Payback period. Understanding each one ensures that they can be applied appropriately to ensure the business case is communicated effectively and well-supported.

Payback
The time required for cash flows to recover an initial investment.

Application: Helps companies understand and manage cash flow, liquidity and risk exposure of projects. Answers: "When will a project reach its breakeven point?"

Return on Investment (ROI)
Measures total returns as a percentage of the initial investment.

Application: Determines how effectively the project converts investment into profit. Answers: "How much return will the company gain for every dollar invested in this project?"

Net Present Value (NPV)
The total value an investment creates in today's terms after accounting for the time value of money, expressed as an absolute monetary value (e.g. US$).

Application: Measures the value that a project creates for the company. Answers: "What is the value and financial benefit that the company will gain from this investment?"

Internal Rate of Return (IRR)
Determines the annualized return an investment generates, expressed as a percentage.

Application: Used to compare returns generated by a project to a hurdle rate or cost of capital. Answers: "Does this project generate high enough returns?"

Payback

Payback is a simple measure of how long it takes to recover an initial investment, and it is measured in years or months. The payback period provides valuable insight for cash flow planning and managing liquidity and short-term risk.

Payback (even cash flows) = Capital expenditure ÷ Net annual savings

Payback (uneven cash flows) = Last year with negative cumulative cash flow + (Remaining negative cumulative cash flow ÷ Next year's net cash inflow)

Payback is useful:

- To carry out early screening and compare different investments when quick recovery of capital and risk management is a priority.
- When used as a complementary metric to IRR, NPV and ROI, as these metrics provide insights into overall returns and value of a project.

Shorter payback periods are better than longer payback periods as it means that the project will recuperate the initial investment quicker, which reduces risk and minimises exposure to unforeseen changes in the market and technology. A "good" payback period will depend on the project and what the company considers acceptable. This is a key metric for companies with liquidity or short-term financial considerations and is especially useful for mobile network operators that operate in fast-moving markets with tight budgets.

Advantages	Limitations
• Simple calculation to understand. • Can compare multiple investment opportunities. • Serves as a useful screening metric to prioritise investment options. • Supports cash flow and risk management, as selecting projects with shorter payback periods recuperates costs quicker and reduces risk.	• Doesn't consider cash flows after the initial investment is recuperated, potentially underestimating the value and benefit of the project. • Doesn't account for the time value of money and can misinterpret the true value of an investment. • Doesn't provide insight into the profitability of a project. A project may have a short payback period but may not generate sufficient profits in the long run.

Return on Investment (ROI)

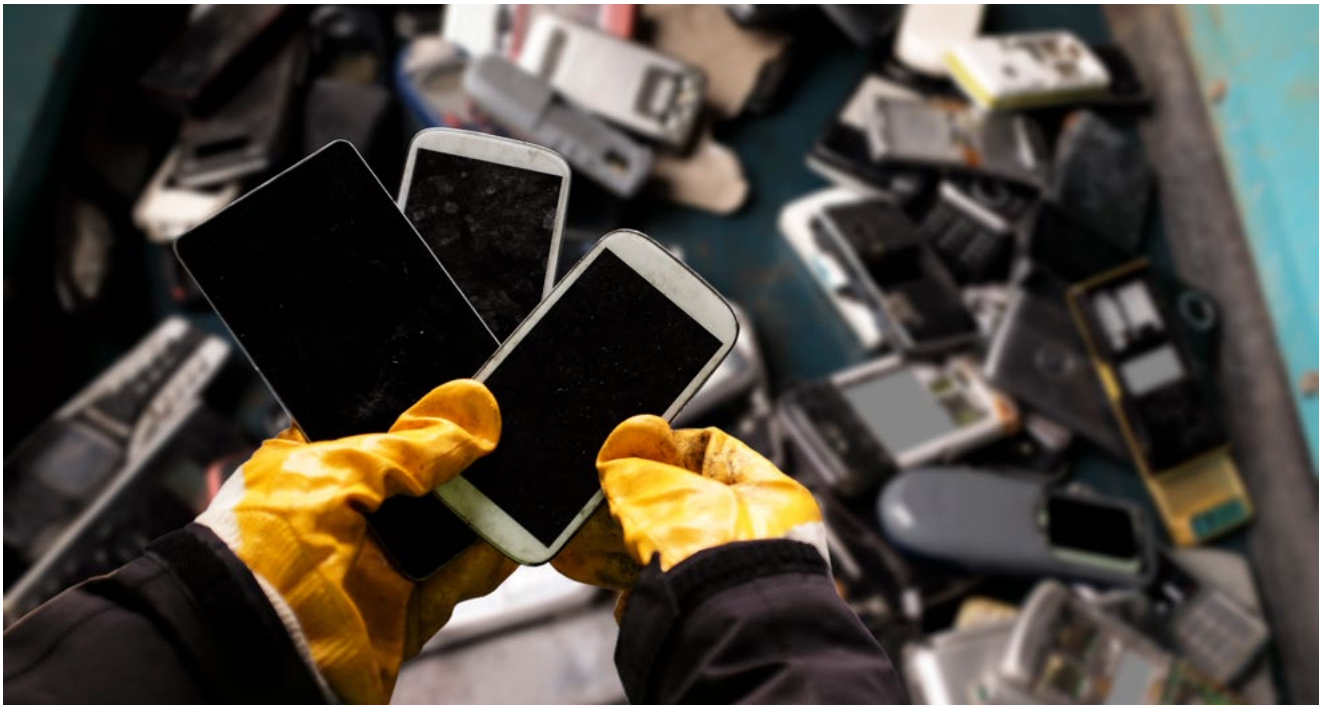
ROI is a financial metric used to evaluate the profitability of an investment by comparing its financial gain or loss relative to its cost. It assesses the potential returns from an investment and helps evaluate the financial viability of a project.

$$ROI = \frac{(\text{gains from investment - cost of investment})}{\text{cost of investment}} \times 100$$

ROI is useful:

- It provides a quick way to compare multiple projects before deeper analysis.
- It shows how much value is created per unit of investment.
- For short-term projects where timing and risk are less critical.
- It is supplementary to other metrics, such as NPV and IRR, delivering the full picture of the financial performance of a project.

Advantages	Limitations
• Simple calculation. • Can be used to compare returns from investments with different sizes and durations.	• Doesn't account for the time value of money and should be complemented by NPV and IRR. • Doesn't provide insights to manage risk.



Net Present Value (NPV)

The NPV of a project is the sum of all cash inflows and outflows over the lifespan of a project, discounted back to today's value at a rate that reflects the project's risk and the cost of capital. It is calculated using a discount rate and annual net cash flows. NPV provides a clear indication of the actual value added by the investment and the financial benefit that you will gain from the investment.

$$NPV = \sum_{i=1}^{n} \frac{R_i}{(1+r)^i} - Initial\ investment$$

Where:
Ri is the estimated net cash flow for the *i* period
R is the required rate of return per period, and
N is the life of the project in months, years, etc.
NPV in excel = NPV (Discount rate, Sum of net cash flow [excluding the initial investment]) – Initial investment

NPV is useful:

- For medium- to long-term projects where future cash flows and discounting impact value.

The key concept that NPV accounts for is that money is not worth the same over time. As many projects last for several years, one requires a metric that determines the total value of the project in today's terms. The NPV tells you whether an investment is "worth" more than its upfront cost, i.e. whether the rate of return on it exceeds your targeted returns.

If the NPV is: < 0: the project will cost the company money
= 0: the project will add no financial value to the company
> 0: the project will earn the company money

Advantages	Limitations
• Considers the time value of money when there are both immediate and future cash inflows and outflows. It is therefore well suited to evaluating long-term projects. • It accounts for project risk by taking into consideration the cost of capital and the risk inherent in making projections about the future through applying an appropriate discount rate. • It can be used for projects with variable or uneven cash flows over the time period.	• Requires an accurate cash flow projection. • For long-term projects (15–20 years), NPV becomes highly sensitive to assumptions about the discount rate, as even small changes can significantly reduce the present value of future cash flows. This underscores the importance of selecting an appropriate and defensible discount rate. • Discounting cash flow has minimal impact on short-term projects. • Not useful when comparing two projects of different size, i.e. a big project might have a larger NPV in absolute terms compared to a smaller project, however the big project might have a lower return percentage wise as compared to the smaller project.

Internal Rate of Return (IRR)

The IRR is a measure that indicates the annual rate of return that an investment is expected to earn over its lifespan. It is calculated using the net cash flows, including the initial investment.

$$IRR(\%) = \frac{(Future\ value)^{\frac{1}{Periods}}}{Present\ value} - 1$$

IRR in excel = IRR (sum of net cash flows [including initial investment])

IRR is useful:

- If you have to compare one project with another that has different cash flows over the same time period.

The higher the IRR, the more desirable the project is to invest in. What constitutes a "good" IRR varies with industry, company and risk factors. The IRR must be compared to the Weighted Average Cost of Capital (WACC)[2] or an internally set "hurdle rate" to determine if the investment is good or not:

If your required return (e.g. WACC) is **lower than IRR**, the project adds value (NPV > 0)

If your required return is **higher than IRR**, the project does not add value (NPV < 0)

IRR can only be calculated when there is an initial investment or net cost, i.e. when there is negative cash flows. If a project creates a positive cash flow from year 1, NPV would be the only financial metric to show the financial benefit.

Advantages	Limitations
• Gives a single percentage future, which is useful when comparing different investments. • Considers all cash flows i.e. cash flows after the payback period has been reached.	• Doesn't account for different project sizes, i.e. a large project might have a lower IRR percentage as compared to a smaller project, but provides a larger financial return in absolute terms. • Not suitable to compare projects with different time-frames. Since IRR measures a rate of return rather than total value created, a short project may show a higher IRR than a longer project even if the longer project is financially superior.

[2] A firms Weighted Average Cost of Capital (WACC) represents its blended cost of capital across all sources, including common shares, preferred shares, and debt. Source: Corporate Finance Institute

Example: When considering the hybrid diesel-solar PV and battery system example, the financial appraisal can be created for the four indicators. The calculated metrics are:

Financial metric	Value
IRR (20 years)	19%
NPV	$18,350
ROI	325%
Payback	4.73

This project is projected to generate a 19% return per year over its lifetime. If the company's hurdle rate is lower than 19% (e.g. 11%), this project exceeds that threshold and is considered financially attractive. An NPV of $18,350 means that, after accounting for the time value of money, the project is expected to add $18,334 in today's terms to the company in financial value. A positive NPV indicates the investment is expected to generate more value than it costs, making it a financially sound decision. The ROI is 325%, meaning the project will yield $3.25 in profit for every $1 invested. This is a strong indicator of profitability and efficiency in converting investment into returns. The payback period is approximately four years and nine months; after this point, all subsequent returns contribute directly to profit. However, if the company does not favour projects that have a payback period longer than, for example, four years, the project may therefore be less attractive.

Appendices 1 (page 51) and **2** (page 58) illustrate how this is applied in the context of additional carbon reduction measures (Physical PPA and Device Circularity).

3 Scenario building – Integrating climate risks, opportunities and dependencies

3.1 The value of analysing scenarios

The previous section explained the fundamentals of building a business case. With clean energy technologies becoming increasingly cost competitive, many carbon reduction measures deliver attractive returns, and financial analysis of a single scenario can justify the business case. However, for business cases that are borderline, a scenario analysis can help strengthen the case for investment.

This scenario analysis focuses on Transition Risks and Opportunities (TROs)[3]. TROs are the risks and opportunities facing the business as they align the company with the shifts in energy markets, technology, and policy towards a low-carbon economy. Finance teams may also want scenario analysis to include other factors beyond climate, such as market volatility or changing interest rates, as part of the business case, but this is not considered in this section. Finance teams will typically be able to provide guidance about which scenarios to analyse.

In the transition to a low-carbon economy, the cost of carbon-intensive activities is expected to rise through mechanisms, such as carbon pricing and stricter regulations, increasing the risk of not acting. At the same time, changes in technologies and customer preferences create opportunities for new revenue streams.

Why enterprise-wide scenario analysis cannot be directly applied to a business case

1. The analysis is often focused on a longer time horizon than most business cases.
2. The scenarios used are not sufficiently granular to isolate the impact on a business case or only focus on enterprise-wide impacts.
3. The focus is often on stress scenarios, which make unrealistically ambitious assumptions about climate policy.

Many mobile network operators already identify, analyse and disclose the TROs most relevant to their business as part of their internal climate risk analysis. This has been driven by voluntary disclosure requirements first under the Taskforce for Climate-related Financial Disclosure (TCFD) and, since 2023, under the International Financial Reporting Standards (IFRS) S2 disclosure standard, which is increasingly becoming mandatory in many geographies[4].

[3] More detail on TROs can be found from the IFRS here: Sustainability-related risks and opportunities and the disclosure of material information.
[4] See IFRS - ISSB and TCFD for an explanation of the disclosure standards. The International Transition Plan Network provides an interactive map that includes the state of disclosure requirements in different jurisdictions: Interactive Map - ITPN.

However, these processes typically focus on long-term analysis of the degree of exposure to TROs with a different methodology than what would commonly be used for a business case (see footnote for further reading[5]). This section aims to translate the enterprise-wide scenario analysis used in a transition plan into a methodology that can be incorporated into business cases for individual carbon reduction measures.

To implement scenario analysis in practice, it is helpful to include three scenarios in the business case. The middle scenario, i.e. the base case, is what was calculated in Section 2 and represents the most likely financial impact of the carbon reduction measure. This section introduces how to calculate an optimistic case, where TROs materialise faster than expected to create a financial upside, and a pessimistic case, where TROs materialise less than expected in the base case (**Table 7**). The latter means that climate action proceeds slower than expected, and factors that the base case depends on – the 'dependencies' – fail to materialise, creating a financial downside.

Table 7 Using three scenarios for the business case

Pessimistic case	Base case	Optimistic case
A scenario where climate action is weaker than expected and so dependencies fail to materialise. This could be a weakening of policy, removal of financial support, or delays to required low-carbon infrastructure. This scenario helps assess downside risk exposure.	The most likely outcome based on current assumptions and expected conditions. It represents the scenario you believe will happen if everything goes as planned.	A scenario where climate action is accelerated with effects such as higher revenues from low-carbon products or increased carbon taxes increasing savings. It shows the potential upside if favourable conditions occur.

[5] For a longer discussion of how transition planning and financial planning differ, see Accounting for Sustainability: Aligning Transition Planning with Financial Planning.

3.2 Building the optimistic case

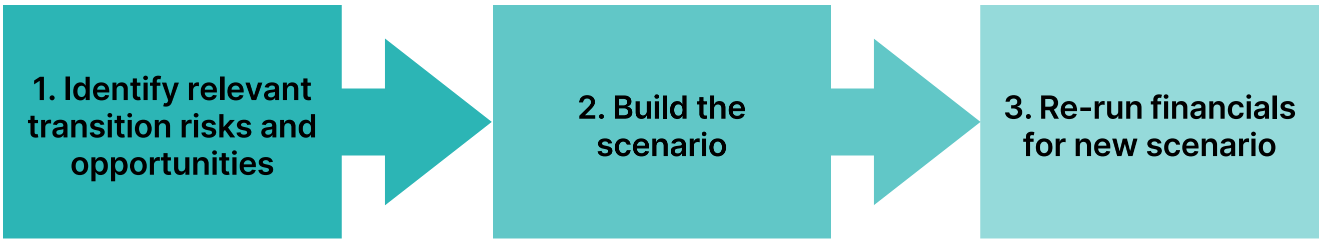
The optimistic case illustrates the potential increase in returns if conditions turn out more favourable than expected from the value of capturing transition opportunities and avoiding transition risks. These arise from uncertainties related to changes in regulations, consumer preferences, technological developments, and investor expectations related to the transition to the low-carbon economy. The risks and opportunities can significantly affect a business but are rarely included in the base case, which focuses on the most likely future scenario.

Often transition risks and opportunities are more relevant to the business case than physical risks. Physical risks refer to climate impacts, such as storms or heatwaves. These typically require adaptation efforts and are not mitigated through decarbonisation because climate change is driven by global emissions and not by the decarbonisation initiatives of one operator.

There are exceptions where decarbonisation projects can also reduce physical risk, such as on-site production of clean electricity, reducing reliance on the electricity grid that can be vulnerable to extreme weather events. However, such cases are rarely material and are therefore not covered in this handbook.

To analyse how TROs can shift the business case, there are three key steps (**Figure 5**):

Figure 5 Three steps in building the optimistic case



Identify relevant transition risks and opportunities

TROs fall into three categories: policy, technology and market. **Table 8** presents some common transition risks within each category and its impact on the calculated cash flow.

Table 8 Common transition risks and assessment questions to help identify them

Category	Transition risk and opportunity	Impact on measure cash flow	Assessment questions
Policy	Introduction or expansion of carbon pricing	Increases operating costs for business-as-usual, making low-carbon measures more cost-competitive.	Could the emissions avoided by the measure be in scope of a carbon pricing scheme?
	Introduction or expansion of subsidies for the measure	Reduces CAPEX or OPEX, improving measure returns and increasing the cost of not acting.	Are there any relevant subsidy schemes in place or has there been any discussion of introducing such schemes?
	Removal of subsidies for fossil fuels	Raises baseline energy costs, increasing savings from low-carbon measures.	Does the measure reduce reliance on subsidised fossil fuels?
	Stricter emissions standards for operations or value chain	Shortens expected lifetime of current assets, increasing risk of stranded CAPEX; may require reinvestment sooner.	Are there any trends or announcements of increasing emissions standards affecting current assets?
Technology	Rapid innovation making current solutions obsolete	Reduces residual value of existing assets, increasing comparative attractiveness of new measure.	Could existing equipment lose value or become unusable if technology standards change?
	Faster low-carbon innovation improving the economics	Reduces CAPEX or OPEX, improving measure returns and increasing the cost of not acting.	Are low-carbon technologies being used that are currently seeing significant innovation?
Market	Increase and volatility in fossil fuel and electricity prices	Higher baseline OPEX improves cost savings from clean energy projects and volatility adds a benefit of hedging.	Does the measure reduce the reliance on fossil fuels or electricity?
	Increased cost of inputs, such as raw materials	Raises CAPEX for measures dependent on scarce materials.	Does the measure reduce the use of raw materials?
	Increased willingness to pay for low-carbon solutions	Potential revenue uplift for measures tied to customer-facing products/services.	Are low-carbon products being sold as part of the project?

Build the scenario

The impact of the TROs needs to be assessed by understanding how each TRO can materialise in practice. To create a credible scenario, there are two useful options: backwards-looking and forwards-looking. The backwards-looking option leverages a recent event to illustrate the potential impact if this event happens again.

As an example, a scenario for the risk of increasing wholesale power prices in a European market can be constructed based on the historical data of wholesale power price increases after the Russian invasion of Ukraine. Backwards-looking options are typically useful if the risk in question is linked to market dynamics, because it helps illustrate how these have played out in the past.

The forwards-looking approach typically relies on announced policy or pledges to exemplify a particular risk. The base case typically includes policies already implemented or likely to be implemented. A scenario can be constructed that instead focuses on the impact of policies that have been announced but are uncertain, or where a political pledge has been made but without concrete policy yet having been announced.

An example could be governments deciding to introduce a new carbon pricing scheme to help realise their long-term pledge of reaching net zero emissions. This is for instance expected to be the case in various Southeast Asian economies[6].

Top tip

Don't include too many TROs as part of your scenario analysis; focus only on the most material ones.

Re-run the financials

To model the optimistic case, the same methodology and financial metrics are used as in Section 2, but the cash flow is adjusted based on the impact of the TRO. To model how the cash flow changes, the variation from the forecast used for the base case needs to be calculated. If using a recent event to model the value of risk avoidance, historical data can be taken for that event to see how strongly the relevant variable was impacted compared to the price level (Illustrated by the physical PPA worked example in Appendix 1). An assumption could then be made that the divergence from the forecast will apply to the same extent. If using an announcement, such as a policy change, it can be more difficult to source data, but national and international agencies as well as data providers often provide estimates that can be used. This could for instance be the impact on carbon prices or energy prices.

6 For more information see Ember's discussion of carbon market developments in Southeast Asia: Ember. Voluntary carbon markets are also growing in Southeast Asia: The Carbon Trust.

Applying it to the worked example

The key climate transition risks that a hybrid diesel–solar PV and battery system can mitigate include policy and market risks, while climate transition opportunities can include technology innovation.

Under policy risk, a carbon price of fuel is introduced and is modelled as an additional 13% of the diesel price per litre, illustrating the cost exposure of continuing with diesel-only generation. Market risk is addressed by modelling short-term cost spikes and medium- to long-term diesel price increases of 1–2% above inflation, reflecting volatility in fuel markets.

For technology opportunity, the optimistic case assumes faster low-carbon innovation, with battery technology achieving a +2% annual cost reduction, strengthening the economics of hybridisation over time. By comparing these avoided costs and technology gains against the baseline scenario, the analysis demonstrates how hybridisation mitigates transition risks while capturing opportunities for cost stability and low-carbon innovation.

Cost savings
= lower current spend
Reductions in costs you are currently incurring today

Avoided costs
= eliminate future spend
Future costs you do not end up incurring because a project prevents them

Appendices 1 (page 51) and **2** (page 58) illustrate how this is applied in the context of additional carbon reduction measures (Physical PPA and Device Circularity).

Category	Transition risk/opportunity	Optimistic case modelling assumptions[7]
Policy	Carbon pricing	Higher fuel costs: carbon pricing introduced at 13% of price per litre
Technology	Faster low-carbon innovation	Faster battery technology learning rate (+2% cost reduction)
Market	Diesel price volatility	Short-term cost spikes; diesel prices rise 1–2% above inflation in medium/long term

When re-running the financials, the cash flows change and the financial metrics improve. Payback period dropped below four years, NPV almost doubled and the IRR increased to 24%.

Indicator	Base case	Optimistic case
IRR (20yrs)	19%	24%
NPV	$18,350	$35,588
ROI	325%	537%
Payback	4.73	4.32

7 All values used are illustrative, representative inputs used solely for demonstration. Actual values will differ by country and company context.

3.3 Building the pessimistic case

The pessimistic case illustrates the potential reduction in the calculated return if key dependencies do not hold as expected. Dependencies matter because they represent conditions that must hold true for the base case to be accurate. The three steps to analysing the pessimistic case are the same as for the optimistic: identify the dependencies, set-up the scenario and model the impact on cash flow.

Identify relevant dependencies

It is necessary to understand the key dependencies that underpin the financial assumptions of the base case. Common examples include the continuation of subsidies or tax incentives, timely delivery of grid connections or the reliable performance of new technologies. For instance, a project may assume that a government subsidy remains in place or that a new low-carbon technology becomes commercially available. If these conditions fail, the financial impact can be significant. **Table 9** shows the main types of dependencies for climate business cases as well as the questions to ask to help identify dependencies built into the business case.

Table 9 Types of dependencies in climate business cases

Type of dependency	Descriptions	Assessment questions
Policy and Regulation	The project may depend on specific policies or subsidies that if withdrawn may significantly weaken the project economics, such as subsidies for renewable energy deployment.	Does the measure currently benefit from any subsidy or tax incentive?
Market	Some measures depend on consumer behaviour, particularly their interests in and willingness to pay for more sustainable products or services. One example might be second-hand devices. If market demand does not materialise as expected, projected revenues may fall short.	Is it assumed that customers would pay a premium for the measure’s products or services?
Technology	When deploying newer technology, there is a risk that performance may fall short of expectations. For example, a battery may prove less durable than anticipated. This increases operational risks and reduces expected benefits.	Does the measure rely on newer technology that could underperform?
Infrastructure	Many climate initiatives depend on supporting infrastructure beyond the project’s control, such as grid capacity or charging networks for electric vehicles. The project may face bottlenecks that delay it becoming operational.	Does the measure depend on the development of any local infrastructure?

Build the scenario

A scenario is constructed to reflect what could happen if one or more of these conditions change. As with the optimistic case, a pessimistic case can use data for past events or anchor it to possible future events. Dependencies on factors, such as infrastructure or technology, are well-suited to leveraging data from past events.

For example, a project might depend on a new grid connection being completed on schedule, but experience shows such infrastructure can be delayed by several years. Similarly, a measure could rely on an existing subsidy scheme continuing, yet political cycles, such as an upcoming election, could lead to its removal within that time frame.

Re-run the financials

The scenario is translated into cash flow impacts by capturing changes in the inputs of the base case. Continuing the example above of a subsidy being discontinued, the impact depends on whether the subsidy is applied to the CAPEX, OPEX or revenue. This variable is then adjusted in the cash flow analysis, and the financial metrics are re-calculated.

Top tip

Where precise data isn't available or possible, these reductions can be reasonable, judgement-based deviations, but they should be grounded in plausible rationale and validated internally.

Applying it to the worked examples

Key dependencies for a hybrid diesel–solar PV and battery system include technology and market factors. Technology risk is captured by assuming lower system performance, where batteries and PV replace 20% less diesel than anticipated per installation, reducing expected fuel savings.

Market risk is addressed by modelling a slowdown in technology cost reductions, where battery costs fail to decline as projected and instead track inflation. This could be because of raw material price pressures and slower innovation.

By incorporating these pessimistic assumptions into the analysis, the business case demonstrates resilience under adverse conditions and highlights the importance of risk mitigation strategies, such as performance guarantees.

Category	Dependencies	Pessimistic case modelling assumptions[8]
Technology	Lower performance of technology	Technology and batteries replace less diesel than anticipated (-20% diesel replaced per installation).
Market	Slowdown of technology cost reduction	Battery costs do not reduce as expected due to pressure on raw material prices and slower technology improvements (costs of battery technology reduces below or equal to inflation rates).

When the financials are re-run, the cash flows and financial indicators worsen. Payback period extends beyond five years, NPV falls by almost a quarter, and IRR drops to 17%.

Financial metric	Pessimistic case	Base case	Optimistic case
IRR (20 years)	17%	19%	24%
NPV	$14,311	$18,350	$35,588
ROI	288%	325%	537%
Payback	5.55	4.73	4.32

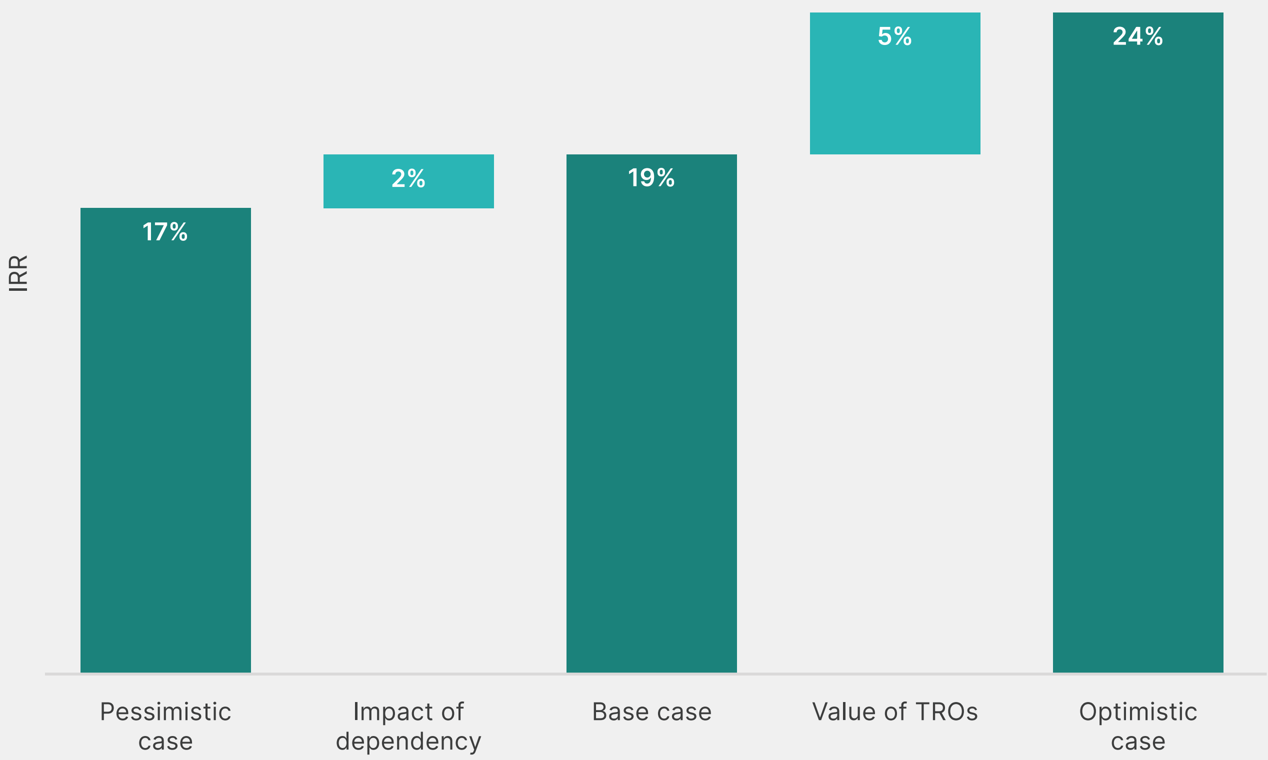
Appendices 1 (page 51) and **2** (page 58) illustrate how this is applied in the context of additional carbon reduction measures (Physical PPA and Device Circularity).

[8] All values used are illustrative, representative inputs used solely for demonstration. Actual values will differ by country and company context.

3.4. Interpreting the results

Once the financial results for the base, optimistic and pessimistic case have been calculated, the business case now shows a range of possible returns rather than a single figure. This is valuable because it reflects uncertainty and demonstrates that risks and opportunities to the measure have been considered. **Figure 6** illustrates what this might look like.

Figure 6 Showing the financial results in each of the three scenarios



The results illustrate that the return does not shift significantly in the pessimistic and optimistic cases, reflecting a lower-risk project profile where the project is expected to pay back the investment across all scenarios.

If there are multiple relevant TROs or dependencies to consider, additional scenarios can be added. By modelling a scenario for every TRO or dependency, the impact of each can be isolated. However, to maintain ease of interpretation, presenting the business case with three scenarios is often sufficient. Rather than assigning probabilities to each scenario, which is often impractical (as it depends on a variety of policy, technology and market dynamics), interpreting the results should focus on how sensitive the results are to the scenarios modelled.

If the pessimistic case still delivers a reasonable rate of return, the project is resilient even if external conditions deteriorate. At the same time, if the optimistic case shows a substantial improvement in returns, the measure becomes more compelling. Such a result can strengthen the case for approval when presenting the business case internally.

4 Extending value – Incorporating non-financial benefits

Decarbonisation projects can create value for telecommunications companies beyond the direct benefits of the measures being implemented. Indirect non-financial benefits are often ignored as they are harder to quantify. Nevertheless, they can usefully strengthen a business case and are important to consider for practitioners developing a business case to assess and communicate these areas of value creation.

Potential areas of non-financial value created by decarbonisation projects and initiatives include:

Non-financial benefit	Description
Supporting corporate goals and strategy	Enabling delivery of sustainability goals and helping meet climate targets or supporting key pillars of corporate strategy.
Brand reputation and customer loyalty	High-visibility projects can create the potential for positive coverage and demonstrate corporate values in practice.
Competitiveness	Ensuring that the company keeps pace with competitor practices or providing distinctive advantages that enhance its ability to compete.
Investor confidence and ESG finance	Enabling the company to meet investor expectations or enabling the company to attract new sources of investment and financing.
Resilience	Enhancing the company's ability to manage and navigate external pressure and systemic shocks (market, financial, climate-related).
Regulatory compliance	Enabling the company to stay ahead of future regulatory requirements impacting the sector.

4.1 Identifying areas of value creation

To assess the areas of indirect value a carbon reduction measure may generate, companies need to identify links between the measures implemented and company's value drivers. **Table 10** outlines a set of value drivers and accompanying questions that practitioners can use to assess whether strong and credible linkages exist between the project and the broader benefits to the company.

Table 10 Mapping non-financial benefits to value drivers

Non-financial benefit	Value drivers	Assessment considerations
Supporting corporate goals and strategy	All	• Does the measure support/fulfil key organisational strategy commitments? • Does the measure support a long-term strategic goal? • Is the measure a longer-term opportunity? • Does the measure build a desired future capability or business model?
Brand reputation and customer loyalty	Increase/protect revenues Increase profitability Enhance customer engagement	• Does the measure provide an opportunity for positive promotion of the brand? • Could a lack of action lead to negative perspectives, particularly in comparison to peers? • Does the measure enhance your value to your customer base? • Could key customers move to competitors if they are not implemented? • Does the measure provide opportunities to promote/ collaborate with your customers?
Competitiveness	Increase revenues Increase profitability	• Does the measure support/build your relationship with key value chain players? • Does the measure provide a differentiator to your competition?
Investor confidence and ESG finance	Reduce cost of capital New investment sources	• Does the measure provide an opportunity to qualify for sustainability-linked finance? • Does the measure improve transparency and/or strengthen position with sustainable investors or credit rating agencies?
Resilience	Protect revenues Reduced risk exposure	• Does the measure reduce the risk of outages? • Does the measure protect against supply chain disruptions?
Regulatory compliance	Alignment with future regulation	• Does the measure align with current and near-term sustainability regulation?

Applying it to the worked example

Implementing a hybrid diesel–solar PV and battery system delivers significant non-financial benefits beyond cost savings. It directly supports corporate strategic goals by reducing reliance on fossil fuels and enacting a key action in Climate Transition Plans, essential for meeting science-based targets (SBTs).

This measure also enhances resilience by lowering market exposure to diesel price volatility and reducing supply chain disruption risks. From an investor perspective, hybridisation demonstrates a strong commitment to decarbonisation and energy independence. These qualitative benefits, aligned with corporate strategy, resilience and investor confidence, strengthen the case for investment and are outlined in **Table 11** below.

Top tip

Engaging teams across the business can help identify value creation opportunities, such as ESG-linked investor insights from Investor Relations and changing customer expectations from Sales.

Table 11 Qualitative assessment matrix for the diesel genset conversion

Non-financial benefit	Example strategic goals	Qualitative assessment
Supporting corporate goals and strategy	Reduce fossil fuel reliance Enactment of climate transition plan	Aligns with corporate strategy to reduce Scope 1 emissions in line with transition plans and support achieving SBTs.
Resilience	Enactment of climate transition plan	Reduces market exposure to volatile diesel prices and exposure to diesel fuel supply chain disruption.
Investor confidence and ESG finance	Reduce fossil fuel reliance Commitment to decarbonisation	Provides investor reassurance of increasing energy independence and reduced reliance on fossil fuels. Improved ESG ratings from agencies (MSCI, etc.).

4.2 Assessing indirect or intangible benefits

Quantifying non-financial benefits is challenging and not always possible. Where a strong linkage can be made between a carbon reduction measure and an area of indirect value, this can be communicated through a qualitative assessment. Where possible, value can be quantified by utilising benchmarks or proxy data (e.g. instances when a similar impact occurred in the past or by using internal or external case studies).

Table 12 below outlines potential metrics and quantification approaches for assessing the indirect value created by decarbonisation initiatives for the diesel genset worked example.

Table 12 Qualitative assessment matrix with example quantification metrics for a diesel genset conversion

Non-financial benefit	Example strategic goals	Qualitative assessment	Optional quantification*
Resilience	Market resilience Reduced risk exposure	Reduces market exposure to volatile diesel prices and exposure to diesel fuel supply chain disruption.	-5% supply chain risk index
Investor confidence and ESG finance	Reduce fossil fuel reliance. Commitment to decarbonisation	Provides investor reassurance of increasing energy independence and reduced reliance on fossil fuels. Improved ESG ratings from agencies (MSCI, etc.).	+5% ESG rating

*Estimated impacts are illustrative and not based on actual data.

4.3 Incorporating non-financial benefits

The assessment of non-financial benefits requires a clear summary narrative to support the business case. This can include both the qualitative and quantitative assessments if available, and it should focus on the highest impact benefits. Often, a strategic value statement can clearly and simply communicate the additional non-financial benefits of the measure. For example:

“Beyond financial returns, this measure creates significant strategic value for the business. It directly aligns with our sustainability commitments and wider ESG goals and strengthens our position relative to our competitors by showcasing our climate leadership through purchasing renewable energy and communicating this with customers. It also builds trust with our stakeholders and investors by demonstrating our commitment to reaching net zero while shoring up our energy supply.”

There are further details on the types of non-financial benefits defined above on the following pages. This can be used to support qualitative and quantitative assessment.

Supporting corporate goals and strategy

Stakeholders expect companies to deliver on publicised strategies and, therefore, a carbon reduction measure that supports the corporate strategy can be valuable beyond its financial impact.

A business case should directly link the measure to items in a Climate Transition Plan and demonstrate how it will progress the business towards its sustainability goals.

Each measure should be considered in relation to the long-term strategy as some measures may be enablers for long-term strategic opportunities. In these cases, the carbon reduction measure can be structured as a pilot project to reduce exposure to financial risks while generating the valuable insights needed.

Brand reputation and customer loyalty

Brand reputation can have a significant impact on how likely the public is to purchase a company's goods and services. A recent study found 81% of consumers expect companies to improve the environment; those that don't, risk losing market share[9]. Assessing the impact of a carbon reduction measure on brand reputation and customer loyalty will require engagement with marketing teams that are experienced at dealing with these topics. Additional measures and indicators to be aware of include:

- ESG ratings (CDP, EcoVadis, etc.)
- Media sentiment analysis
- Net Promoter Score (NPS)
- Targeted surveys

Methods, such as sentiment analysis and customer perception surveys, can be applied during pilot trials to indicate the potential impacts of carbon reduction measures.

Competitiveness

Remaining competitive in the telecoms market increasingly depends on a business' sustainability credentials and actions. Many businesses and governments now include ESG criteria in their procurement processes, with preference for network operators with credible Climate Transition Plans.

Quantification typically uses traditional financial metrics, such as sales, B2B wins and market share values. By assessing recent tender wins and losses, measurement of your business' competitiveness can be linked to scores on ESG sections in RFPs, as well as feedback from procurement teams on how your own net zero progress impacts the success of the bid.

Investor confidence and ESG finance

Strong ESG performance can unlock access to additional sustainable finance opportunities and strengthen existing investor relations. It is useful to consider how the carbon reduction measure could positively impact relationships with financial institutions and strengthen your position with green financers.

Direct sustainable financing will be considered within the business case financials. However, executing a transition plan can help mobilise finance as highlighted by guidance from the International Transition Plan Network (ITPN)[10]. Common measures and indicators include ESG ratings[11] and sustainability indexes[12].

9 The Database: What Sustainability Means Today.
10 Private-Sector-Transition-Plans-A-Critical-Tool-for-Mobilising-Finance.
11 Home - Sustainalytics.
12 Sustainability Indexes | MSCI Indexes.

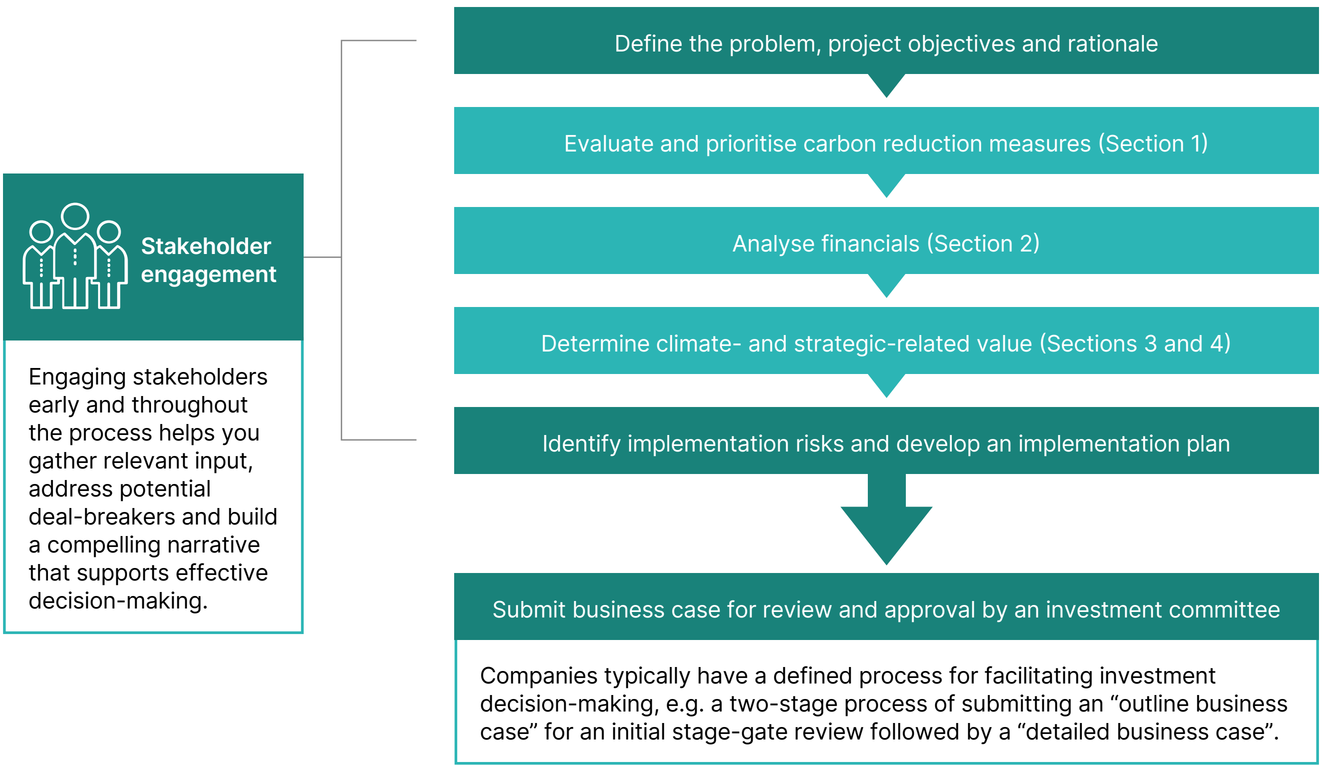
Resilience	**Regulatory compliance**
Resilience to quantifiable transition risks will be assessed in the optimistic case outlined above, however, some risks will be challenging to quantify. For example, carbon reduction measures that diversify the supply of raw materials or energy sources can improve resilience to supply chain disruption and infrastructure outages, but there may not be suitable data to quantify these impacts. It is the reason why assessing the impact on transition and physical risks qualitatively can be useful. The ITU and OECD provide a wealth of additional information on this topic. When looking to quantitatively assess these, network operators can consider climate risk assessments[13] and stress tests[14] or supply chain continuity scores.	Implementing carbon reduction measures supports alignment with regulatory frameworks, such as the European Corporate Sustainability Due Diligence Directive (CSDDD), that set mandatory requirements to mitigate adverse environmental impacts throughout their operations and supply chains. Carbon reduction measures should be considered if they prevent non-compliance or position the business favourably ahead of potential future regulation. If further assessment is desired, network operators can consider the following measures and indicators: • Audit readiness scores • Alignment with standards

[13] World Bank Climate and Disaster Risk Screening | The World Bank Climate and Disaster Risk Screening Tools.
[14] Stress Testing Supply Chain Networks at Scale.

Progressing to action

The outputs from methods covered in this handbook provide the core elements of a business case, specifically the financial and non-financial assessments and rationale for undertaking an investment. As outlined in the introduction, these outputs will form part of a business case document. The steps for developing a business case document are outlined in **Figure 7** below, with the items covered by this handbook highlighted in green.

Figure 7 Steps to develop and submit a business case for approval



Identifying implementation risks and developing an implementation plan are important considerations to ensuring projects are implemented successfully. These should therefore be included in a business case document at the appropriate level of detail and are elaborated further below:

Risk assessment and management

Within the business case document, you should identify and evaluate wider implementation risks to the project, and what mitigation approaches need to be considered. This includes documenting the potential impact of the risk, the likelihood of it occurring, and suitable risk mitigation measures. These may include, but are not limited to:

- **Operational risks:** Such as potential delays to completing the project, which can impact operations and budget.
- **Technical and engineering risks:** Such as integration challenges, inaccurate or incorrect design or specification errors, or underperforming or lower-quality components and equipment that do not meet required standards.
- **Supply chain disruption:** Such as delays in sourcing specialised or imported equipment.
- **Supplier or contractor performance issues:** Such as under performance of contractors, which might impact timelines and quality.
- **Health and safety risks:** Such as exposure to operational or environmental hazards during installation or commissioning.

Implementation planning

The implementation plan should outline timelines and how the project will be executed effectively. It should include:

- **A workplan:** A detailed timeline showing key activities, dependencies and sequencing from procurement through to commissioning.
- **Resource requirements and responsibilities:** The internal resources required (e.g. Finance, Procurement, Engineering, Operations) along with external contractors and any specialist skills needed, including clearly defined roles and responsibilities for each.
- **Stakeholder engagement plan:** An outline of which internal and external stakeholders will be engaged, including the purpose, methods, and frequency of engagement.

The implementation plan should also highlight linkages and dependencies to relevant existing or future projects and programmes (for example as part of your organisation's Climate Transition Plan).

Implementing the processes in this handbook will enable cross-functional teams to build compelling business cases and clearly articulate the value of carbon reduction measures. This will ultimately help telecommunications companies move from ambition to successful implementation of their Climate Transition Plan.

Top tip

The business cases developed are often relevant for various sustainability-related disclosure standards, such as EU Taxonomy, CSRD and IFRS S2. This may, for instance, include the CAPEX outlined in the business case that would meet EU Taxonomy thresholds for sustainable activities, as well as the need to describe key decarbonisation strategies and their financial impacts under IFRS S2.

Appendix

Appendix 1: Physical PPAs worked example

Progressing to action

Building the base case[15]

Overview

- **Business-as-usual (BAU case):** Purchasing electricity from the grid or market at standard rates.
- **Solution case:** Entering into a physical Power Purchase Agreement (PPA) contract to procure renewable energy. A physical PPA is a long-term contract between an electricity generator and an offtaker for the physical delivery of electricity. Unlike virtual PPAs or renewable energy certificates, a physical PPA ensures that the renewable electricity is delivered and consumed by the buyer through the grid.
- **Expected benefit:** PPA contracts agree an electricity price over the contract term, protecting the buyer from market volatility in electricity prices. Physical PPAs are a key means of reducing Scope 2 emissions.

Step 1: Determine input assumptions

The general, the BAU case and the Solution case input assumptions can be defined as follows:

General assumptions:

Input	Description	Value/Assumption
Contracted Volume	Annual energy purchased under the PPA	90,000 MWh/year
Contract Term	Duration of the physical PPA agreement	15 years
Discount Rate	Annual discount rate used to discount future cash flows	10%

BAU case:

The cost concerns the projection for future costs from sourcing electricity. This should be the electricity in the market that the PPA would displace. For this, a weighted average power price is needed together with a view of future prices driven by inflation.

Input	Description	Value/Assumption
Baseline Power Price	Weighted average market price without PPA	$61.5/MWh
Inflation	Annual inflation in power prices	3%

15 All values used are illustrative, representative inputs used solely for demonstration. Actual values will differ by country and company context.

Solution case:

- Modelling the Solution case requires general assumptions covering the contracted volume, term and discount rate. These cover how much electricity would be covered by the PPA and over what time horizon. This also covers the discount rate used to discount future cash flow.
- It also requires the CAPEX and OPEX of the PPA. The CAPEX is typically small and covers the project development and set-up costs. The OPEX, the cost of sourcing the electricity through the PPA, constitutes most of the total cost of electricity. This typically requires the strike price as well as an agreement on how this strike price develops over time.

Top tip

For a PPA, the business case is very sensitive to assumptions about the future electricity price in the business-as-usual scenario. Therefore, it is key to understand which internal projections are available, where energy procurement teams will typically be able to advise.

Input	Description	Value/Assumption
CAPEX: Development costs	One-off project development and setup costs, such as legal fees	$300,000
Strike price	The fixed price agreed per MWh of electricity delivered	$61/MWh
Price escalation	Annual escalation applied to PPA price	Fixed at 3%

Step 2: Map out cash outflows and inflows over the project timeline

Once the inputs have been determined, map out and calculate the cost assumptions over the 15-year PPA period.

Period	BAU case	Solution case	
	OPEX	**CAPEX**	**OPEX**
Year 0		300,000[b]	
Year 1	5,535,000[a]		5,490,000
Year 2	5,701,050		5,654,700
Year 3	5,872,082		5,824,341
Year 4	6,048,244		5,999,071[c]
Year 5	6,229,691		6,179,043
Year 6	6,416,582		6,364,415
Year 7	6,609,079		6,555,347
Year 8	6,807,352		6,752,008
Year 9	7,011,572		6,954,568
Year 10	7,221,920		7,163,205
Year X...			

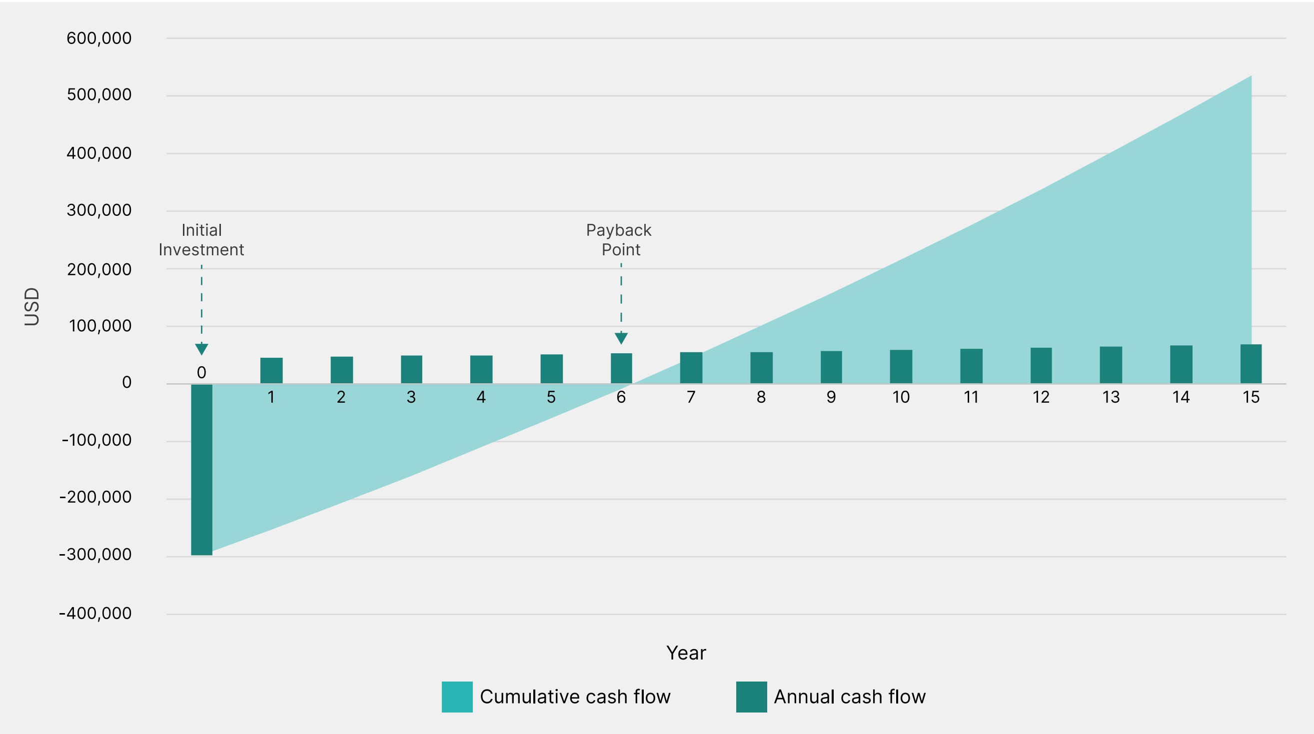
a Electricity cost under standard market conditions
b Initial development costs
c Electricity cost under PPA

Step 3: Determine the annual net and cumulative cash flows

Once the annual costs are calculated for each case, both the net and cumulative cash flows can be determined by subtracting the cost for the Solution case from the BAU case.

Period	BAU case	Solution case		Annual cash flow	Cumulative cash flow
	OPEX	CAPEX	OPEX		
Year 0		300,000		-300,000	-300,000
Year 1	5,535,000		5,490,000	45,000	-255,000
Year 2	5,701,050		5,654,700	46,350	-208,650
Year 3	5,872,082		5,824,341	47,741	-160,910
Year 4	6,048,244		5,999,071	49,173	-111,737
Year 5	6,229,691		6,179,043	50,648	-61,089
Year 6	6,416,582		6,364,415	52,167	-8,922
Year 7	6,609,079		6,555,347	53,732	44,811
Year 8	6,807,352		6,752,008	55,344	100,155
Year 9	7,011,572		6,954,568	57,005	157,160
Year 10	7,221,920		-7,163,205	58,715	215,875
Year X					

Cash flows illustrated by the chart below:



Using the net and cumulative cash flows, the financial metrics are calculated as follows:

Financial metric	Value
Internal Rate of Return (IRR)	15%
Net Present Value (NPV)	$103,904
Return on Investment (ROI)	279%
Payback (Years)	6.17

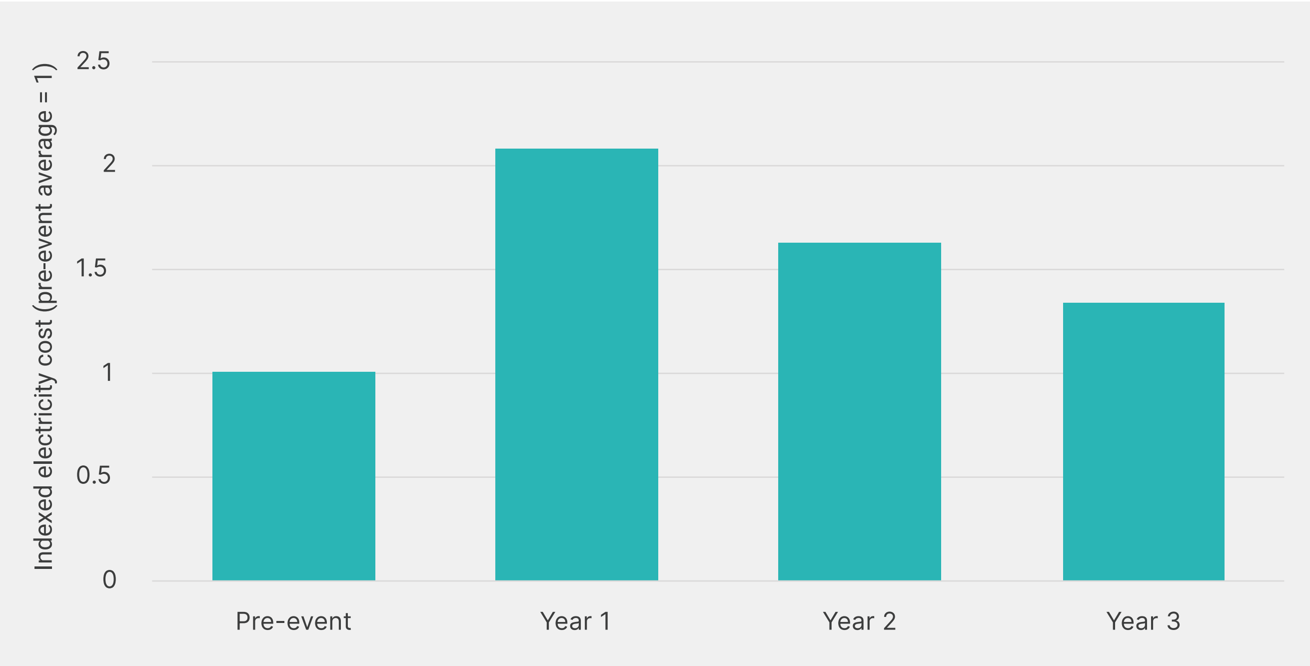
Building the optimistic scenario

The most significant transition risk a Physical PPA avoids is the risk of increasing wholesale electricity prices. This would increase energy procurement costs without the PPA. This scenario looks at two types: carbon pricing and volatility in power prices.

To calculate the impact of a carbon price on the power sector, the key inputs are the effective carbon price levied per tonne of carbon emitted as well as the average grid carbon intensity. For simplicity in this worked example, it is assumed that this increases the power price $5/MWh. In practice, however, the dynamics are more complicated, depending on the type of electricity system, the ability of operators to pass through the carbon tax and the response of electricity users.

To create a scenario for how power price volatility would impact energy procurement costs, historical data and market analysis can help quantify this exposure by showing how past volatility impacted costs. For example, the sharp increase in wholesale power prices in Europe following the Russian invasion of Ukraine provides a useful precedent for modelling extreme price movements. By comparing prices after the event has happened with a pre-event trend, a scenario can be created for how power prices would diverge and for how long. This is illustrated in the graph on the following page. To translate this into cash flow analysis, the BAU power prices can be uplifted by the same amount, to understand how the results would change if a similar scenario played out again and a physical PPA provided a hedge against this risk.

Category	Transition risk/opportunity	Optimistic case modelling assumptions
Policy	Carbon pricing	$10 per tCO_2e Grid carbon intensity of 0.5 tCO_2e/MWh
Market	Volatility in power prices	Volatility like European power price spikes in and after 2022



Building the pessimistic case

A common dependency for physical PPAs is the timely delivery of grid connections that the generation asset depends on. If this infrastructure is delayed, the project cannot operate as planned, which directly impacts cash flows. Historical data on grid delays can provide a useful precedent for modelling this risk. For example, assume a two-year delay in grid connection: during this period, the project would incur capital costs without generating the expected electricity. To build the scenario, adjust the cash flow model so that PPA delivery starts two years later than in the base case without affecting the initial development costs. This creates a pessimistic case that illustrates the downside risk of dependency failure.

Interpreting the results

With both the optimistic and pessimistic scenarios constructed for the Physical PPA, the full table of results can be created.

When interpreting the results, the positive NPV across all scenarios indicates that the project adds value even under the adverse conditions of dependencies failing. At the same time, the optimistic case demonstrates a disproportionate benefit in the optimistic case, with NPV and ROI increasing dramatically compared to the base case. Such a large swing is unusual and highlights how the results are very sensitive to changes in the electricity price assumptions, illustrating the significant value of the project to protect against future energy price spikes.

Metric	Pessimistic case	Base case	Optimistic case
Payback	7.84	6.17	1.51
ROI	249%	279%	26915%
NPV	$23,879	$103,094	$47,598,890
IRR	11%	15%	278%

Non-financial considerations

In most circumstances, the most important non-financial benefits are likely to be the alignment with corporate climate strategy, customer demand, resilience and ESG finance. Regulatory compliance may be a secondary consideration, as direct procurement of renewables is rarely mandatory. The table below outlines the qualitative assessment of each non-financial benefit as well as potential quantification approaches.

Non-financial benefit	Strategic goals	Qualitative assessment	Optional estimated quantification
Supporting corporate goals and strategy	Decarbonisation	The Physical PPA aligns with the corporate strategy to reduce Scope 2 emissions in line with the science-based targets and the Climate Transition Plan. It also helps reduce risks of tightening accounting standards around scope 2 decarbonisation instruments.	30% of transition plan reductions realised from Physical PPA
Competitiveness	Renewable energy	Sourcing a Physical PPA reflects best practice, exceeding the actions of competitors that use Renewable Energy Certificates (RECs), virtual PPAs, or nothing at all, putting the company in a leadership position.	+10 percentage point renewables sourced compared to the market average
Resilience	Market resilience	By sourcing renewable energy with secure PPAs, any internal supply chain risk scoring will reflect the increased resilience in energy supply.	-5% supply chain risk index
Investor confidence and ESG finance	Commitment to decarbonisation	Large decarbonisation efforts, such as purchasing PPAs, can affect external ESG ratings from agencies (MSCI, Sustainalytics, etc.) and signal to existing and future investors the business' climate readiness.	+5% ESG rating
Brand reputation and customer loyalty	Market leadership Revenue growth	Carbon reduction measures, such as renewable energy, can protect revenues as customers increasingly mandate it in tender documents.	30% of tenders with renewable energy targets

Appendix 2: Device circularity: Device refurbishment programme worked example

Building the base case[16]

Overview

- **BAU case:** Buying new devices from Original Equipment Manufacturers (OEMs) to be sold to customers
- **Solution case:** Network operator acquires used devices, refurbishes them and resells to customers instead of sourcing new devices.
- **Expected benefit:** By extending the life of existing devices, embodied carbon emissions and e-waste is reduced while meeting customer demand at a competitive price point. Repaired and refurbished phones typically have 80–90% lower carbon emissions than new phones[17].

Top tip

Since wholesale and retail prices vary according to the brand and model of each device, each device brand and model should be modelled separately to ensure accuracy and account for different margins.

Step 1: Determine input assumptions

A device refurbishment programme not only has cash outflows but also generates revenue, therefore cash inflows should be accounted for. The general, BAU and Solution case input assumptions are defined as follows:

General assumptions:

The projected volumes of devices to be refurbished and sold per year should account for declining demand as newer device models enter the market.

Input	Description	Value/Assumption
Device volumes	Number of handsets, per device type, that that will be refurbished in a year	5,000 per year
Change in device sales volumes	Annual change in the sales volumes of a particular device type	15% decline in sales volumes each year
General CPI	Annual inflation applied if not specified otherwise	4%
Discount rate	Annual rate used to discount future cash flows	10%
Duration	Time horizon for the business case	5 years

16 All values used are illustrative, representative inputs used solely for demonstration. Actual values will differ by country and company context.
17 GSMA. 2025. Rethinking Mobile Phones: The business case for circularity

BAU case:

The costs and revenues reflect the wholesale and retail prices at which new devices are purchased and sold. Projections for wholesale acquisition cost and retail price should be adjusted over time to reflect the introduction of newer technology and downward trends in the price of older devices.

Type	Input	Description	Value/Assumption
Cash outflows	Cost of Goods and Services (COGS): new device acquisition cost	The wholesale cost of purchasing a new device	$700, reduced at 12.5% annually
Cash inflows	New device sales revenue	The retail price of a new device	$800, reduced at 12.5% annually

Solution case:

Modelling the Solution case requires several costs and revenue assumptions covering, CAPEX, the cost of acquiring the devices and reverse logistics and refurbishment costs:

- Factor in any capital costs for programme set-up, such as:
  - Refurbishment operations
  - IT system integration
- Account for reverse logistics costs, which should be escalated annually with the CPI.
- Adjust the buy-back price for used devices to reflect a decrease in device values over time.
- Refurbishment costs should be adjusted to increase over time, as they depend on the device's age and condition:
  - Newer devices may only need minor work
  - Older devices may require more extensive refurbishment, such as battery replacement or other significant repairs
- Revise selling prices for refurbished devices downwards over time, as new models become available and device values decrease.

In practice, the dynamics for the costs and revenues may be more complicated, however for simplicity the following assumptions are applied:

Type	Input	Description	Value/Assumption
Cash outflows	CAPEX: development costs	One-off IT system integration costs, such as device tracking, inventory management and data wiping compliance; reverse logistics costs; quality control equipment	$200,000
	COGS: device acquisition cost	The cost to buy back used devices	Initially 50% of retail cost, and reduced 5% each year
	OPEX: device refurbishment cost	Cost to refurbish devices before reselling. Cost is per handset	$50, escalated by 5% per year due to devices requiring more repairs the older they get (up to a point where a decision is made to scrap/recycle)
	OPEX: other costs	Reverse logistics per handset (e.g. collection and transportation). Escalated by CPI inflation	$10
Cash inflows	Refurbished device sales revenue	Selling price of refurbished devices	$560, assumed at 70% of original retail price and reduced by 3.5% each year

Step 2: Map out cost assumptions over the project timeline

Once the input assumptions have been determined, map out and calculate the cash flows over the defined period. Given how often new devices are launched, the duration is expected to be considerably shorter than for other carbon mitigation initiatives, such as physical PPAs and on-site solar PV, which typically span up to 20 years.

	BAU case		Solution case				
	Cash outflows	Cash inflows	Cash outflows				Cash inflows
Period	**Acquisition costs**	**Revenue**	**CAPEX**	**Reserve logistics**	**Acquisition costs**	**Refurbishment costs**	**Revenue**
Year 0			200,000				
Year 1	3,062,500	3,500,000		50,000	2,000,000	250,000	2,800,000
Year 2	2,277,734	2,603,125		44,200	1,530,000	223,125	2,261,000
Year 3	1,694,065	1,936,074		39,073	1,156,000	199,139	1,820,700
Year X							

Step 3: Determine the annual net and cumulative cash flows

Once the annual costs and revenues have been determined for each case, both the net and cumulative cash flows can be determined.

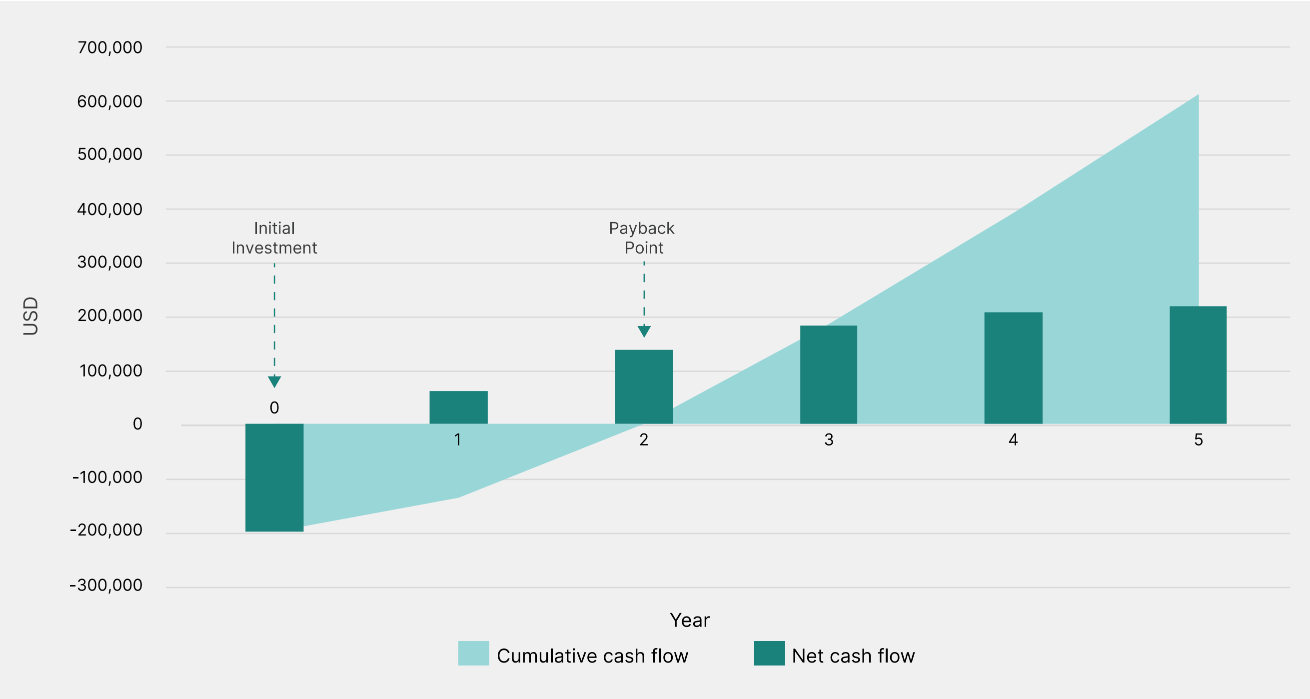
For a device refurbishment programme, there is an additional step to determine net cash flows: Both the BAU case (linear model) and the Solution case (circularity model) have their own distinct cash flow because each involves both cash inflows and outflows. To evaluate the financial impact of the Solution case compared to the BAU case, the difference (delta) between the BAU case's net cash flow and the Solution case's net cash flows needs to be determined. This delta cash flow represents the incremental financial benefit (or cost) of adopting the Solution case and serves as the key input for further financial analyses, such as IRR and NPV calculations.

	BAU case			Solution case					
	Cash outflows	Cash inflows		Cash outflows				Cash inflows	
Period	Acquisition costs	Revenue	Net cash flow	CAPEX	Reserve logistics	Acquisition costs	Refurbishment costs	Revenue	Net cash flow
Year 0				200,000					-200,000
Year 1	3,062,500	3,500,000	437,500		50,000	2,000,000	250,000	2,800,000	500,000
Year 2	2,277,734	2,603,125	325,391		44,200	1,530,000	223,125	2,261,000	463,675
Year 3	1,694,065	1,936,074	242,009		39,073	1,156,000	199,139	1,820,700	426,488
Year X									

The delta net cash flow is determined by subtracting the Solution case's net cash flow from the BAU case's net cash flow:

Period	BAU Net CF	Solution Net CF	Δ Net CF	Cumulative Δ Net CF
Year 0		-200,000	-200,000	-200,000
Year 1	437,500	500,000	62,500	-137,500
Year 2	325,391	416,500	91,109	-46,391
Year 3	242,009	334,995	92,986	46,595
Year X				

The annual net and cumulative delta cash flows are illustrated visually in a chart below. The initial investment is gradually recuperated through the increased unit cash margin generated from selling refurbished devices:



Using the delta net annual and cumulative cash flows, the financial appraisal for the four indicators is as follows:

Financial metric	Value
Financial metric	57%
Internal Rate of Return (IRR)	$389,361
Net Present Value (NPV)	307%
Return on Investment (ROI)	2

Building the optimistic scenario

Device refurbishment programmes can mitigate exposure to embodied carbon in new device manufacturing and regulatory risk exposure under evolving environmental regulations and Extended Producer Responsibility (EPR) schemes.

- To quantify a carbon price, the modelling applies an internal carbon price of $50 per tonne CO_2e and assumes each handset carries 50 kg of embedded CO_2e. This internal carbon price is added to the cost of acquiring the new devices. This allows the refurbishment programme's climate benefit to be expressed in financial terms, reflecting the cost that would otherwise be incurred if carbon pricing in the supply chain of new device procurement was introduced.
- Should future regulations pertaining to EPR be introduced, there could be a risk of receiving penalties for non-compliance. A one-off EPR penalty of $100,000 has been assumed to illustrate the compliance risk of continuing with business-as-usual. By comparing these avoided costs against the baseline scenario, the analysis demonstrates how circularity can mitigate both carbon exposure and regulatory penalties, strengthening the case for investment.

Category	Transition risk/opportunity	Optimistic case modelling assumptions
Policy	Carbon pricing Non-compliance penalties	$50 per tCO_2e Embedded carbon of handset assumed to be 50 $kgCO_2e$ One-off penalty of $100,000

Building the pessimistic scenario

A common dependency for a device refurbishment programme is customer willingness to pay for refurbished devices at the target price point. If customers perceive refurbished phones as less desirable or overpriced, sales volumes will fall short of projections, directly impacting revenue and margins. For this example, we assume a scenario where customers are not willing to pay the assumed retail value for a refurbished phone, and this willingness reduces even more with time as compared to the base case, while leaving acquisition and refurbishment costs unchanged. This creates a pessimistic case that illustrates the downside risk if customer willingness to pay does not materialise as expected.

Category	Dependencies	Pessimistic case modelling assumptions
Market	Customers not willing to pay price for refurbished devices	3% reduction in revenue

Interpreting the results

With both the optimistic and pessimistic scenarios constructed, the full table of results can be created.

Metric	Pessimistic case	Base case	Optimistic case
Payback	3.91	2	1.92
ROI	85%	307%	381%
NPV	$41,604	$389,361	$501,712
IRR (5 years)	15%	57%	69%

When interpreting the results under the pessimistic scenario, the lack of willingness to pay for more sustainable products significantly reduces cash inflows, leaving the project's NPV significantly lower than in the base case. Other financial metrics, such as ROI and IRR, also lower significantly. This demonstrates how sensitive the business case is to market demand and underscores the need for businesses to monitor trends closely and adjust pricing strategies to mitigate risk, ensuring the programme remains financially viable even under less favourable conditions.

In contrast, in the optimistic scenario, IRR and NPV increases, highlighting the benefit that avoided penalties can bring to the business case. The payback period changes only slightly, as the assumption is that penalties would occur after The payback period is reached.

Incorporating the non-financial considerations

Implementing a device refurbishment programme delivers significant qualitative benefits beyond financial returns. It directly supports corporate sustainability commitments by reducing environmental impact and advancing circular economy objectives, while demonstrating progress toward net zero targets within the value chain. Offering refurbished devices signals innovation and environmental responsibility, enhancing brand perception and customer loyalty. A key finding from the GSMA's Rethinking Mobile Phones[18] report shows that a large proportion of consumers considered sustainability to be a more important factor in purchase decision than AI capabilities or visual appeal. The report also shows that consumers are increasingly interested in buying used and refurbished devices, with cost savings as a key driver for the decision, and therefore implementing a device circularity programme can improve competitiveness. Circularity also boosts external ESG ratings and signals climate readiness to investors. Operationally, it reduces reliance on new device procurement and OEM supply chains, improving resilience against global disruptions and price volatility.

Non-financial benefit	Strategic goals	Qualitative assessment	Optional quantification
Supporting corporate goals and strategy	Supply chain decarbonisation	Implementing handset circularity directly supports corporate commitments to reduce environmental impact and achieve circular economy objectives. It demonstrates progress toward net zero targets and strengthens ESG reporting credibility.	5% of transition plan reductions for Scope 3 realised from implementing device circularity initiatives
Brand reputation and customer loyalty	Increase/protect revenues Increase profitability Enhance customer engagement	Offering refurbished devices demonstrates innovation and environmental responsibility, improving brand perception and customer loyalty.	+5% NPS (Net Promoter Score) in eight years
Competitiveness	Increase revenues Increase profitability	Offering refurbished devices at competitive prices increases competitiveness and provides additional revenues.	Quantify additional revenue from cash inflows
Investor confidence and ESG finance	Reduce cost of capital New investment sources	Circularity also supports external ESG ratings and signals climate readiness to future investors.	+5% ESG rating
Resilience	Protect revenues Reduced risk exposure	By reducing reliance on new device procurement and OEM supply chains, a circularity programme improves resilience against global supply disruptions and price volatility for new handsets.	-5% supply chain risk index

[18] GSMA. 2025. Rethinking Mobile Phones: The business case for circularity

Appendix 3: Quick-start guide

Report section	Summary of steps	Minimum data and input requirements
1. Prioritisation and screening of carbon reduction measures	• Prioritise carbon reduction measures based on technology maturity, integration complexity, investment nature and carbon abatement potential. • Identify which measures merit deeper financial evaluation.	• Technology maturity and commercial readiness • Integration complexity (operational impact, skill requirements) • Nature of investment: CAPEX vs OPEX • Potential funding source (internal vs external) • Carbon abatement potential (tCO_2e) • High-level CAPEX and OPEX estimates across the project duration
2. Financial appraisal of carbon reduction measures	• Develop annual cash flows for the BAU case and the Solution case. • Determine net annual and cumulative cash flows. • Calculate financial indicators: NPV, IRR, ROI, Payback. • Establish the base case (most likely financial outcome).	• Detailed CAPEX and OPEX inputs for both the BAU case and the Solution case • Discount rate • Cost escalation assumptions (CPI, fuel/ electricity price escalators) • Operational and technical assumptions (project duration, energy savings, replacement cycles, etc.)
3. Scenario building – Integrating climate risk and dependencies into the business case	• Build the optimistic case by modelling the financial value of transition opportunities (e.g. carbon pricing, subsidies, technology cost reductions). • Build the pessimistic case based on dependencies failing (e.g. delays, under-performance, subsidy removal).	• Quantified cost implications of relevant transition risks for the project (policy, market or technology-driven) • Data/assumptions for opportunities (e.g. carbon price forecasts, technology price reductions, market volatility) • Dependencies that influence CAPEX/OPEX if they fail to materialise (technology performance, grid access, customer demand, subsidies, etc.)
4. Extending value – Incorporating non-financial considerations	• Identify the non-financial value created (strategic, reputational, ESG, resilience). • Quantify benefits where possible or provide a structured qualitative assessment.	• Summary narrative outlining qualitative and/or quantitative non-financial benefits (e.g. alignment to strategy, customer perception, regulatory preparedness, resilience improvements, ESG ratings impacts)

Appendix 4: Potential sources of assumptions

Below is a non-exhaustive list of potential sources of key assumptions used in the handbook's worked examples. The list is provided as guidance and should not be considered definitive. Relevant internal teams are indicated in brackets and may be consulted for further input and information.

Report section	Summary of steps
Discount rate	• Official corporate hurdle rate or WACC (Finance team) • Company-wide investment approval guidelines
Equipment and technology CAPEX	• Vendor quotations or OEM data sheets or catalogues • Historical price movements (either based on internal cost or external market assessment) • External market cost benchmarks (e.g. IRENA, NREL)
Equipment and technology CAPEX cost trajectories	• CPI escalation • Historical price movements (internal or external) • Technology specific escalation from external market outlooks and technology learning curves (e.g. IEA, BloombergNEF Battery Pack Price Survey, NREL Annual Technology Baseline)
Operations, maintenance and logistics costs	• Site fuel consumption logs and historical O&M costs (Operations team) • Service contract quotations from maintenance providers
Hybrid system performance (diesel displacement)	• Hybrid system performance modelling (Engineering team) • Historical consumption from hybrid pilot sites (if available) • Consult Engineering team on reasonable performance variations
Carbon pricing	• BloombergNEF carbon pricing outlooks • World Bank Carbon Pricing Dashboard (latest carbon price ranges) • Network for Greening the Financial System (NGFS) • National/regional carbon pricing roadmaps
Commodity/energy outlooks	• World Bank Commodity Markets Outlook • U.S. EIA (Energy Information Administration) • Historical precedent: Ukraine-related oil and fuel price shocks
Electricity price baseline and escalation	• Current energy bills (Operations or Engineering teams) • Historical inflation in power prices; market projections from energy regulator
PPA development/ set-up costs	• Cost estimates from service providers • Engineering or Legal team input on expected PPA development and set-up costs
Grid connection delays	• Grid operator/regulator publications and developer reports on delays
Device sales volumes and demand trends	• Internal Commercial/Retail team input on device sales volumes and changes in demand • Supplementary reference points: internal sales and device procurement data (including any historical device take-back and trade-in volumes)
Device pricing (new and refurbished)	• Internal Commercial/Retail pricing team input on wholesale, retail, trade-in and refurbished resale prices • Supplementary reference points: historical pricing; OEM recommended retail prices and resale values (e.g. Apple Certified Refurbished; Samsung Refurbished Store)
Upfront IT integration and reserve logistic set-up costs	• Internal IT and Operations team input on expected and historical IT systems integration project costs • Procurement quotations from logistics and refurbishment partners
On-going refurbishment and reserve logistics costs	• Internal Supply Chain and Operations input on refurbishment costs and reserve logistic costs • Partner quotes/service contract rates (refurbishment and reverse logistics); internal repair/refurbishment data; OEM service pricing (battery replacement and parts estimates)

Acronyms

B2B	Business-to-Business
BAU	Business-as-usual
CAPEX	Capital expenditure
COGS	Cost of Goods and Services
CPI	Consumer Price Index
CSDDD	Corporate Sustainability Due Diligence Directive
EPR	Extended Producer Responsibility
ESG	Environmental Social Governance
HVO	Hydrotreated Vegetable Oil
IFRS	International Financial Reporting Standards
IRR	Internal Rate of Return
ITPN	International Transition Plan Network
ITU	International Telecommunication Union
MACC	Marginal Abatement Cost Curves
NPS	Net Promoter Score
NPV	Net Present Value
OECD	Organisation for Economic Co-operation and Development
OEMs	Original Equipment Manufacturers
OPEX	Operating expenditure
PPA	Power Purchase Agreements
PV	Photovoltaic
RECs	Renewable Energy Certificates
RFP	Request for Proposal
ROI	Return on Investment
SBTs	Science-based targets
TCFD	Task Force on Climate-related Financial Disclosures
TRO	Transition Risks and Opportunities
WACC	Weighted Average Cost of Capital