science group
CTO forum

Updated: March 2024
Full version including tools & observations

CTO FORUM

Net Zero Playbook

From the Science Group CTO Forum

Amcor Global Flexibles | Bayer Crop Science | Mars Incorporated | PepsiCo Inc. | Solvay SA | Stepan Company | The Procter and Gamble Company

Science Group is a science and technology business providing consultancy and systems to an international client base.

Science Group's CTO Forum tackles issues of material interest to R&D leadership with the goal of sharing insights and of developing actionable tools and methods that can be put to practice within the R&D function and so help companies tackle key challenges ahead.

To create these outputs, Science Group participates in (and facilitates) the Forum, regularly consulting with senior executives of the participating companies, drawing on its own wide base of knowledge and experience, and undertaking its own research.

Science Group is grateful for the cooperation, support and insight provided by the members of the CTO Forum:

- **Victor Aguilar** – Chief Research, Development and Innovation Officer, The Procter and Gamble Company
- **Nici Bush** – Vice President Innovation, Science and Technology, Mars, Incorporated
- **Nicolas Cudré-Mauroux** – Chief Technology Officer, Solvay SA*
- **William Jackson** – Chief Technology Officer, Amcor Global Flexibles
- **Jason Keiper** – Vice President and Chief Technology and Sustainability Officer, Stepan Compa
- **René Lammers** – Executive Vice President & Chief Science Officer, PepsiCo Inc.
- **Robert Reiter** – Head of Research & Development, Crop Science Division, Bayer
- **Maria Velissariou** – Global Corporate R&D Vice President & Chief Science Officer, Mars, Incorporated*

* the individual has changed their role since the Playbook was completed

Science Group is represented by

- **Caroline Potter** – VP Sustainability, Sagentia Innovation
- **Dan Edwards** – Group Managing Director, Science Group Plc
- **Michael Zeitlyn** – President Advisory Service, Science Group Plc

Using this Playbook

This Playbook has been developed to help R&D leadership tackle the challenge of reducing carbon.

The **Introduction and Orientation section** of the Playbook describes the challenges faced by R&D and introduces the 'Net Zero Maturity Model'. A simple visualization and diagnostic tool, it plots R&D's journey towards actioning net zero. The Model helps to identify areas that may require attention and points to the relevant 'Plays' and 'Principles' that are found in the body of the Playbook that may help the company realize its net zero ambition.

> Blue Chips have made public their net zero commitments. Implementation is now in full swing – but the journey will be tough. This Net Zero Playbook offers senior leadership a head start with a distillation of the principles and practices conceived and trialled amongst Science Group and the CTOs of Solvay, P&G, Amcor, PepsiCo, Mars, Stepan and Bayer Crop Science."
>
> *– Dan Edwards - Group Managing Director, Science Group Plc.*

The content is organized into three Plays:

Play 1 - **Commit:** Chief Technology Office or Chief Science Officer (CTO/CSO) working with peers outside of R&D (internally and externally)

Play 2 - **Plan:** CTO/CSO working with the R&D leadership team

Play 3 - **Do:** R&D leadership working with the R&D team, leadership in other internal business functions, and external partners.

Under each Play you will find:

- Observations – Reflections on the current situation
- Key Principles – A list of principles that relate to the Play
- Tools – One or more tools that might help the organization put the principles into practice

The Playbook is not a 'manual' and users need to overlay their context to its use in the organization.

The 'Tools' presented in the Playbook have been 'road-tested' and can be used in the form presented. However users may also want to customize them to the specific needs of the business. The conversation on the detail of the tools will in itself bring value to the business.

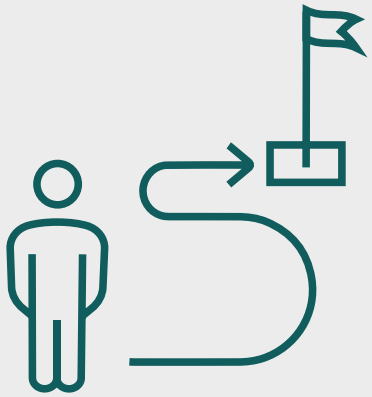
Introduction and Orientation

Our organization is on a journey towards net zero

We are in good company. Alongside leading businesses in all sectors, we are facing up to the realities of implementing greenhouse gas emissions reduction and of innovating to create products that serve the carbon reduction needs of customers.

R&D will make a significant contribution to progress, and will need principles and tools to address the challenge.

Let this Playbook help...



The first step is to recognize that we are on a journey towards net zero

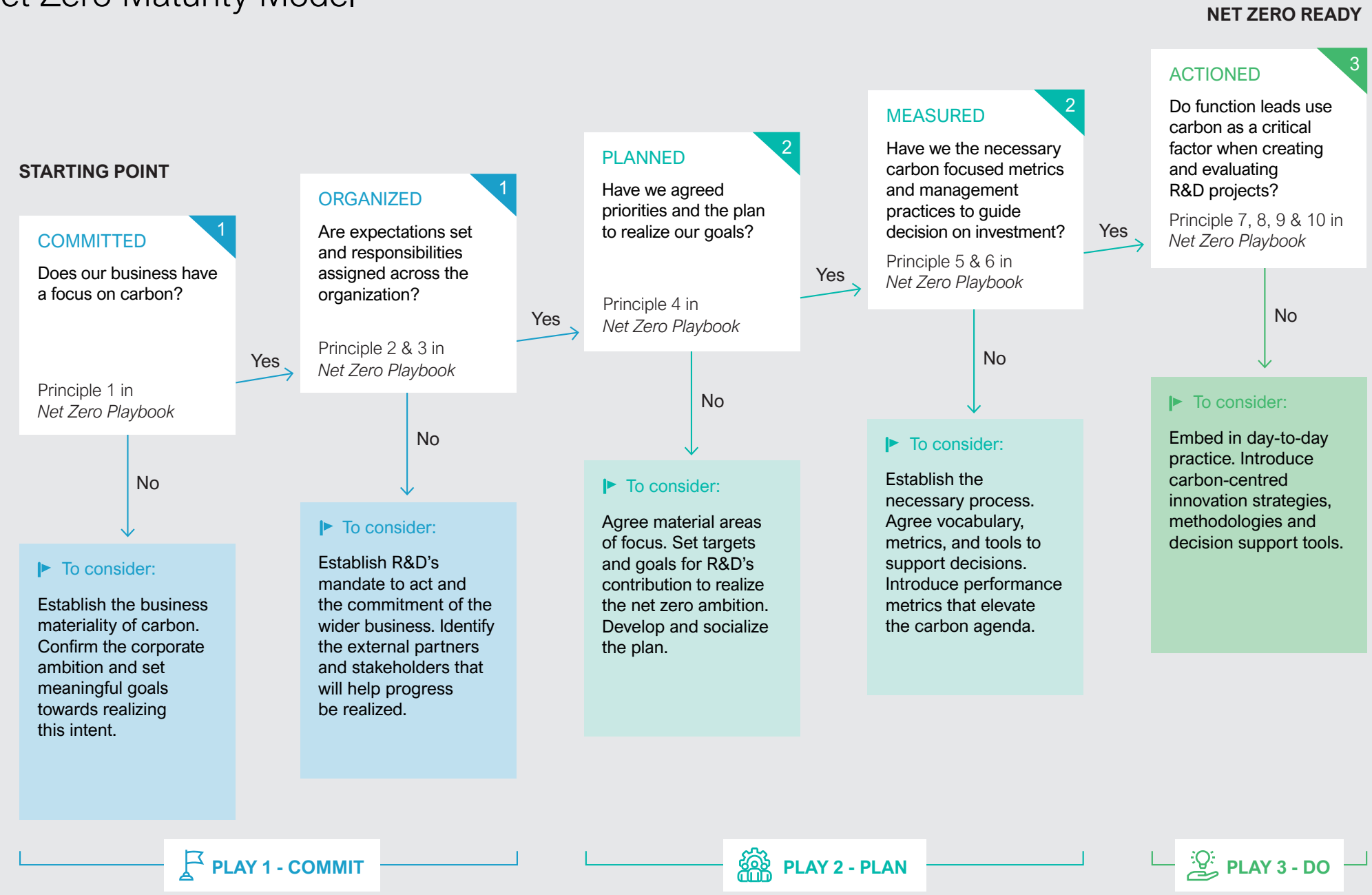
Business faces a climate imperative. As nations commit to reducing their GHG emissions, companies also must take appropriate steps. Promises, plans and actions are being scrutinized and companies need to be confident in their strategy and their ability to deliver meaningful change.

The first step is to recognize “the journey” towards net zero and to understand where on that path the company is. Companies must lay down the foundation that allows R&D and other functions to prioritize the carbon agenda. Business functions can then evolve their thinking and practices to make them compatible with a net zero outcome. There are several steps in this journey and viewed from R&D’s perspective, the ‘Net Zero Maturity Model’ charts the forward path.

The maturity model is presented as a linear progression of dependent steps. Best practice would have the corporate foundations laid before other departments act to any significant degree. However, in practice few companies will be starting from an entirely clean sheet and many will be progressing on several fronts simultaneously and not always in the prescribed sequence. Companies have to be pragmatic but to realize the necessary scale of change, obvious ‘gaps’ in the upstream portion of the journey need to be ‘backfilled’.

The Net Zero Maturity Model serves as a simple ‘diagnostic’ tool. Although it can be used to appraise the whole company, some companies may need to consider looking through the lens of specific business units, or regions. Company structure, culture, and ways of working all influence the operation of the organization and carbon maturity may vary across the business.

Net Zero Maturity Model



R&D leaders are well equipped to navigate the technical complexities of net zero

In companies yet to establish a corporate mandate for carbon reduction, R&D may need to take the initiative. Of all business functions R&D may be best placed to provoke the discussion and implement the changes that will create the momentum for carbon reduction. R&D leadership is well positioned to provide informed scientific perspective on what is a complex technical issue. R&D leadership can act as a change agent and may expect to make the early headway that provides the evidence needed by the CEO and wider business executive. R&D can make a significant contribution to realizing the corporate ambition for carbon reduction. But to achieve what's possible it will require the cooperation of other business functions and external partners.

> "Within the company leadership team, the CTO has an important role to provide critical thought on this technical topic. Many companies have started their journey and will continually mature in their thinking, readiness, and capacity to act. Understanding where one is precisely on this journey is key."
>
> *– William Jackson - Chief Technology Officer, Amcor Global Flexibles*

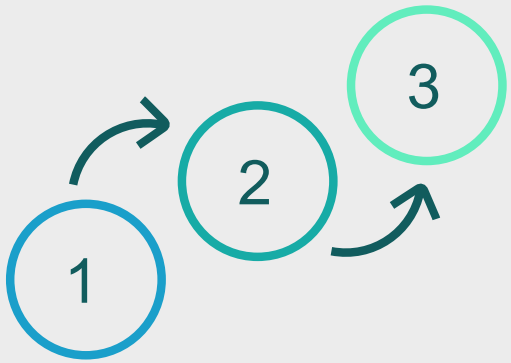
From here...

From here we will describe the principles and realities of delivering net zero over the coming years. This Playbook and the principles highlighted are intentionally focused on realizing progress towards net zero. Business practice though will demand companies also continue to make progress on other sustainability goals such as plastic waste, biodiversity, water etc. Sometimes what is the right course of action for climate change may be at odds with realizing progress on another sustainability issue. Companies will need to acknowledge and manage these trade-offs and may for given geographies, markets or categories decide that net zero goals are trumped by another sustainability goal, but overall companies will need to deliver substantive progress on GHG reduction.

Overall, the Playbook spotlights 10 key principles. Companies that embrace and embed those principles that resonate with their business will be more likely to realize their net zero ambitions.

Principles in Overview

Ten key principles across the three plays



Play 1 - COMMIT

Make carbon reduction a core value and an unambiguous point of focus with identified goals and responsibilities

1. Learn to articulate carbon and other sustainability themes as distinct but related issues
2. Have an explicit mandate for R&D (and other science and technology functions) on carbon reduction
3. Recognize where external partnership is a prerequisite for success on carbon reduction

Play 2 - PLAN

Make carbon reduction a central tenet of R&D planning and performance measurement

4. Don't trust to luck; plan from where and by when R&D effort will yield carbon reduction
5. Assess the 'carbon health' of R&D's portfolio to make sure it is fit for purpose and aligned to carbon reduction
6. Expect 'the carbon impact' to be part of any conversation on innovation

Play 3 - DO

Make carbon reduction an essential consideration in mainstream innovation practice

7. Start with the customers, products and/or brands with an affinity for net zero messaging to build early momentum
8. Realize the market value of a climate-friendly product
9. Find the synergies and flywheels; where innovating to serve the needs of the market creates opportunity to reduce carbon
10. Consider trading-off on price and/or performance where a reduced carbon product would enable a bigger win for the business

Play 1 – COMMIT

Observations

Making carbon reduction a core business value

Progress towards realizing carbon reduction commitments will be harder to win in companies that don't have carbon deeply embedded as a core business value. Companies need to look at their culture and see how consistent it is with their climate change ambition. Over time companies may need to think of GHG reduction as a business fundamental in the same way we already think about safety and quality; poor performance is an issue management lose sleep over. Driving a change in culture to put carbon amidst other fundamentals will take time, but without such a change it will be more difficult to move the needle at the required pace.

Corporates are committing to long-term carbon reduction goals

Fighting climate change is an acknowledged business imperative. Many large companies have already committed to significant goals that aim to reduce GHG emissions and slow the rise in average global temperatures. The timeframe over which gains will be realized create a specific challenge. Promises made today require current management to act but also depends on the actions of future generations of management. As companies respond to the call for action, they need to ensure effort is both timely and sustained. Existing management must 'own' the challenge and make sure the baton of responsibility is passed on.

One of many sustainability goals on the corporate agenda

Climate change is just one item on the corporate sustainability agenda which umbrellas a wide array of similarly important topics. While the importance of carbon reduction is not disputed, companies are under pressure to progress other sustainability issues too. The scale of this undertaking means that in practice the discussion on climate can often be bundled with other sustainability issues. This can lead to a loss of focus, blurred priorities, and less effective activity especially as there can be significant tensions between serving the climate agenda and tackling other sustainability goals. Without clearly stated priorities the company risks eroding value it could otherwise realize.

Carbon responsibilities reach across the supply chain

To achieve meaningful progress on carbon reduction, companies must consider Scope 1, 2 and 3 emissions. Long term 'Science Based Targets' will need to include 90% of Scope 3 emissions, meaning that companies will need to pay particular attention to how they affect carbon reduction in the up and downstream supply chains and onwards through the full product life cycle. There will likely be high dependence on partnership and collaboration across value chains with the burden of cost shared as well as the returned value.

A joined-up effort is required

The actions and interventions needed to reduce carbon across all three scopes of emission require contributions to be made by many parts of the organization including, but not solely, R&D. Most business functions are being asked to act on sustainability but must also serve and satisfy conventional business metrics. There are often tensions between these drivers, and across the organization the actions of different functions can unintentionally work in opposition. Without a common agenda, coherence, and synchrony there is a risk that despite a significant commitment of resource, progress on carbon reduction will be sub-optimal.

> "Climate change is impacting our world and realizing net zero requires us to act with urgency. We must aspire to a culture where the reduction of carbon and greenhouse gas emissions is seen as a core operating principle – like quality and food safety. The Net Zero Playbook is an enabler to embrace net zero thinking and practice."
>
> *- Maria Velissariou - Global Corporate R&D Vice President & Chief Science Officer, Mars, Incorporated*

Make carbon reduction a core value and an unambiguous point of focus with clearly identified goals and responsibilities

Key Principles

1. Learn to articulate carbon and other sustainability themes as distinct but related issues

Acknowledge that carbon is one of several sustainability issues, provoke a discussion on when carbon does and doesn't 'trump' other sustainability goals.

Carbon must be separated from other sustainability issues to create the focus needed to drive change. The actions needed to serve one sustainability goal can be detrimental to progress on another, and circumspect of the risks.

Companies need explicit and unambiguous carbon reduction goals (including clarity on the need to act on scope 1, 2 and 3), a clear strategy, and well-defined metrics. A focus on carbon does not lessen the importance of other sustainability ambitions and carbon may not always be deemed the priority. However, by prioritizing other areas progress on carbon reduction may be compromised. R&D should provoke a discussion on when, where, and why carbon is and is not the primary concern.

2. Have an explicit mandate for R&D (and other science and technology functions) on carbon reduction

Consider the impact and timing of R&D versus other functions and make metrics and incentives carbon centric.

Achieving net zero is a business wide endeavor with different functions each taking a share of the GHG reduction load. Companies must ensure that it is not viewed as someone else's responsibility. R&D's contribution is likely to be significant, but its effort must be reserved to help realize the carbon gains that other parts of the business can't so readily achieve.

It should leverage and build on the contribution of other functions. R&D is not always the only or best way to progress the agenda and its resources should be used intelligently as part of a coherent and coordinated business-wide effort. Defined responsibilities and clear expectations need to be coupled with relevant incentives and metrics. Companies must include measures that reward and facilitate business-wide support to carbon reduction initiatives to fully realize the opportunity and avoid conflicting initiatives.

3. Recognize where external partnership is a prerequisite for success on carbon reduction

Decide where the company can act alone and where it must act with others outside the organization if it is to make meaningful progress.

Substantive progress on carbon reduction may require the wider support and participation of customers, suppliers, regulators, other stakeholders and even competitors. The company must assess and decide where collaboration and external engagement provide the best route to make meaningful and lasting progress: external partners will need to be engaged, aligned and opportunities found to share the burden and gains associated with carbon reduction.

> "R&D has an essential role to play if we are to achieve meaningful progress on GHGs... but this has to be a team game. We can't do it without the joined-up effort of the wider business and the partnership and cooperation of our suppliers and customers. I think this is where companies may struggle, we must ensure that decarbonization isn't someone else's responsibility."
>
> *- Jason Keiper - Vice President and Chief Technology and Sustainability Officer, Stepan Company*

Who Does What Framework:

This Framework makes explicit the expectation of R&D and other business functions with respect to how they will work individually and jointly to help the company tackle GHG reduction (also highlighting potential tensions and conflicts).

Companies require a coherent approach towards reducing GHG emissions. Too often the efforts made by different functions of the business are not joined-up. This may lead to missed opportunity or at worse see different parts of the business inadvertently working in opposition.

Initially written through the lens of R&D, the framework is intended to provoke discussion with peers and so allow the company to forge a common vision as to how the necessary carbon reductions will be achieved.

The expectation is that R&D leadership (working with or through the sustainability team where such a function exists) may need to take the initiative and populate an initial draft using this framework. Climate change has a strong science and technology context and so R&D is especially well-placed to instigate this discussion. In completing a first draft, R&D should outline what it expects to do and also what it assumes will be realised by the efforts of others.

The framework considers:

1. Parties – the business functions that need to cooperate to reduce GHG emissions.
2. Mandate – a clear expression of what is expected of each business function in respect to helping the company reduce GHG emissions.
3. Scale and scope of contribution – the 'scale' of GHG reduction (a qualified or quantified estimate of the contribution to GHG reduction made by the business function) and the scopes (types of emission i.e., scopes 1, 2 or 3) being addressed.
4. Timing – the timeframe over which the efforts of a function are expected to 'yield impact'.
5. How emissions will be reduced – the tactics, types of project or initiatives that will be central to each function's effort to reducing GHG emissions.
6. Conflicts and dependencies – the possible barriers to success including possible conflicts and dependencies and underlying assumptions.

The framework also provides space to identify external organizations ('partners') that will likely play a critical role in helping the company achieve its goals. Although these organizations should be identified, the ownership of the challenge must not be offloaded to them.

The draft can be used in discussion with other departments. Further iteration may then be needed. Where there is misalignment between the goals/expectations of different parties, the framework provides a basis for discussion with the Executive.

Who Does What Framework

1 Set the Context

Confirm what goals and ambitions are being developed or have already been made by the company.

2 Make R&D's Commitment

Work with the R&D leadership team to consider how, where, and by when R&D can contribute to delivering the corporate ambition. Pay particular attention to the dynamics with other parts of the business – who can help and hinder your progress and what needs to be done to minimize the risks.

3 Provoke the Discussion

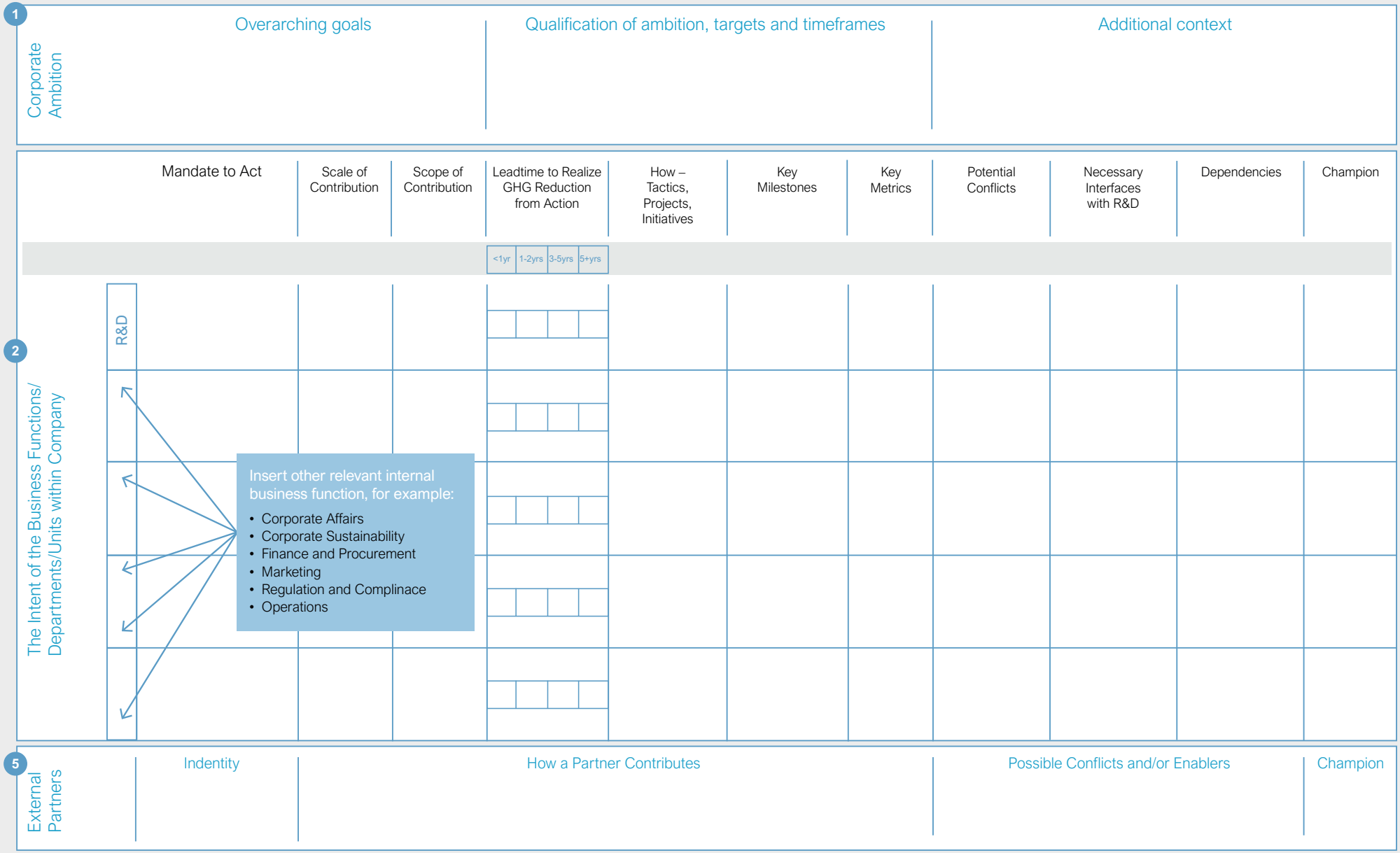
Insert your assumptions as to what you assume other business functions will be doing to help the company achieve the carbon reduction goal.

4 Identify Key External Partners

Recognize which external organizations will need to be worked with in order to realize the ambition.

5 Engage and Align

Work with your peers in other business functions to align on respective roles responsibilities and goals and on working practices to help the company deliver its carbon reduction goal.



Who Does What Framework - examples of content

Mandate to Act

Product Development: Design new products to achieve category agreed carbon targets.

Manufacturing Innovation: Eliminate use of high carbon manufacturing processes.

New Ventures: Develop technology enabled value propositions based on carbon reduction.

Scale of Contribution

30% of business-wide Scope 1 and 2 targets for 2045 (of which 10% must be realised by 2030).

Scope of Contribution

Scopes 1 and 2 through to 2030 with Scope 3 being prioritized 2030 onwards.

Leadtime to Realize GHG Reduction from Action

<1yr: 0%, 1-2yrs: 5%, 3-5yrs: 20%, 5+yrs: 75%

How - *Tactics, projects, initiatives*

New product carbon reduction hurdles to be set for each business category.
Modelling to be used to digitally assess process innovation options.
Partnerships with key suppliers to co-develop low carbon input materials.

Key Milestones

Carbon metrics into stage gate process (2025). Phase out all high carbon projects by 2030. Have the required technology available to allow manufacturing to eliminate 80% of high carbon processes by 2040.

Key Metrics

Carbon impact score of portfolio.

Potential Conflicts

Procurement emphasis on material cost reduction could hinder adoption of low carbon materials.

Necessary Interfaces with R&D

Marketing - to align on product trade-offs.

Corporate Sustainability - to look at conflicts with other sustainability goals.

Dependencies

Business acceptance of category carbon targets. Willingness of manufacturing to make capital investment on new process technology

Champion

Jane Smith

Play 2 – PLAN

Observations

An expectation that companies take appropriate steps

Despite shareholders expecting companies to deliver financially, they and other stakeholders will increasingly penalize those same companies if the GHG footprint or climate impact of their products is deemed unhealthy. The business risk of not acting is either loss of market share or a deterioration in investor confidence.

Time is not on our side

The clock is ticking on climate change and companies are expected to act in time to minimize the temperature increase to less than 2°C. Corporations are setting audacious long-term goals with targets realized in up to 10 or 20 years plus. Given the scale of change required the long-term view is essential but companies can't afford to rely on realizing a disproportionate share of these gains late in the day.

Companies need to make the right bets

Progress toward a corporate's net zero goal can't be trusted to chance and good intention; it must be planned for. Although there will be many possible battlegrounds, not all opportunities will yield equivalent reductions, even if at first inspection they are comparable in potential. The ability to achieve carbon reduction is dependent not only on technical feasibility but also a host of other commercial and operational constraints, not least the dependence on others in the supply chain, the actions of customers, and/or the likely growth or decline of the market. Effort needs to be directed towards those areas that can deliver scale and will yield a return appropriate to necessary investment.

Metrics may need to be rethought

R&D should make itself accountable for delivering solutions to the business that will realize substantive carbon reduction. However, metrics typically do not acknowledge this requirement. Without 'incentives', checks and balances that drive carbon-centered decision making, R&D may find it difficult to manage the portfolio to keep it on track for net zero.

It is the net impact of the portfolio that matters

To date sustainability issues including climate change have often been the focus of special projects, rather than being fully integrated within the day-to-day business of R&D. Although this has helped secure investment for bets that might otherwise have been culled, it can also serve to distract. By creating a focus on a smaller number of 'big bets' and 'game changing' projects there is a risk that less attention is paid to the impact realized from many smaller but less notable wins across the portfolio. Some R&D organizations already include sustainability issues in portfolio assessment but there is opportunity to do more. The GHG impact of individual projects is of little consequence if the R&D portfolio is not going to realize the net zero goal the business requires. Although companies may permit individual projects to underperform in terms of GHGs, they can't allow the portfolio to fail to deliver the net reduction.

Data gaps should not block progress

The unreliability of data is a recognized concern and can instill a level of reluctance to make judgements and/or cause decision making to be slowed. There is an expectation that data supply will improve and tools such as AI will in the future help to normalize and gap fill. However incomplete, data has value in serving to fuel thinking, and can inspire innovators to act. R&D leadership will need to balance the desire for accuracy with expedience.

There are different challenges across the portfolio

An R&D portfolio will include a mix of projects or project clusters that aim to improve existing products and ones that will introduce new products. The potential to solve for carbon will vary by circumstance.

> "Tackling climate change is a marathon not a sprint and, whilst net zero goals and pledges may stretch beyond our personal tenure, we must own the problem. We need to reach significant milestones in the short-term and not trust that technological advances will 'find a way' in the long-term."
>
> *- René Lammers - Executive Vice President & Chief Science Officer, PepsiCo Inc*

Key Principles

4. Don't trust to luck; plan from where and by when R&D effort will yield carbon reduction

Make smart bets; commit R&D to battlegrounds (e.g., categories etc.) with the potential to yield carbon reduction at the scale needed by the business and/or its customers.

R&D needs to account for how it will realize the scale of carbon reduction required of it by the company within a target timeframe. It must identify the battlegrounds (specific categories, markets, brands, customers etc.) that are likely to yield meaningful reduction and over what timeframe the business can be expected to reap the benefit of these advances. Invest resources accordingly.

R&D also should consider the types of innovation that will be required to capture this opportunity. It needs to consider the merit of concentrating on a few big bets versus accumulating the net yield of many smaller successes. The time and risk profile of these strategies differ so R&D leadership must balance the portfolio to align to the strategy and goals. As it evaluates different options it should also consider the extent to which progress will need third party involvement and as appropriate consider the merit of pre-competitive industry-wide collaboration.

5. Assess the 'carbon health' of R&D's portfolio to make sure it is fit for purpose and aligned to carbon reduction

Make carbon impact a standard lens through which to view the R&D portfolio. Be prepared to rebalance investment to stay on the correct carbon reduction trajectory.

Success on net zero will be realized by the net impact of the portfolio, not the win or loss associated to an individual project. Evaluate the portfolio from a carbon reduction perspective as well as by other conventional metrics and be prepared to adjust investment to achieve appropriate balance. As carbon data becomes more readily available expect to routinely forecast the likely impact of the R&D portfolio on the GHG emissions associated with future business activity.

6. Expect 'the carbon impact' to be part of any conversation on innovation

Make carbon a hurdle for all innovation projects alongside strategic fit and commercial return and don't let data be a barrier.

Carbon is currently too often treated as an afterthought; to move the needle towards net zero the estimated carbon impact of proposed new products or other innovations must be viewed as a hurdle in the same way that price and performance already are.

Companies will need to remain pragmatic; perhaps setting different levels of hurdle for different parts of the business and at times making exceptions after considering the wider business case. The accurate calculation of carbon impact can be difficult, R&D will need to get comfortable with the idea of working with the available data, accepting approximations, and using what data there is to provoke discussion. Currently data used to estimate carbon impact often lacks quality. It will get better. In the meantime, R&D should trade accuracy for speed, leveraging value from the conversations data concerns provoke.

> "We have to learn to make choices taking into account the "Carbon Return on Investment" of R&D initiatives. As we prioritize we must also bear in mind the impact on corporate reputation of the decisions we make."
>
> *- Nicolas Cudré-Mauroux - Chief Technology Officer, Solvay SA*

Carbon Battlegrounds:

Prioritizes carbon reduction 'battlegrounds' that are likely to yield significant carbon reduction whilst addressing hot topics perceived in the market. It lists hunting grounds, not specific projects.

R&D will be needed to realize many carbon reduction opportunities. There are many 'hunting grounds' but not all offer an appropriate 'carbon return on investment' (CROI). The tool screens the battlegrounds 'unit of analysis', such as product type or category, different brands, distinct market application, or even components of the supply chain etc. It considers:

- The scale of carbon emissions associated with the domain
- The 'appetite' of stakeholders for a low carbon solution (e.g., customers, NGOs, government, investors etc.)
- The barriers to realizing the opportunity (e.g., a lack of control or dependence on supply chain cooperation and/or technical challenges which also serves as an indicator for scale and duration of the required investment)

Beyond the initial screen, companies must also reflect on R&D's significance in realizing an impact on given battlegrounds. Some battlegrounds may be best addressed by different business functions with R&D playing a supporting role, others will require R&D's leadership.

The tool forms part of an iterative process facilitated by R&D but involving other business functions. The first task is to shortlist battlegrounds that appear to have the most potential. Further assessment of these is required. 'Specialists' should sense check what is needed, what may be possible, and how and who would be needed to realize the win. Having taken stock of the specialist inputs, the need and role for R&D can be considered before R&D commits to the challenge.

The tool will provoke discussion, both as stakeholders discuss what is encompassed within the parameters and as they evaluate specific battlegrounds. There is value to be had from the discussion not least from the opportunity it creates to consider what an acceptable CROI looks like.

Don't be constrained by lack of accurate data, be comfortable with the use of rough estimations or analogues that give appropriate order of magnitude assessments.

> This tool will provoke discussion, not least to consider what does an acceptable carbon return on investment look like.

Carbon Battlegrounds

1 Agree the Key Principles

Align on what is the 'unit of analysis' of a battleground and also agree what is meant by each of the assessment parameters and on the principles/rules for assigning a high, medium or low score.

2 Create the 'Long List'

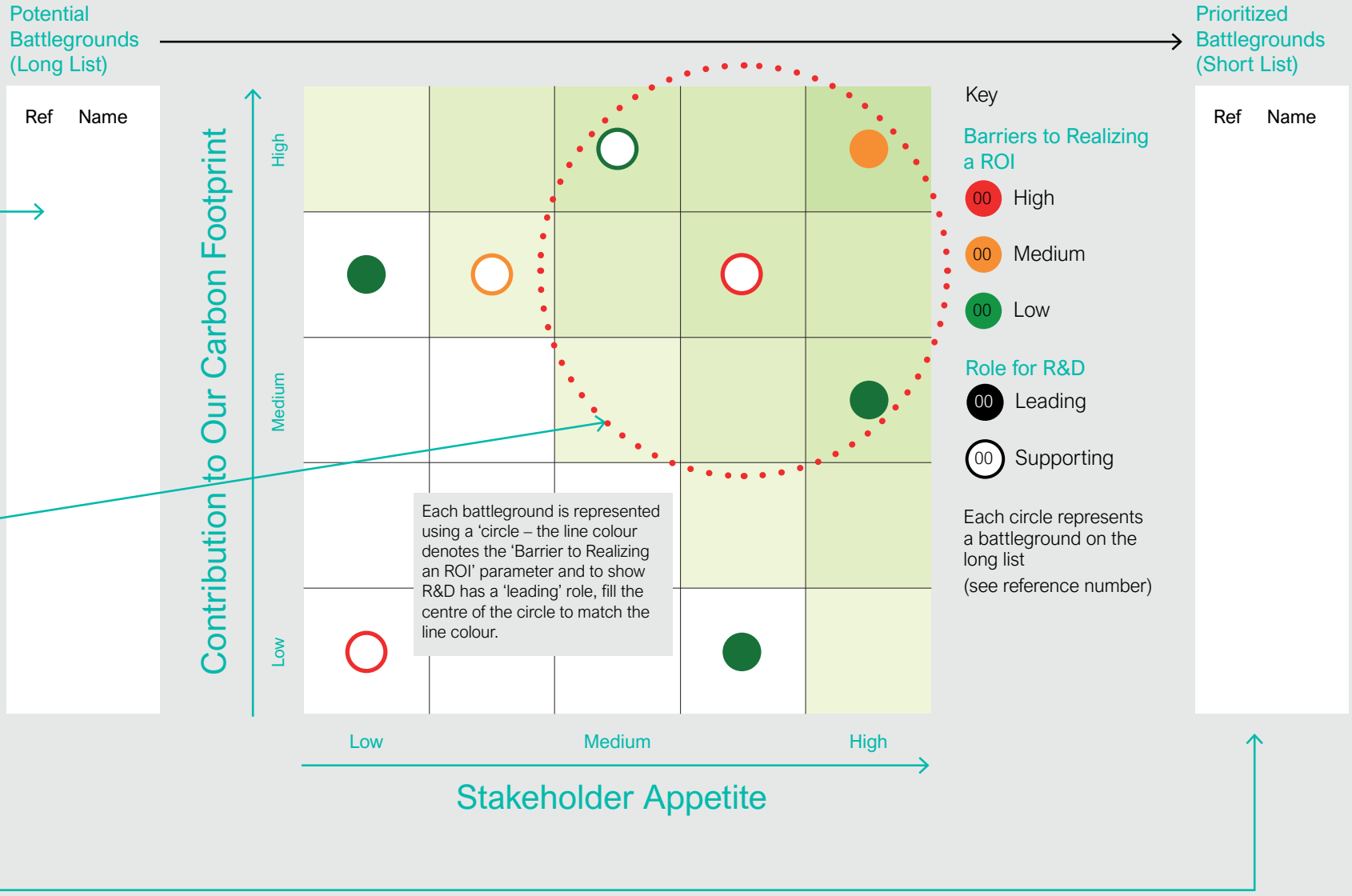
Agree the 'unit of analysis' of battlegrounds (e.g. brand, category, part of the supply chain) and list out those that are considered as possible targets.

3 Plot the 'Battlegrounds'

Discuss and score each 'potential battleground' (focus on Carbon and Appetite) and plot the item on the matrix. The question as to 'Barriers' and 'Role for R&D' will be challenged later in the process (see step 4).

4 Identify the 'Short List'

Use the matrix to guide the discussion on which battleground R&D should prioritize effort. For those that appear most relevant, engage with the internal experts to discuss the 'Barriers' and who, and what is needed to make substantive change. As part of this consider the value of pre-competitive collaboration. Based on these discussions discern if, and to what extent, R&D is central to achieving the necessary change and plan R&D effort accordingly.



R&D Portfolio - Carbon Scorecard:

The Carbon Scorecard sense checks the health of the R&D project portfolio through the lens of carbon reduction; considering how project number, impact, and time horizon align to the corporate ambition.

The tool is designed to facilitate a rapid assessment of the portfolio. Intentionally it trades detail and accuracy for speed and ease of execution, whilst retaining a quantitative element to allow targets to be set and performance tracked. The tool looks at the net impact of the portfolio of projects.

Acknowledging that R&D success will only realize carbon reductions as and when it transfers into the market, the tool also factors in when R&D projects might be expected to reach the market and the likely scale of their adoption; a small win on a widely adopted solution can deliver more than a big win on a niche application.

By visualizing and 'scoring' the carbon impact R&D projects will have in the short, medium and longer-terms, R&D leadership can be confident (or not) that their efforts align to the company's carbon reduction time-linked goals.

The tool involves assigning each R&D project a positive or negative 'carbon impact score' (2, 1, 0, -1, -2), estimating when that R&D effort will be put to commercial use, and on what scale. The carbon impact score of each project is multiplied by a factor to represent the impact of scale (x1 for low, x 2 for medium, x3 for high). The factored scores for each project within each of short, medium, and long-term time horizons can then be summed to give a 'net score' for the pipeline health for each time horizon. This can be compared to a target score set by the company as a measure of acceptable performance.

Assigning a 'Carbon Impact Score' to each project is the central task that underpins the scorecard. Neither robust nor complete data may be available so this is a value judgement and leadership must be comfortable with qualified assessments so that a quick and routine 'sense' of the carbon health can be derived without significant delay. There is value in trading accuracy for speed and expedience to drive necessary conversation.

As the portfolio may be reviewed annually, like-for-like comparisons will be wanted, so it is important for leadership to align on the principles that underpin positive or negative score e.g., what signals a project as a '2' (substantive carbon reduction) versus a '1' (some carbon reduction). As part of this process, the team needs to align on what they are including in their assessment e.g., the upstream supply chain, manufacture and operations, product use in the market and/or disposal or recovery.

Routinely reviewing the carbon impact score of the portfolio, comparing it to past performance and to a baseline target, will provoke discussion and be a catalyst for action.

> By visualizing and scoring the carbon impact, R&D leadership can be confident (or not) that their efforts align to the company's goals

R&D Portfolio - Carbon Scorecard

1 Agree the Scope

Align on which parts of the supply chain and product life cycle are most significant in terms of GHG emissions so that you can better judge which innovations are likely to have meaningful impacts on carbon footprint.

2 Align on the Scoring Principles

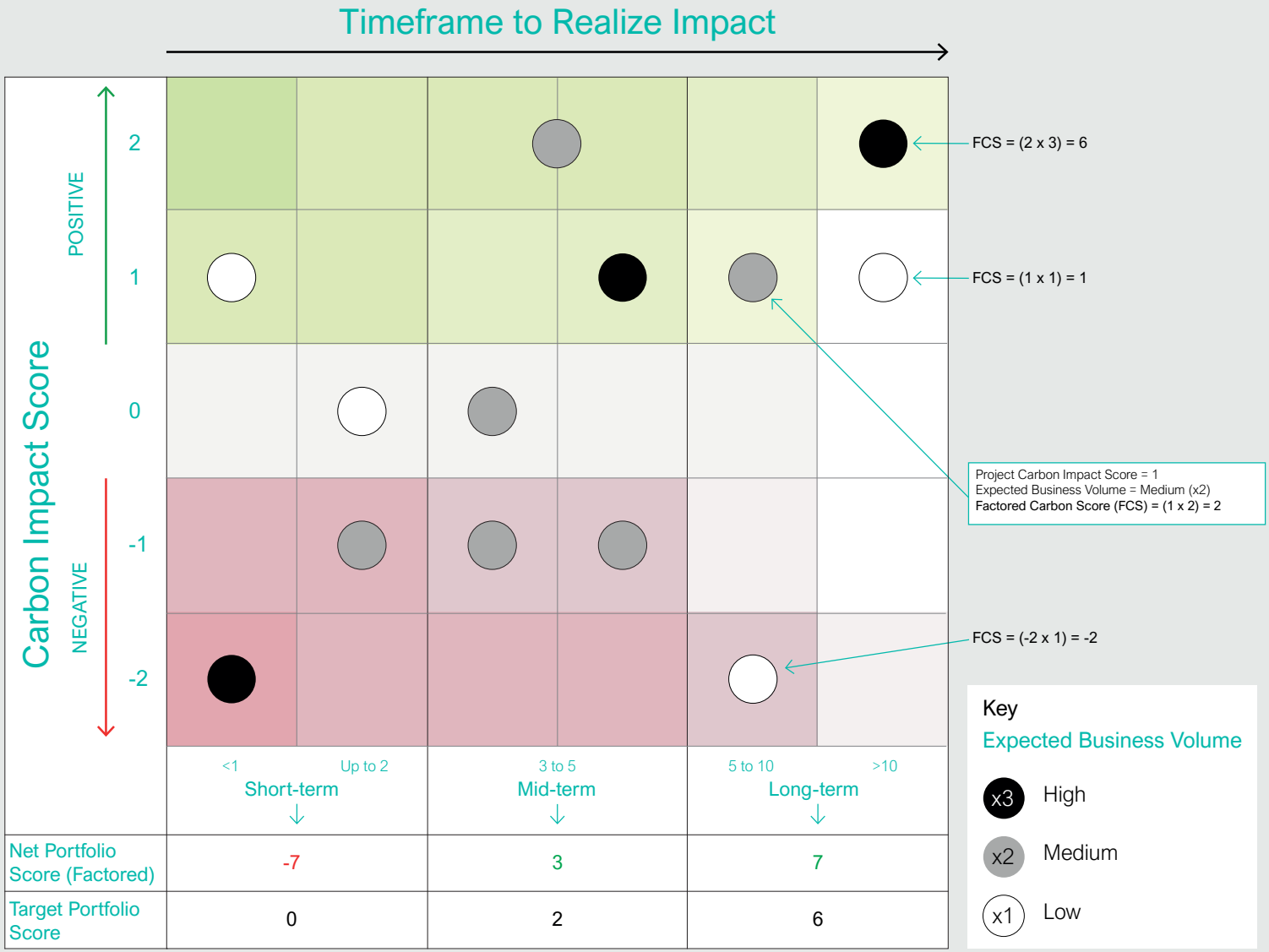
Agree the principles that underpin each score e.g. what signals a carbon impact score of '2' (substantive carbon reduction) versus '1' (some carbon reduction). Also align on what is understood as short, medium and long-term timeframes. As the end impact in the market will reflect the scale of use, also agree what is considered as high, medium and low volumes/ applications.

3 Score and Plot Projects

List the R&D projects in the portfolio, 'score' using the agreed principles and then plot them on the matrix as per the adjacent illustration.

4 Calculate the Portfolio Score

Multiply the carbon impact score of each project by either 3, 2 or 1 to adjust the project score to reflect the 'Expected Business Volume' i.e. the scale of impact in the market.. Sum the positive and negative scores for projects in each of the the short, mid and long-term parts of the portfolio to derive a net score for each timeframe. Using the score in conjunction with the visualization decide whether the portfolio needs to be rebalanced. Ideally have a pre-agreed target score to compare to.



Play 3 – DO

Observations

Most markets don't put sufficient value on carbon

Although the importance of carbon may be acknowledged, for many markets, reduced carbon products don't command a premium.
A climate-friendly product will often come at a 'cost'; higher material costs, operational constraints, productivity losses and compromised performance. Companies face difficult decisions; who should pay the price for reduced carbon products and what risks should companies tolerate?

There are early wins that can be realized

There are a growing number of market segments for which carbon impact is or will soon become a value parameter. There are certain product categories and brands for which being 'climate-friendly' has strong resonance in the market which may make 'trading-off' on price or performance potentially more acceptable. These opportunities need to be identified and realized to help make progress on carbon reduction.

Carbon's 'value' will rise

Although in most markets and within the majority of companies carbon does not have the weight of importance as price and performance, we should expect some level of change. A new paradigm is required, innovators will need to start viewing the carbon impact of their products and services as a central and significant consideration. Looking to the future, the carbon impact of new products and services may achieve near 'equivalence' to other conventional parameters as companies consider how they capture opportunities and secure their position in the market.

Regulations and industry standards can change the game

Over time carbon performance will likely become a 'must have' or 'hygiene factor' in many markets. Companies will have to decide if they should wait until they have to act or whether they should take a leadership position and pre-empt or even champion change. Timing will be critical, companies will need to assess what's required to retain or gain value and must focus on the big win, not the trade-off. Regulation is a critical enabler of progress towards net zero; companies must ride this wave and work with regulators to shape the agenda to create an environment that welcomes, and values reduced carbon products.

> "We can't treat carbon reduction as an afterthought, it must be woven into the fabric of our innovation practices from origination through to execution. We must use it as a lever to think differently so that we find opportunity to create irresistible experiences for our consumers whilst also reducing carbon."
>
> *- Victor Aguilar - Chief Research, Development and Innovation Officer, The Procter and Gamble Company*

> "Accomplishing net zero goals takes courage. There are going to be tensions, and at some point there will be the need to make tough choices by raising the price or taking a cost hit when the low hanging fruit opportunities are gone. I guess one can wait for regulation to keep the playing field level but sometimes a company needs to lead the way."
>
> *- Robert Reiter - Head of Research & Development, Crop Science Division, Bayer*

Key Principles

7. Start with the customers, products and/or brands with an affinity for net zero messaging to build early momentum

Capitalize on the brands, customers, and products with an affinity for net zero messaging as these will likely gain traction and more likely to support premium pricing.

Screen brands, customer segments, and innovation platforms to reveal where there is an overlap (or not) with the equity of net zero – 'not all brands are created equal' and not all customers are ready to transition. By selecting those which resonate with a climate-friendly message, companies are more likely to succeed and thereby create early momentum in the market.

They are also more likely to do so without the need for compromise on price. As companies look to realize this opportunity, they should also re-examine current products and past innovation, looking at them through the carbon reduction lens. Carbon impact is a new measure of performance that may have been previously overlooked and a fresh look may reveal hidden gems.

8. Realize the market value of a climate-friendly product

Expect that the customer will have to 'pay' for the benefit of reduced carbon products and learn how to make the case.

Miracle innovations are not the norm; if the carbon reduction benefits the customer, the business must be confident in marketing either a premium (price) for the net zero upgrade, or a product that legitimately trades-away performance.

Where regulation and standards favor or require carbon reduced products, the market will likely accept price or performance compromise and companies should scan the horizon to detect these opportunities. In the absence of regulations or standards, companies need to consider how different customers, brands, markets, and product use cases resonate with climate-friendly messaging. These opportunities should be found and leveraged.

9. Find the synergies and flywheels; where innovating to serve the needs of the market creates opportunity to reduce carbon

Engineer opportunities to serve conventional market needs in ways that serendipitously deliver carbon reduction.

Serving market need remains the business imperative. Although carbon reduction is not normally a primary value parameter, R&D teams should find opportunities whereby solving the customer's primary need can be re-engineered to simultaneously deliver a carbon reduction benefit.

Innovators need to systematically 'challenge' how and where they can create synergies between key innovation platforms and carbon reduction and upweight the effort to realize these opportunities.

10. Consider trading-off on price and/or performance where a reduced carbon product would enable a bigger win for the business

Take risks that might sacrifice price or other conventional value parameters in anticipation of demand shifting to climate-friendly solutions.

As focus on reduced carbon products sharpens there will be opportunity to realize bigger wins even though it may come at a short-term cost. Companies must be prepared to take the hit on margin to win on share and profit and/or to take a leadership position in fast growing market spaces.

In time carbon impact is likely to emerge as a significant value parameter; R&D must consider if, where and when there is need to reframe the value proposition and even reimagine their business model to realize this opportunity. Recognize that carbon-unfriendly products run the risk of losing market share in the medium-term and, as and where reduced carbon becomes a hygiene factor, companies must expect to make strategic trade-offs with an eye to staying in the game or to mitigate the risk of loss. If you do not assess the downside risk of no change, you may come unstuck.

Innovation Flywheels – 12 inventive principles:

The 12 inventive principles in this tool will help innovators find synergies between conventional innovation goals and carbon reduction, delivering uncompromised customer values whilst also serving the planet.

Despite growing interest in sustainability, most customers remain focused on conventional benefits and although the wish to avert climate change is sincere, purchasing decisions often remain centred on established value parameters. Products that compromise customer performance or demand premiums for reduced carbon can struggle to win business favor and market traction; the ideal opportunity is where the momentum to serve the customer need is synergistic with carbon reduction (hence the term 'flywheel').

There are examples of products achieving market success whilst also 'inadvertently' reducing carbon footprint. To move the needle on climate change, more such serendipitous outcomes must be engineered. Innovators need to find and leverage this coincidence of purpose, creating 'flywheel' opportunities.

The 'Innovation Flywheels' tool provides a method for revealing synergies between market needs and carbon reduction. It retains the focus on serving conventional customer needs but asks innovators to consider if and how there is a resonance with one or more of the 12 inventive principles associated with carbon reduction. The 12 principles are creative stimulus. Considering each one can reveal new opportunities. You only need to succeed with one to realize change.

The 12 principles can be introduced into R&D planning (screening growth platforms) or used tactically in ideation and value proposition development. Used tactically, the principles can be integrated into a variety of ideation methods, but the essence involves testing conventionally driven propositions against the principles and, where resonance can be found, building the original idea so that it fully exploits the carbon reduction opportunity.

> The Innovation Flywheels tool supports the development of product concepts that have conventional customer benefits and net zero gains

Innovation Flywheels - exemplar process

1

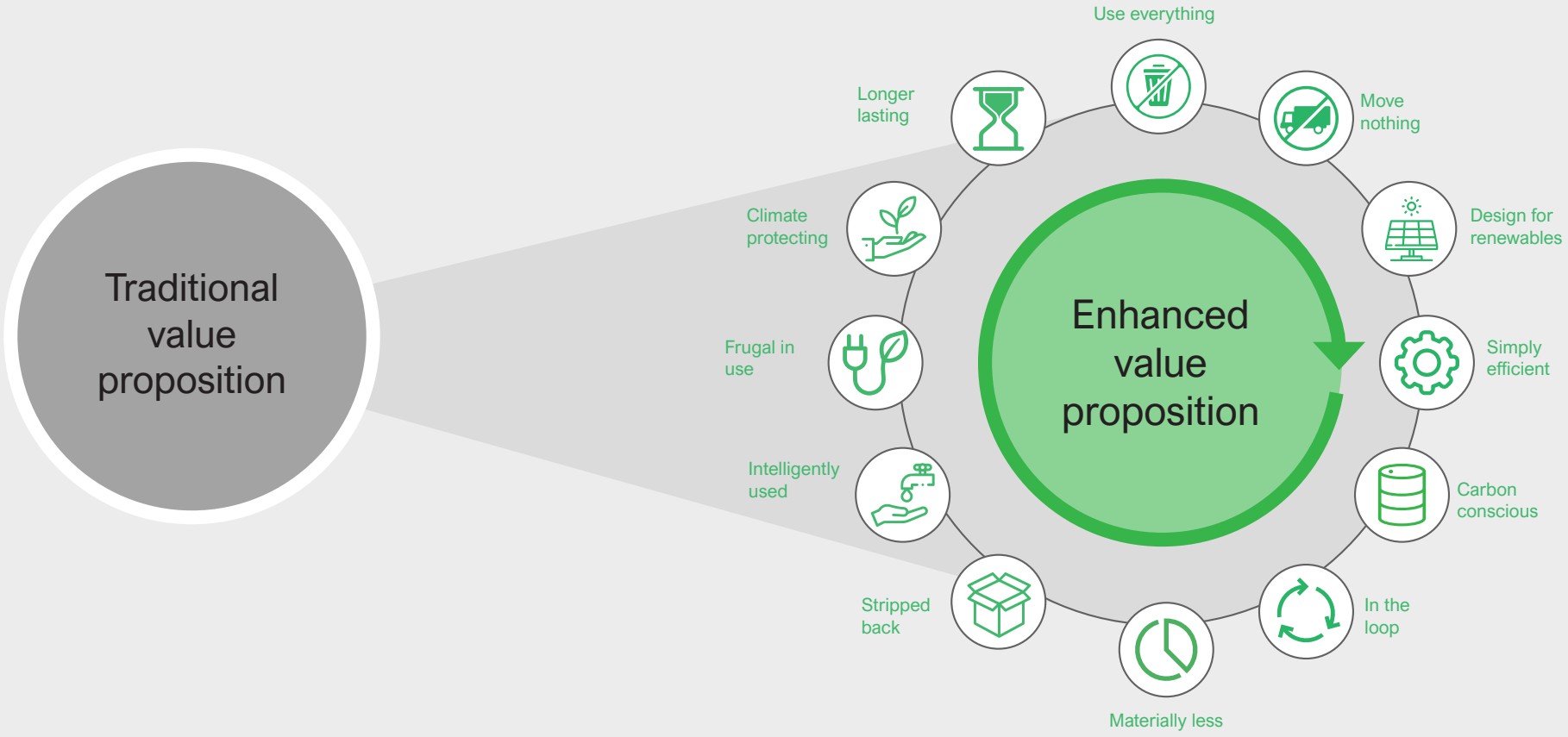
Start with categories and products that deliver on conventional customer drivers and commercial goals

2

In creative sessions develop and screen value propositions using the 12 inventive principles

3

Derive enhanced propositions that deliver what the customer values but also allows carbon reductions to be realized



Outcomes

Customer benefit
Commercial gain

Outcomes

Enhanced customer benefit
Enhanced commercial gain
Carbon reduction

12 inventive principles that are consistent with reducing carbon footprint and handprint:

Use everything - Utilize what otherwise would have gone to waste

Could the product be designed to minimize or eliminate material waste in manufacture, could it be made from recycled material (ideally from the same product or process), or could unavoidable waste streams feed the manufacture of other products or be used for other applications?

Example: Nike Flyknit makes footwear uppers from yarn rather than cutting them from fabric to reduces scrap waste.

Move nothing - Eliminate the need to move materials or finished product unless there is no alternative

Could the product be designed with the intent of using locally sourced materials or ingredients, could manufacture be located near the source of the 'bulk' of materials used in its making (heavy or high-volume materials) and/or close to the product's prime market?

Example: Serious Tissues have reduced the carbon footprint of their toilet roll products by sourcing and manufacturing in the UK.

Design for renewables - Design the product or process so that renewable energy can be used in manufacture

Could the product be designed to eliminate the need to use energy sources other than renewables in its production, selecting processing methods that are compatible with electrical energy rather than gas or other fossil fuels, or could on-site renewable energy generation be coupled to the manufacturing process?

Example: Heineken are using solar energy to generate steam on site.

Simply efficient - Reduce the complexity of manufacture and the energy it demands

Could the manufacturing process be simplified, production steps eliminated, energy intensive processes substituted, and/or waste energy recovered and redeployed (e.g., re-using steam's thermal energy in the same or in another process)?

Example: Patagonia replaced batch dyeing with solution dyeing to dramatically reduce the energy needed.

Materially less - Design the product to be materially less

Could the product be designed to use as little material as possible, unnecessary parts/components eliminated, could the product be 'concentrated or made compact and/or be made as spatially and weight efficient as possible?

Example: P&G has developed a solid format for shampoo that eliminates water, liquid stabilizers, and fillers.

Carbon conscious - Limit the carbon embodied in the product

Could the input materials be restricted to those with low carbon footprints, could the product be made a 'sink' for carbon dioxide or other greenhouse gases?

Example: AirCo are using waste carbon dioxide to generate alcohol for beverages and hand sanitizer.

Stripped back - Eliminate unnecessary packaging and auxiliaries whilst retaining necessary function

Could non-essential product accessories be eliminated, could product design/format or distribution model be changed to reduce or eliminate the need for secondary or tertiary packaging, could refrigeration or greenhouse gas generation distribution or other energy consuming requirements be avoided (e.g., ambient distribution only)?

Example: Apple removed the plug from the iPhone 12 thereby reducing the emissions associated with production and transportation; assuming customers would already have one.

Frugal in use - Avoid creating carbon through use or disposal of the product

Could the product use case be reimagined to reduce or remove the need for energy, could product use be designed to eliminate the production/generation of materials with high global warming potential e.g., propellants and refrigerants, could the product be made with materials which are not energy intensive to recycle?

Example: P&G has enabled effective cleaning at lower temperatures with Tide Coldwater.

Climate protecting - Help the customer save carbon and reduce GHG emissions by use of the product

Could the product directly contribute to saving energy, be used in products or processes that consequentially reduce greenhouse gas emission (e.g. agricultural products that minimize the metabolism of fertilizer by bacteria and hence nitrous oxide emissions), and/or could they help improve the performance of other processes and technologies that reduce the use of fossil fuels (e.g. coatings that enhance wind turbines to increase the efficiency)?

Example: Stepan's polyols are used in to make rigid insulation products which reduce the energy used to heat buildings (estimated at 1.2 billion barrels of oil equivalents over a 20-year product life cycle in the last decade).

Longer lasting - Extend the useful life of the original product

Could the product's functional life be extended, made more durable, designed to be modular to allow unit components to be replaced instead of the whole product, and/or designed for easy and economic repair?

Example: Gore-Tex design jackets for durability and longevity as an influential factor to improve environmental impact.

Intelligently used - Enable the consumption to be smart; timely, efficient, necessary, and sufficient

Could the product and use case design aim to realize full value from every gram of the product (no excess allowed, nor waste permitted), can unnecessary use and/or non-essential consumption be avoided?

Example: Dyson have used machine learning to program robot vacuum cleaners to clean an area in the most efficient way so that energy is not wasted going over areas previously covered.

In the loop - Find the way to complete the loop and realize circularity

Could the product design pre-empt and enable component separation to aid recycling, could materials selection prioritize those with viable recovery, recycling, and reuse models, can the business model facilitate a service or lease and return value proposition as well as conventional purchase (e.g., renting children's or maternity clothing).

Example: Niaga mattresses are made using a specially designed adhesive that decouples on demand so that their products can be recycled back into the same product.

The Green Premium?

A framework to provoke a conversation on who pays for reduced carbon solutions and explore which trade-offs to consider under what circumstances.

Without regulation or industry standards, reduced carbon products can be less commercially attractive than conventional options. Production costs may be increased and/or performance compromised. If there is a 'price to pay' for reducing carbon who should shoulder this burden?

The starting assumption is that the company wants a reduced carbon solution; driven by market interest and/or an eye to carbon footprint and corporate reputation. This tool provokes discussion by advocating preferred strategies for different market scenarios. However, what is and isn't an acceptable trade-off for realizing a carbon reduction is company specific. Boundary lines will be influenced by the market environment, competitor activity and not least by company's own culture, values, and ambition. Context is everything and the ground rules need to be understood.

Key factors influencing strategy are: customer appetite (for a reduced carbon products); and market maturity. These parameters are used to form the Decision Framework. The customer appetite points to the opportunity of making the customer pay (or not). Market maturity infers a focus on winning share or margin. By relating these parameters, 12 distinct scenarios are created which can demand different go-to-market strategies.

The Decision Framework leads the user to possible options:

- Charge a premium for the benefit, potentially considering other business models such as subscription
- Trade off performance to protect price
- Justify added cost (or lost performance) by upgrading another value parameter
- Introduce a new benefit/value parameter (not sustainability per se) to justify cost increase
- Absorb the additional costs incurred
- Share cost with the supply chain

This list is not exhaustive. Context is everything: answers are seldom black or white. The Decision Framework points to a strategy but the specific context of the situation must be overlaid. Amongst the many factors that could influence the decision are brand strength, customer switching costs, customer relationship, through to whether the product has some headroom in terms of price or performance versus the competitive set. The tool provokes discussion, it may result in the original recommendation being adopted, but there will be circumstances where alternates are reasoned, and instances when the conclusion is that a reduced carbon option is not commercially viable. With alignment on strategy, R&D can focus its effort. For example, if the customer is expected to pay, R&D effort may look to optimize for carbon reduction, whereas if the company is to absorb the additional costs, R&D's focus may switch to innovating to mitigate the cost uplift.

The Green Premium?

If to realize a reduced carbon offering a trade-off will be needed.

1 Identify the Scenario

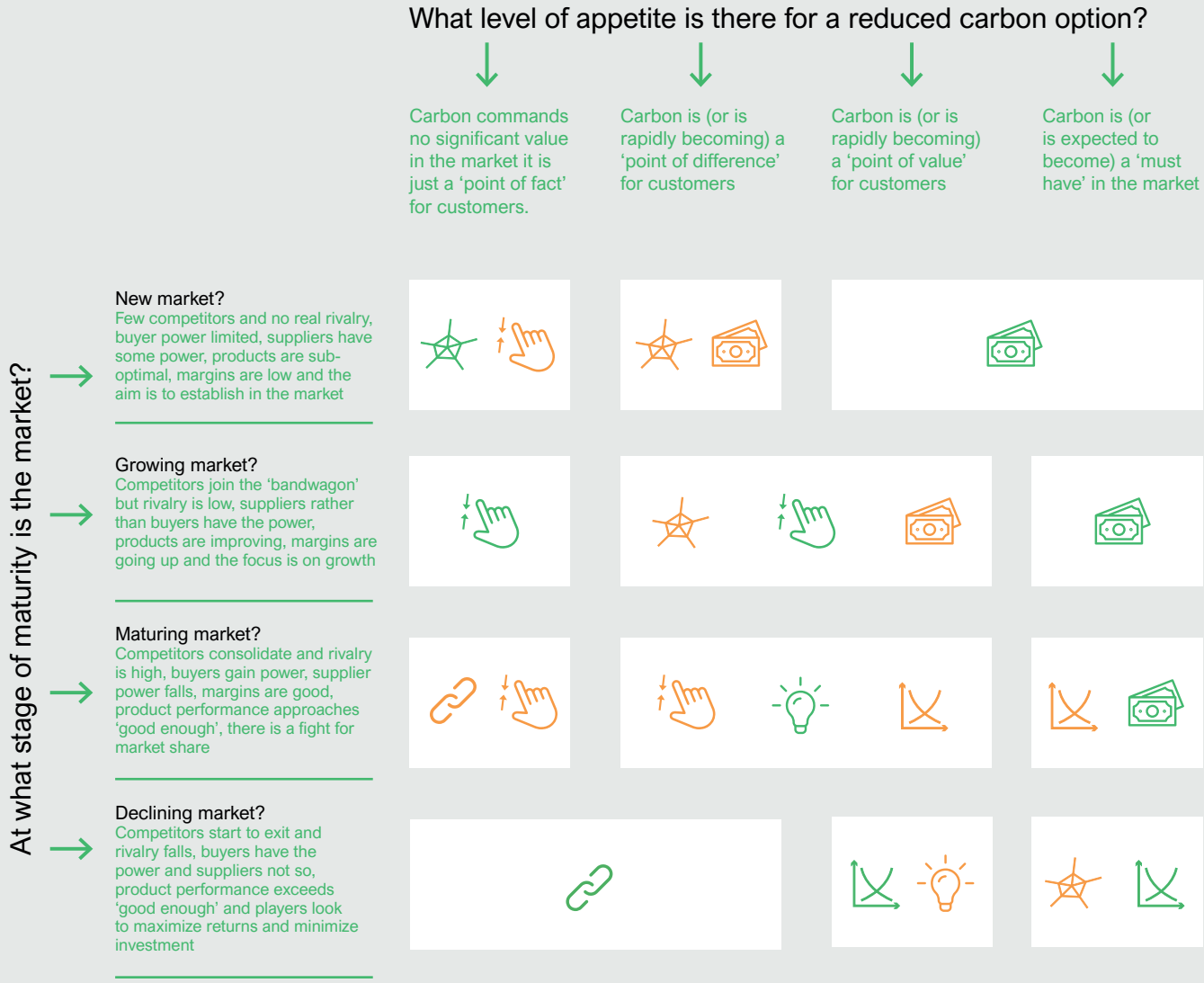
Consider the maturity of the market the opportunity sits in and align on the level of appetite for a reduced carbon offering.

2 Challenge the Strategy

Look at the go-to market strategy advocated in the framework for the chosen scenario and challenge its merit given the context of the specific situation before fixing on a preferred strategy. Be prepared to table alternative strategies not explicitly called-out on the Framework where they provide a better solution.

3 Focus the R&D effort

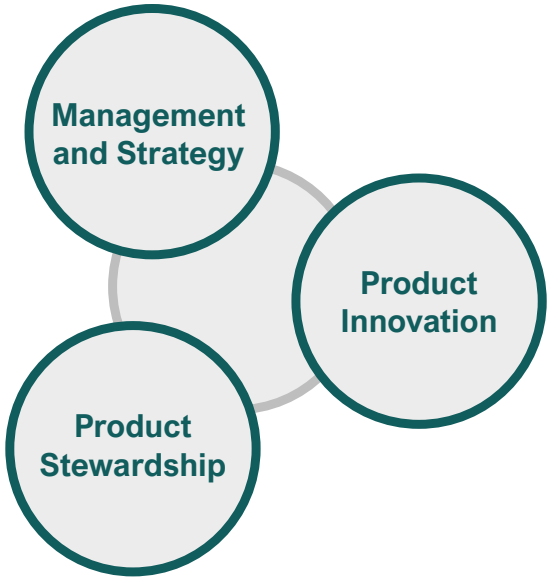
Align on how R&D can best serve the business – e.g. is it in solving a technical challenge to make the reduced carbon project realizable or is to find ways to offset costs or to provide alternate up-sides.



Conclusions

Recommending 3 areas to focus on

Consider where your organization is on its net zero journey and how management practice might need to evolve. Expect to improve the quality of the conversation on carbon reduction and other sustainability issues. As you look at realizing your carbon ambition we recommend you consider three activities:



Management and Strategy

The focus on carbon reduction will continue to increase in the years ahead. There will be difficult challenges but also opportunity to be grasped. 'Carbon impact' must become a central consideration in day-to-day management thinking, and be embedded in organizational culture. Leaders will need to be articulate in the language of its practice, clear as to their mandate for action, and expect to collaborate internally and externally to realize the ambition. The strategy and planning process must tackle carbon reduction goals with metrics in place to help maintain the correct trajectory. The 'climate clock' is ticking and trusting to luck is not an option. Confronted with many possible battlegrounds, companies will need to analyze their options and invest dollars on the areas likely to give carbon return on investment. They will also need to look beyond the success of individual projects and consider the net impact of their portfolio.

Identify the best investment bets for carbon reduction and use tools to quantify and track the net contribution of your portfolio to greenhouse gas reduction.

Product Innovation

To achieve their net zero ambition, companies will need to ground their aspiration in mainstream activities. Product innovation teams must consider the carbon implication from the outset. Where possible they should look for opportunity to realize value from reduced carbon solutions. Although there may be occasions when companies have to consider accepting a short-term trade-off to realize a carbon reduction, in the medium term carbon reduction will benefit all parties.

Introduce process to make carbon a key consideration for innovation, provide tools that help to reveal opportunities to reduce carbon and benefit the customer, and be open to strategic plays that will deliver carbon reduction and business value.

Product Stewardship

Emerging regulation, evolving standards, NGO advocacy, increasing stakeholder scrutiny, and the growing significance of ESG reporting are factors that compound the pressure on product companies. Businesses will need to look at their supply chain and consider the risks and opportunities ahead. Some challenges may require industry members to work together to achieve necessary change. No industry is immune, companies must apply sustainable principles and ensure claims are founded on robust evidence.

Consider the implications of current and future regulation, standards, and practices and work with internal and external parties towards science based commercially astute solutions.

science group plc

Headquarters
Harston Mill, Harston,
Cambridge, CB22 7GG
United Kingdom

Email
info@sciencegroup.com

Phone
+44 1223 875200

www.sciencegroup.com