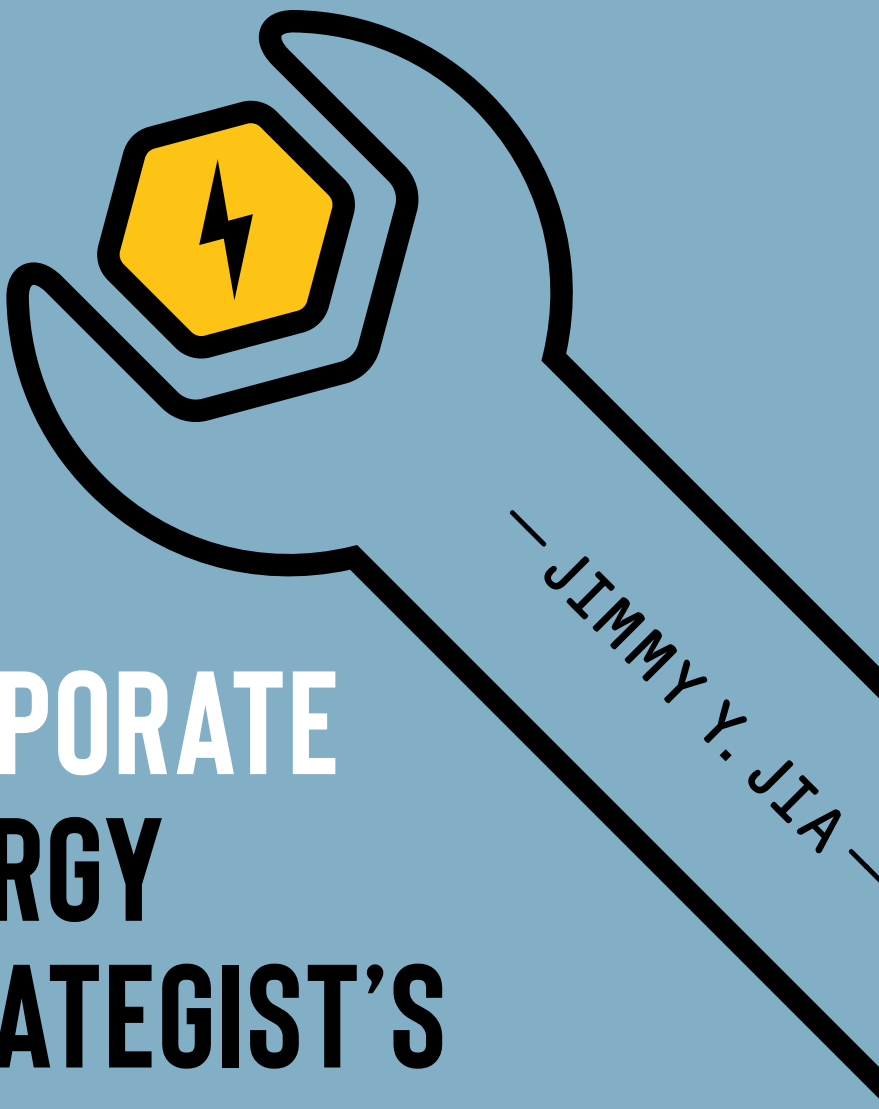

THE CORPORATE ENERGY STRATEGIST'S HANDBOOK

FRAMEWORKS TO ACHIEVE ENVIRONMENTAL SUSTAINABILITY AND COMPETITIVE ADVANTAGE

— JIMMY Y. JIA —

The Corporate Energy Strategist's Handbook

"Jimmy Jia's book is an invaluable resource for corporate executives and other leaders trying to develop strategies for the costs, risks and opportunities relating to the ways they use, produce, and conserve energy in their businesses. It is both a manual for and a call to create the role of Chief Energy Strategist—a job title that few organizations have now, but one which many desperately need."

—Ross Macfarlane, Director, *Sierra Club National Board*

"Jia provides guidance for how leaders can incorporate effective strategies for energy management *and* corporate governance, including how to foster innovation and reduce carbon emissions, to make their businesses more competitive."

—Karen Wayland, CEO, *kW Energy Strategies*

"*The Corporate Energy Strategist's Handbook* explains how to seize the large opportunities for competitive advantage and climate impact revealed through a whole system analysis of a company's energy system. Although it illuminates the interactions between energy science, finance, decision systems, and innovation methodologies, the book is surprisingly easy to read. Every large organization needs an energy strategist to integrate the many decisions impacting energy. Anyone interested in sustainable energy needs to read this book."

—Gifford Pinchot III, President, *Pinchot & Company*

"*The Corporate Energy Strategist's Handbook* makes a compelling case for the proposition that managing the flow of energy is different than managing the flow of money and, therefore, new tools are required. This book introduces the Energy Balance Sheet, Energy Activity Statement, and Energy Flow Statement as the new tools that energy strategist should use and provides an easy-to-read guide to operationalizing concepts that have the potential to change the way we think about energy management and its role in driving corporate success."

—Lawrence E. Goldenhersh, President, *Center for Sustainable Energy*

"Jimmy Jia has provided us a new strategic framework for thinking and managing this business hurdle that is becoming more important every day. The role of an Energy Strategist is likely emerging."

—Tom Ranken, President and CEO, *CleanTech Alliance*

"Jimmy's done the hard work to synthesize and test the best available thinking through more than a decade of business school lectures. As I build a team of sustainability strategy consultants, the *Handbook* contains the foundational body of knowledge necessary for my team to deliver on the opportunity around energy for our clients."

—Garrett Kephart, National Practice Leader and Managing Principal, Strategy, Sustainability, and Social Impact, *Point B Inc.*

"Very comprehensive, up-to-date, and possibly the best short reference book on energy resource management recently published. Thoughtfully compiled by Jimmy Jia to expertly help and inform a cross-functional collaborative approach for engineers, economists, accountants, and business managers a like to develop better ideas to innovate solutions immediately in their organization."

—Jameson Morrell, *Jacobs Engineering Group*

Jimmy Y. Jia

The Corporate Energy Strategist's Handbook

Frameworks to Achieve Environmental Sustainability and Competitive Advantage

palgrave
macmillan

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To my mom

Acknowledgments

Books take on a life of their own with their pathway influenced by every conversation. I am only fortunate enough to get a front-row seat in watching these ideas mature over time.

Thanks to the students of the Bainbridge Graduate Institute, Pinchot University, Presidio Graduate School, and George Washington University, especially those who took one of my courses in strategy, sustainable energy, or climate change. Through your curiosity we studied, questioned, and co-created many frameworks for wiser approaches to energy problems.

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Prologue: Why Create a Toolkit of Frameworks?

After teaching classes in sustainable energy, climate change, and strategy at MBA programs for a few years, I noticed my students struggling to choose which frameworks to use under what circumstances. I noticed a similar problem in the professional world as well, where the business field swarms with books, each teaching their own frameworks and retelling case studies of others through their lens. Unfortunately, this means a leader has to read entire bookshelves to learn a set of tools, and is still left with the challenge of figuring out which framework is applicable to their situation.

This problem is especially acute in energy and sustainability management, disciplines that require holistic approaches. Energy is a critical resource for an entire organization, yet the tools were developed by a myriad of stakeholders, each managing the issue from their point of view. Energy management lacked organization-wide tools to approach organization-wide problems.

This book addresses the problem in several ways. First, as a collection of frameworks, it provides a tapestry of tools available across an organization to manage energy. Although not an exhaustive collection, it includes critical concepts and content gathered from over a decade of working in energy and sustainability management. Second, the brief explanations, examples, and diagrams are an aid to diagnose whether a framework is applicable to the situation at hand. A leader can then do their own research into a framework to gain further familiarity and understanding. Lastly, the review shows where there are gaps in our techniques for energy management. Some of the frameworks presented are my own—developed to fill these gaps by combining others to create new frames of reference. The reader may notice other gaps and is encouraged to develop their own tools.

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For readers who are acquainted with the tools, please use this book as a reference book and jump to the part or chapter most relevant to you. For those who are at the beginning of their journey, the concepts in each chapter are arranged to build upon each other. Words in **Bolded Small Caps** are references to other frameworks in the book. Look in the Index or the Table of Contents for their page numbers and Fig. 1.1 for a visual depiction of the chapters.

- *Part I—Energy as Strategy*: discusses fundamentals in strategy, finance, and energy before merging the individual concepts into carbon mitigation strategies.
- *Part II—On System Properties*: examines system dynamics and how to use them to create new frameworks to tackle new situations never encountered before.
- *Part III—On Leadership*: reviews a selection of organizational, decision-making, and communication tools so a leader can convey certainty during times of ambiguity.
- *Part IV—On Innovation*: suggests how to create environments to encourage the formation of ideas and how to recognize innovations when they emerge.
- *Part V—Non-Financial Indicators for Corporate Governance*: observes how energy and other non-financial indicators are analyzed and reported for strategy, corporate governance, and investor decision-making.

Who Should Use This Handbook?

This book is written for the *Energy Strategist*, an emerging role for companies that wish to improve productivity through innovations that reduce environmental footprints. These companies usually face at least one of the following problems: high energy intensity of production, a supply chain that is being disrupted by climate change, increased pressure for fiscal discipline and cost certainty, changes in consumer buying patterns, or activist investors keen on environmental disclosures. As these challenges converge, leading companies are implementing processes for wiser allocation of environmental resources to gain a competitive advantage.

Many individuals can engage with an organization's energy strategy. After all, who can function without energy? Nearly every role is enabled, directly or indirectly, by the availability and accessibility of energy. This could be the

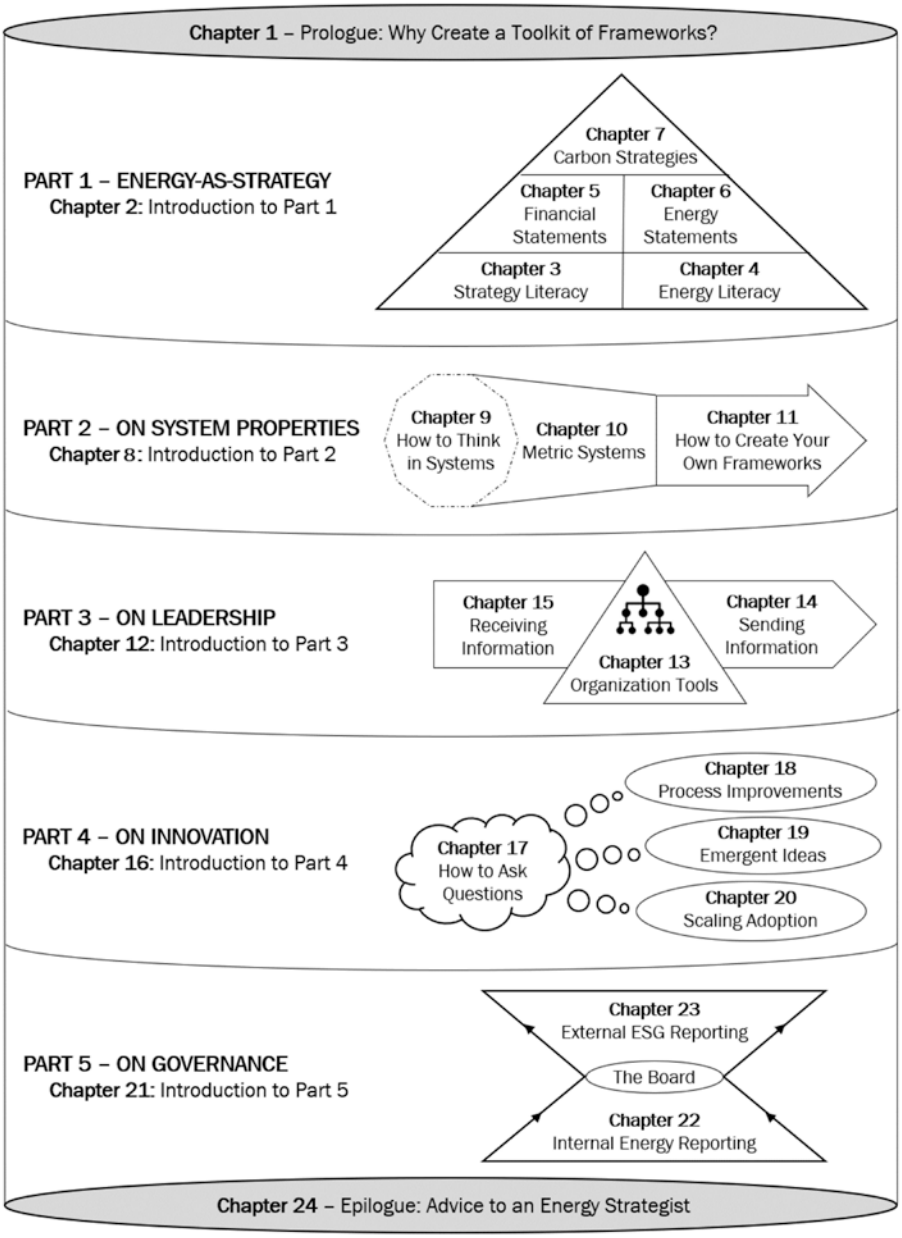

Fig. 1.1 Diagram of chapters. (Source: Author's creation)

technical experts selecting equipment, investment analysts forecasting fuel options, policy advisors advocating for risk mitigation practices, executives responding to a board's environmental concerns, a student studying industry best practices, or an employee simply commuting to work.

Many organizations can benefit. After all, which organization can survive without consuming energy? For sure, energy providers need to anticipate changing consumer preferences for cleaner fuels. Energy consumers also need to be better stewards of the resources available to them. Solution providers need to sell products and services that deliver positive impacts. Government entities need to build century-long resilient infrastructure in the face of decade-long cycles of climate change.

No longer are companies buying energy just by paying the bills. As we see from Fig. 1.2, we have already shifted from this transactional domain of energy management to the managerial domain. Companies are investing in energy efficiency, solar, renewable energy credits, broad resource sustainability initiatives, and so on. Some companies, such as Microsoft, have even moved to the strategic domain by procuring their own renewable power as a way to remove the carbon liabilities that are within their local electric utility's fuel mix.

The role of a *Corporate Utility Office* is to manage the convergence of energy, water, transportation, and many other supply-side infrastructures and balance it with the integrated needs of a corporation. Utilities span far beyond the flow of energy. A company depends on many critical utility resources—water, gas, diesel, trash collection, recycling, sewage, stormwater, and so on. Each resource has its associated capital equipment, operational processes, maintenance cycles, and best practices.

As an example of this decision-making convergence: consider a hot water heater which consumes electricity, water, and sewage utilities. It has a capital replacement cycle of a decade that is managed by the finance department and

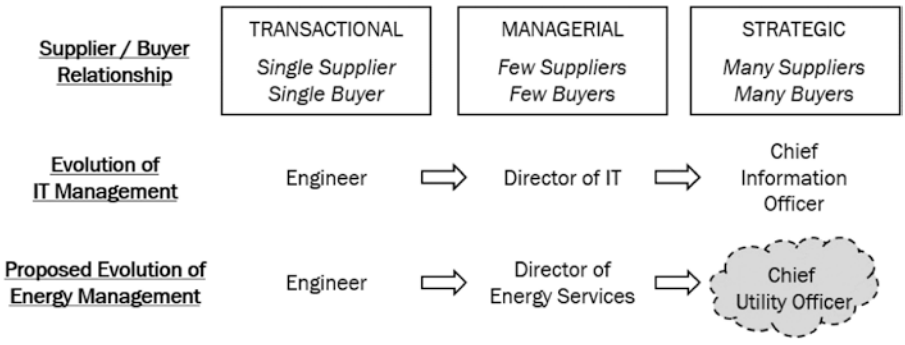

Fig. 1.2 The Evolution of the Chief Utility Officer. (Source: Author's creation)

a daily heating cycle that is controlled by the end user. The facility department may be evaluating an incentive being offered by the utility to upgrade to a more energy efficient heater. Purchasing may need to negotiate the best price from a vendor. Disposal of an old heater may require a special pickup or a trip to the local metal recycler.

It is not uncommon for the C-Suite to be the first place where all of these decisions converge. Organizations need a leader to manage this holistic energy strategy. I call it a *Chief Utility Officer (CUO)* (Jia 2016). You may have other names for the same set of responsibilities. This person views energy and resource flows as a unifying indicator of corporate operations, from upstream and downstream supply chain to internal infrastructure investments to product development and competitive advantage.

The evolution of this position is analogous to that of the Chief Information Officer (CIO) when the information technologies (IT) sector underwent dramatic changes in the 1970s. When there was only one supplier, IBM, and purchases were infrequent, a company needed a technical expert who could determine the best option. As the number of suppliers of computers grew and costs dropped, departments started making their own choices. The Director of IT evolved to help coordinate and integrate purchases. Today, with the proliferation of devices and websites in the Internet of Things (IoT), the CIOs need to manage a company's digital assets as an integral part of corporate strategy, such as top-line growth (marketing via social media), expense management (procuring cloud services vs. managing one's own data center), or risk management (cybersecurity).

A CUO or equivalent is an organizational change approach to energy management to identify, streamline, and improve corporate decision-making. Having someone in this role is a valuable indicator of the maturity of an organization's leadership capabilities in identifying and mitigating short-term and long-term risks. It is a means to evaluating sustainability approaches and reducing financial, energy, and environmental impacts simultaneously while increasing resilience of an organization. In effect, this role is to use energy and its managerial tools as a strategic indicator to improve competitive advantage.

What Are Frameworks Used For?

Frameworks are a collection of experiences and represent a *way of thinking* that has been developed into analytical and decision-making shortcuts. In this book, we use frameworks in a general sense to include models, methods, philosophies, equations, processes, approaches, or any system and their

boundaries. An intractable problem from one lens may be easily solved when viewed from a different angle. Given the complexities and interconnectedness of energy decisions with social, environmental, and economic implications, one needs to have an arsenal of tools that reveal the nuances at the nexus of multiple disciplines.

Frameworks are a point of view, usually developed to solve or explain a problem at hand. They are really good at answering the question they were developed for. Other frameworks may also have valid questions to ask of the same data and will give different answers. The universality of a tool depends on how broad the original question was. Unfortunately, frameworks can be improperly applied by forcing them to answer a question they weren't designed for, giving weird results. Avoid this scenario by learning their intended question and proper application.

Frameworks are a tool to give decision-makers some clarity of their situation. Static frameworks that categorize the information at hand are good for diagnosis. Frameworks that describe processes are best used to organize tasks and a team to complete a project. Relationship-based frameworks demonstrate flows and the dynamic nature of decision-making. Philosophies may elucidate competing trade-offs or priorities that a leader has to grapple with. They give direction to the way decisions are made.

Frameworks are a mediating instrument that creates an organizing principle and structure to align the actors across individuals in a corporation or between corporations in a sector (Miller and O'Leary 2007). Individuals can work to optimize their facet of a framework, knowing that they are plugging into a larger system. For example, the framework of an **Income Statement** brings together the sales divisions that optimize for top-line revenue and the production teams who are optimizing for their expenses.

Frameworks can be used to communicate systems thinking. Embedded within a framework are the definitions, constraints, boundaries, relationships, categories, assumptions, questions, intentions, possibilities, and other characteristics of complex systems. Studying a framework is to learn about the system it resides within. Speaking in frameworks can help convey such complexities and nuances. Thinking in systems can help find subtle and effective solutions with large impacts.

Lastly, frameworks are dynamic beings with lives of their own. They can be created, taken apart, remixed, modified, and adapted for one's own purposes. Play with the frameworks in this book. Experiment with them. Create new ones. Apply them to different situations and discover their strengths and weaknesses. Most importantly, have fun learning in the process!

How to Read This Book

The two hardest parts of problem solving are:

1. How to start
2. When to stop

Gathering information for a framework is a very good place to *start*. This is useful even if one is unsure of what to look for. In writing down what's known, one can start to see patterns, trends, and categories that can inspire further analysis.

One is never finished with problem solving, but one needs to know when to *stop*. System boundaries offer a place to stop because there's nothing left to explore. Once a framework is completely filled in, the analysis is usually done and conclusions can be drawn.

Where one draws the boundary determines the possible set of solutions. Knowing that a problem is solvable is half the battle. In many cases, an unbounded problem is also unsolvable. Spend your time solving *challenging* problems instead of tackling *impossible* ones.

Here is a suggested process to use the frameworks in this book (Fig. 1.3):

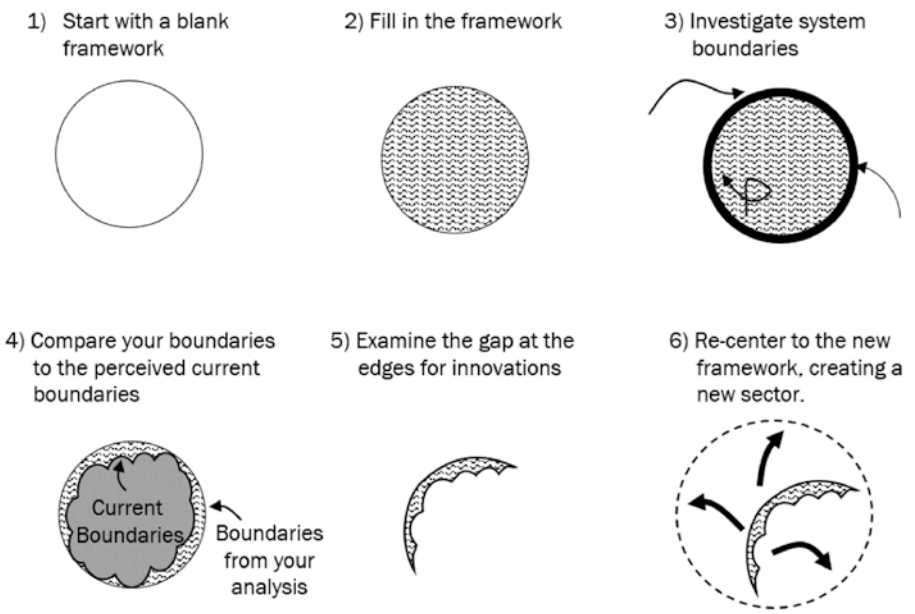

Fig. 1.3 How to read this book. (Source: Author's creation)

1. *Start with any framework*. When at the beginning of the exploration, it actually doesn't matter which one is chosen. Trying out a framework may reveal whether it's useful or not.
2. *Fill in the framework* as best as possible, clearly notating known information, assumptions, and educated guesses.
3. *Investigate system boundaries* by pushing beyond the assumptions. What if the opposites were true? What are the extreme operating conditions of the system?
4. *Compare one's boundaries to the actual boundaries* that are perceived by the market, by competitors, or by the general public.
5. *Examine the gap* that is created between your analysis and the reality in the market. These are **White Spaces**, a previously unexplored area where an innovation may lurk.
6. If an innovation exists, *re-center the worldview* to this new frame of reference and create a new sector.

If one is stuck on a problem while going through this process, try picking a different framework to use and follow these same six steps. A shift in frame of reference sometimes offers new insight. When an insight reveals itself, focus on it and try to understand the new assumptions. Explore those new boundaries and see if one can create a new worldview with this newfound lens.

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Part I

Energy as Strategy

2

Introduction to Part I: What Is Energy as Strategy?

Strategy is the art of achieving advantage in the face of uncertainties and constrained by limited resources. Strategy needs to be supported by a plan, and frequently the plan is confused to be the strategy. Indeed, soldiers need to execute the *act* of taking the hill. The lieutenant needs to create a plan of *how* to do it. The colonel needs to pick *which* hill. However, deciding if a battle is even worth it—that is the role of the General. This person, the chief strategist, needs to understand *why* they need to take the hill in the first place.

Money is a limited resource, mediating the exchange for food and water as well as houses, cars, and haircuts. Finance is a field that examines the efficient allocation of resources, given the uncertainty and risk of spending the money. Leaders can use financial tools to wisely and carefully invest their money to meet a required rate of return.

Energy is a limited resource that humanity has consumed for its entire history, harnessing animal power for agriculture, fire for cooking, wind for sailing vessels, fossil fuels for electricity, and so on. As a limited commodity and a contributor to environmental externalities, it also needs to be wisely and carefully consumed.

Carbon is becoming a global constraint as an externality from our fossil-fuel-based economy. Carbon emissions have risen dramatically in the last few decades, contributing to wild swings in weather and a changing climate. Companies are evaluating their impact on the environment as well as their resiliency to future weather-related disasters. Governments are evaluating carbon pricing as a way to minimize this flow through monetization and decarbonization investments.

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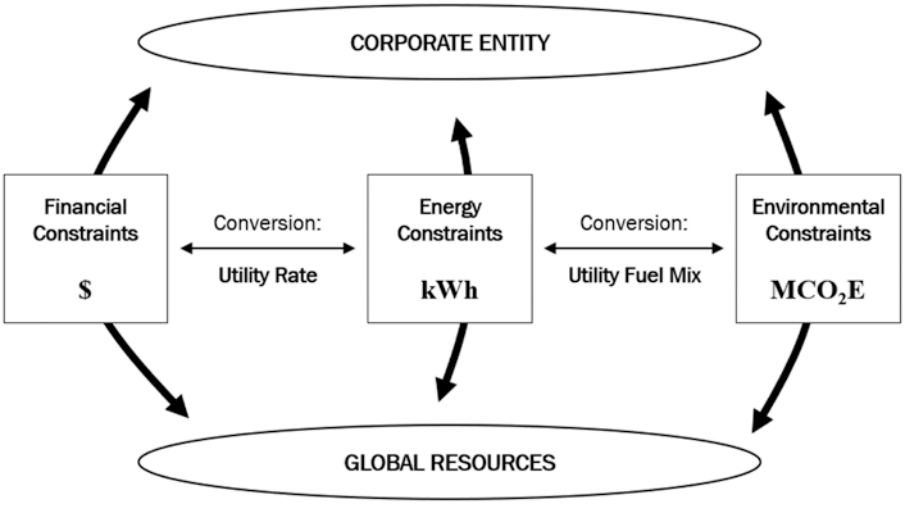

Fig. 2.1 Nexus of finance, energy, and carbon. (Source: Author's creation)

Energy, carbon, and money form a nexus of constraints that converges twice, once as *global resources* and again as a *corporate entity* that consumes those resources (Fig. 2.1). In the first nexus, the planet provides natural resources to be used. Financial wealth can be represented by gold, land, and other physical resources. Energy abundance and scarcity are dependent on the availability of geologically based fossil fuels, hydropower, and, more recently, land-based wind and solar. Carbon emissions are a side effect of the two other flows, emitted into our atmosphere, affecting the climate and weather. Furthermore, the flow of all three resources can be transmuted from one to another. Financial and energy flows are related via the *utility rate*. Energy and carbon flows are related via the *utility fuel mix*.

The corporate entity, as the second nexus, uses all three resources for societal benefits. Financial constraints limit options and dictate how fast one can invest to generate profits. Energy constraints limit operations and where one might site a facility. Carbon constraints are starting to affect resiliency decisions as companies plan for an increase in climate-related natural disasters. Corporate strategy is thus constrained by all three resource flows.

We built separate societal infrastructures to manage each resource flow. Banks manage financial resources, utilities manage energy resources, and governments create laws and regulations for environmental well-being. As these resources converge, so too must the organizational disciplines, managerial tools, and strategy frameworks converge to reflect this new reality.

Energy as Strategy is a new discipline that uses metrics systems of energy as indicators to inform, develop, and evaluate corporate strategy. Because of their interrelated nature, the strategies, risks, and opportunities of each resource affect those of the others. Just like an auditor can use the flow of money to examine a business, an energy strategist can use the heartbeat of energy flow to diagnose the health of a company's operations and processes. These tools complement existing financial strategies, giving businesses a new view into their operations. How well strategists manage the energy-finance-carbon nexus will determine the firm's future position in the market.

Part I explores these nexuses in the following five chapters:

- Chapter 3 examines different *strategic* contexts and their applicable approaches.
- Chapter 4 connects *energy* needs to business decisions.
- Chapter 5 reviews the basics of the *financial statements* as a metrics system.
- Chapter 6 describes a new metrics system, the *energy statements*, that enables the creation and management of energy strategies.
- Chapter 7 delves into systematic approaches of organizations to reduce *carbon-related risks and exposures*.

3

Strategy Literacy: Seeking Competitive Advantage

Strategy, as a discipline of the holistic, is more important than ever, especially as our infrastructure converges, sectors intersect, and different disciplines overlap. Some emerging disciplines, such as sustainability, are holistic by nature. A carbon footprint is caused by the energy consumed, which is driven by equipment operations which is influenced by purchasing decisions authorized by the capital planning department. Further still, some companies are exposed to upstream supply chain risk due to climate change, while others are managing an increase in customers demanding green products.

These forces are creating a unique challenge and opportunity for companies to create new frameworks and management methodologies that reflect our rapidly changing environment. Internally, companies need to manage the intersecting needs of different departments and disciplines. Externally, companies need to understand the interconnectedness of their supply chain and the new risks this entails. Those organizations that adapt quickly may find themselves more fit for the future and resilient to disruptions. For departmental groups, they can communicate more effectively with executives and boards if they speak in the language of strategy. For executives and boards, they can more effectively engage with teams and report to investor/stakeholder groups.

Strategy is grounded in one's own experiences. If one has been in the situation before, one knows what to do. If the situation is new, one may thrash around while trying to make decisions. Militaries run drills to practice scenarios so as to be prepared should a calamity break out. Entrepreneurs use the mantra "fail fast," and Nike expounds "just do it" as encouragements to gain experiences beyond what one currently knows. Unfortunately, in the face of climate change, society as a whole does not have the luxury to practice or

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prepare. It is already happening around us and we need to borrow best practice strategies across all of our disciplines.

A good strategist will know what to look for and will be able to find it fast. A great strategist will know what context to look for and understand why something occurred. A wise strategist will know what's missing or will be able to tell you why something won't occur. Indeed, it takes a great deal of skill to find something that's not there! To do the latter, the wise strategist needs to constantly expand their horizons by accumulating new experiences. They need to understand the micro- and macro-factors that shape and define the new problems our world is facing. They need frameworks to help analyze the situation, develop plans, and implement actions to reach the desired outcomes. Most importantly, they need tools that reveal gaps in information and knowledge, identifying possible blind spots.

Why this chapter is important: The energy strategist needs to know their strategic context quickly so as to diagnose what type of problem they may have and what responses are appropriate. Picking the right strategy will help the organization gain a competitive edge over their peers.

Porter's Five Forces of Industry Analysis

Porter's Five Forces were developed to understand the level of competition through an analysis of the industry's structure (Porter 1979). Its purpose is to understand the attractiveness of a sector in terms of profitability. These factors show the types of threats for resources within a sector as well as the strengths of the supply chain.

The method analyses a sector to evaluate whether a company should enter or exit a market. Because it's an industry analysis, these dynamics reveal the level of effort a company has to apply in order to differentiate itself. If it's in a crowded market with many rivals, differentiation may be key. If the buyers have most of the power, then profitability will depend on customer satisfaction.

- *Suppliers* and *Buyers* have bargaining power that can squeeze the profit margins. Suppliers can raise the prices of raw materials while buyers might pick between many producers.
- *New Entrants* and *Substitutions* can threaten the market position with new products. Fast-growing markets will attract new entrants trying to establish themselves. Customers may also find substitutes that also meet their needs, such as using Lyft, Uber, or other car-sharing applications instead of buying a car.

- *Industry Rivals* are also innovating to gain market share of the same market. They will be developing their own strategies and execution plans.

As an example (Fig. 3.1), for the electric utilities, there are no local industry rivals for their products due to the local monopolies granted by the government. However, the regulations of suppliers and buyers of electricity are strong and split between the federal and state levels. New entrants and substitutions are starting to become concerns as consumers are demanding to generate their own electricity.

What it's good for: This model helps a leader understand the competitive forces and dynamics in a sector. It gives a lay-of-the-land view to understand where the biggest threats may come from. An organization can therefore strategize how to position themselves among the players.

SWOT: Situational Analysis

The SWOT analysis is a very popular method of planning. Unfortunately, its ease of use has resulted in it being poorly applied, producing superficial results. This is because SWOT is frequently used to evaluate a static entity (*perform a SWOT on the company*) rather than as it's intended: an analysis of a dynamic situation (*is our marketing strategy responsive to market needs?*).

The framework started off its life as SOFT (Satisfactory, Opportunity, Faults, and Threats), created by Albert S. Humphrey in the 1960s to answer two questions: *What's good and bad about the operations? What's good and bad about the present and future?* (Humphrey 2005) Heinz Weihrich, in 1982, was the first to create the matrix format that he dubbed TOWS.

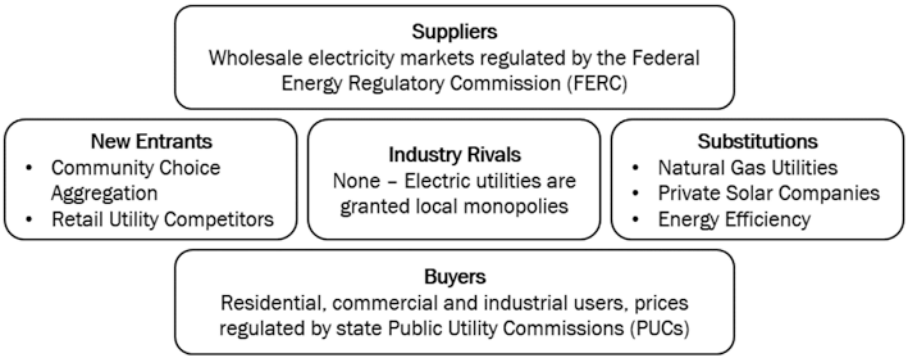

Fig. 3.1 Porters. (Source: Author's creation based on Porter, M. E. (1979) How competitive forces shape strategy, *Harvard Business Review, 57,*137–145)

A well-done SWOT analysis begins with a **Focal Question** and explores the interactions of internal factors, *(S)trengths* and *(W)eaknesses* that are within a firm's control, and external factors, *(O)pportunities* and *(T)hreats* in the market environment. The resulting four strategies are:

- *SO Strategies* are those where a company can lead in the market with their strengths.
- *ST Strategies* are those where a company uses their strengths to manage external threats.
- *WO Strategies* are when a company minimizes their weaknesses in light of an opportunity.
- *WT Strategies* need to be minimized all around, preferably scenarios to be avoided.

SWOT was designed to be contextual and company-specific in its approach to strategy. It was less successful in describing the actions of an industry. As a result, Michael Porter developed his **Porter's Five Forces of Industry Analysis** to fill this gap that SWOT left behind (Porter et al. 2002).

What it's good for: When applied well, it can provide both a landscape of challenges the firm faces as well as reveal possible actions to de-risk activities. It is best used when constrained by a **Focal Question**, evaluating it against a current and dynamic situation (Fig. 3.2).

		INTERNAL FACTORS	
		Strength	Weakness
EXTERNAL FACTORS	Opportunity	SO A firm's strength while responding to a market opportunity	WO A firm's weaknesses in pursuing a market opportunity.
	Threats	ST A firm's strengths that can counter an external threat.	WT Weaknesses of the firm to be reduced in light of an external threat

Fig. 3.2 SWOT. (Source: Author's creation based on Weihrich, H. (1982). The TOWS matrix—a tool for situational analysis. *Long Range Planning*, *15*(2), 54–66. https://doi.org/10.1016/0024-6301(82)90120-0, reprint with permission from Elsevier)

Johari's Window: Analyzing the Strategic Landscape

Although developed for personal self-awareness and communication, Johari's Window can be applied to groups and teams as well as individuals. Project managers can use it to understand what type of situations they face (Kim 2012). Similarly, strategists can use it to understand the strategic landscape and determine the right tool for the problem at hand.

The two axes describe whether we know what options might happen and the certainty of them occurring. Each axis is categorized into *knowns* and *unknowns*:

- *Identification of the event*: Do we know what event could happen?
- *Certainty of the event occurring*: How likely is that event going to occur?

This model creates four scenarios that strategists operate within:

- *Known Knowns*: Events that we know will occur and we know how to manage them.
- *Known Unknowns*: Risks we know are in our path and we know how to mitigate them.
- *Unknown Knowns*: Actions we are taking unconsciously, without realizing them. The organization will benefit if we can systematically harness them.
- *Unknown Unknowns*: Things that are beyond our awareness, thus beyond our ability to describe, prepare and plan for them.

The unknown/unknowns need the most attention from strategists. It is here that resides much of our ambiguous uncertainties of the future. The good news: there are tools that can be used in each situation and the rest of this chapter describes the four scenarios in more detail.

What it's good for: A leader can use this framework to quickly understand their strategic situation, their organizational capacity to respond, and what type of tools are applicable to their situation (Fig. 3.3).

Identified Knowledge (Known Knowns)

Identified knowledge refers to situations that are well known and that one has faced before. The problems are well defined, well scoped, and not likely to change. Solutions exist, even if they are currently unavailable to the team. If

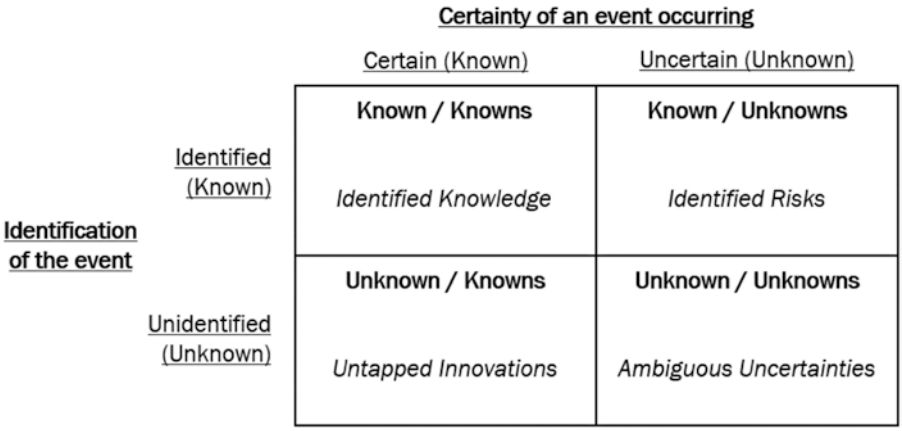

Fig. 3.3 Johari's Window. (Source: Author's creation)

so, then a team member needs to learn the skill or the team needs to hire someone who does. The situation can still be challenging, but a resolution is possible with enough effort and time.

Tasks that are born out of existing processes, checklists, and procedures exemplify identified knowledge. This might include overcoming approval procedures to making a green purchase to following a checklist to receive an energy efficiency rebate for a new motor.

In critical situations, experience can be a factor and one would want a leader who has done it before and who can execute as effectively as possible. When fighting forest fires, a veteran firefighter will know the signs of danger far before a novice. A master electrician who has already dealt with a variety of challenges has more identified knowledge than a journeyman electrician who might be facing them for the first time. Leaders with a track record will be able to respond quickly and accurately to the issues at hand.

Leadership needs: A commander who provides answers that are based on past experiences of similar problems.

Philosophical approach: Déjà vu: *I have seen this before.*

Strategic approach: Execution of well-known frameworks.

Example energy situations:

- Paying/processing a utility bill
- Installing a solar panel
- Preparing a budget for next year's fuel needs

Example frameworks in this book:

- Five Cs of Marketing: Situational Analysis
- Chapter 5—Financial Statements
- Business Model Canvas

Identified Risks (Known Unknowns)

Identified risks describe known negative consequences to be wary of. The risks are well defined, well scoped, and not likely to change. These risks can be day-to-day productivity risks of running an assembly line, to enterprise-wide threats that an industrial sector faces. Some risks might be deemed acceptable while others are to be critically managed. For instance, parking tickets for delivery trucks are deemed a cost of doing business for both FedEx and UPS, even though it runs both companies many millions of dollars per year. On the other hand, a strong cybersecurity program is critical to both companies as disruptions to their logistical computers and disclosure of customer private information would cause irreparable harm and severe losses to their business.

In these situations, the leader is someone who uses well-known techniques to identify the risks and pick the course of action to mitigate them. Presumably these risks can be mitigated or transferred or the organization can protect itself from their occurrence. One can be proactive in risk management by reducing the variability and volatility of activities that generate the risk. Alternatively, one can be reactive and shorten the recovery time when a negative event happens. Either way, knowing what risks exist means the leader can prepare for them.

Leadership needs: A manager who lowers uncertainty by resolving the risk based on past experience of similar risks.

Philosophical approach: Seek to standardize.

Strategic approach: *Reduce* variance of possible outcomes.

Example energy situations:

- Running an energy trading desk to hedge fuel costs for an airline
- Deciding between replacing an end-of-life HVAC system and deferring its maintenance
- Probability of an automobile accident in a corporate fleet

Example frameworks in this book:

- The Five Whys
- Scenario Planning
- Six Sigma

Untapped Innovations (Unknown Knowns)

"Eureka!" Exclaimed Archimedes as he stepped into the bath. He made an insight based on noticing an everyday occurrence—water overflowing when one enters a bathtub—and it sparked an innovation that solved a problem at hand. This effect is sometimes known as the Eureka Effect or the Aha! Moment.

Indeed, most innovations are already there, waiting to be noticed. A shift in context is usually what it takes. Once noticed, they can be systematized, productized, and scaled. For example, cell phones are ubiquitous and single-occupancy vehicles are everywhere. Lyft, Uber, Didi, and other ridesharing applications connected the two and disrupted the deeply entrenched taxi services. As a second example, who knew that chopping a head of lettuce was a problem until the invention of the prepackaged salads?

Innovations and insights are there, waiting to be discovered by those who know where to look. A question or a problem can inform one where to look. In these situations, the leader needs to create an environment where ideas can emerge from the randomness of events.

Leadership needs: A manager who creates a safe space for experimentation and has a keen eye to notice when something interesting occurs.

Philosophical approach: Everything's connected, including possible solutions.

Strategic approach: *Increase* variance for possible outcomes.

Example energy situations:

- Copying of insights from a different sector, such as biomimicry
- Innovating at the intersection of infrastructures
- Managing at the energy/water (or energy/transportation, etc.) nexus

Example frameworks in this book:

- Chapter 11—How to Create Your Own Frameworks
- Questionstorming/Brainstorming
- Six Steps of Innovation

Ambiguous Uncertainties (Unknown Unknowns)

Ambiguity exists when there is more than one way of interpreting the information. Uncertainty sets in when there are multiple possible responses. Unlike previous problem types where one can rely on past experiences, these situations are so novel that one is creating the playbook along the way.

It is inconceivable today for anything to challenge the smartphone. Yet ambiguous uncertainties of the digital camera killed the camera film industry, the refrigerator replaced the ice box industry, and the automobile replaced the horse. Similarly, is artificial intelligence a threat to humanity or a valuable tool? Is cryptocurrency going to replace the economy as we know it, or will it always be relegated to the fringe? Perhaps they are inconsequential and perhaps they are perilous.

In these situations, the leader needs to reduce anxiety of their followers. One way is to be firmly grounded in values that the followers can appreciate. Leading is done along the way by defining what the future holds, redefining the frame of reference, or creating the boundary conditions for the problem and solutions.

Leadership needs: A visionary and a lifelong learner with an intense curiosity to be exposed to what is beyond one's current experiences.

Philosophical approach: Vu Jàdé: *I have never seen this before.*

Strategic approach: Seek out new experiences and define the boundaries for others.

Example energy situations:

- The energy requirements in the future of an automated workforce
- How a company should adapt today for climate change effects predicted in 30 years
- The future of our neighborhoods in the era of globalization

Example frameworks in this book:

- **Wicked Problems**
- **Clumsy Solutions**
- **Muddling Through**

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4

Energy Literacy: The Energy Balance for Business Decisions

This chapter connects everyday business decisions to their impact on energy. Although many consider energy to be an engineering discipline, the management of it is actually an organizational problem.

Behind every electric bill is a piece of equipment that consumed it. Energy is a commodity that runs refrigerators, air conditioners, automobiles, computers, and everyday devices. Behind every equipment is a person operating it. It is the facility team, information technology (IT) department, and staff that deliver comfort and convenience and improve the quality of life. Behind that person is a team with a manager, and so on until we run into corporate policies that are aligned with the strategic aims of the organization. Indeed, one doesn't so much care about electrons as they care about providing cool air, fast Internet, and shareholder returns.

Although energy is governed by equations, consumption of energy is governed by human behaviors. How frequently have we heard that a building is consuming more than expected because *it isn't being operated like it was supposed to*? Optimization of a technical component, such as a motor or fan, can be done through good engineering. Management of the behavioral components of energy, the *time of use* and *duration of usage*, which are highly volatile and based on individual choice, is much more difficult.

For instance, one can install the most effective heating and cooling system on the market in their skyscraper (a technical fix), but employing evening janitorial services (a behavioral decision) can keep the building operating as late as 2:00 AM while staff cleans the facility. This behavioral aspect of energy management is much more difficult to manage than the technical parts. A

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_4

well-oiled machine behaves exactly the same way every time, whereas human behavior is far less predictable!

This chapter uses energy equations to demonstrate the relationships between business decisions and energy outcomes. Each equation gives example decisions that affect each variable. The purpose is not to do calculations. Rather, one should consider the relationship of whether the decision increases or decreases the energy consumed. Recall that, if there's a fraction, when the numerator gets larger, the value of the equation increases. The denominator behaves the opposite way: if it gets larger, the value of the equation decreases.

Why this chapter is important: Energy strategists need to link everyday business decisions to their impacts on energy and the environment. Some decisions will naturally increase energy consumption, while others will decrease it. Use this chapter to diagnose which decisions in one's organization may have an underappreciated impact on energy.

The Conservation of Energy

One of the most fundamental principles of nature, the conservation of energy, dictates that energy can never be created nor destroyed but can merely shift from one form to another. Although mostly used as a technical concept, it also demonstrates the importance of the value proposition for the consumption of energy. Formally, the equation is:

$$\text{Energy In} = \text{Wasted Energy Out} + \text{Useful Energy Out}$$

The more complete diagram in Fig. 4.1 incorporates the three laws of thermodynamics. The equals sign (=) represents a technology that transforms energy. Any form of energy can be transformed into any other form.

1. *Energy In* encompasses concerns about the fuel. Fossil fuel, renewable, and nuclear technologies affect this box.
2. *Energy Transformation* describes the equipment used to do the conversion. The energy efficiency of light bulbs, motors, and other devices affect this box.
3. *Wasted Energy Out* includes the negative side effects of energy consumption. Pollution, acid rain and carbon emissions caused by energy consumption are in this box.
4. *Useful Energy Out* is why we consume energy. Being able to see at night, feeling warm in the winter, and getting home fast are in this box.

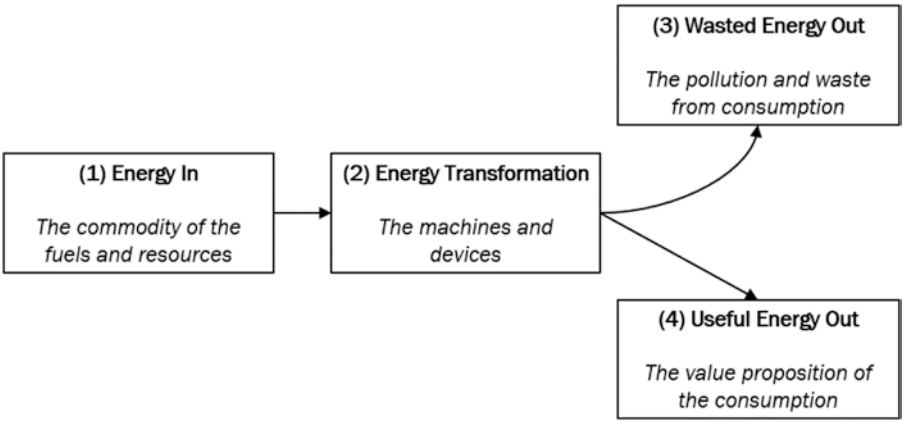


Fig. 4.1 Energy balance. (Source: Reproduced with permission of Cambridge University Press through PLSclear from: Jia, J., & Crabtree, J. (2015). *Driven by demand: how energy gets its power*. Cambridge: Cambridge University Press)

To have a sustainable energy system, we need to manage all four boxes. Rarely does Box 4—the driver of the economy, the value proposition of consumption, the societal benefits of energy—get managed equally to the other three. Box 4 requires innovations in technology, organizational structure, and management techniques to better meet societal demands. In essence, managing Box 4 requires *Energy as Strategy*.

Calculations for Energy Efficiency Depends on Defining the Value Proposition

Why is Box 4 so critical to energy management? We need to look no further than the calculation for efficiency. It is a ratio between the *Useful Energy Out* and the *Energy In*. To paraphrase, it's the value proposition for *why we consumed the energy* divided by *what we consumed to achieve it.*

$$\frac{\text{Useful Energy Out}}{\text{Energy In}} = \text{Efficiency}$$

An incandescent light bulb is a highly inefficient way to generate light—only 2% efficient and the other 98% is lost as heat energy—which is why LEDs are so much more efficient. An electric heater is nearly 100% efficient in converting electric energy to heat energy and very little energy is lost in the form of the red light generated from the glow of the heating elements. One

Table 4.1 Example energy efficiency calculations

	Efficiency to heat a room	Efficiency to light a room
Energy conversion device	Electric to thermal	Electric to photonic
Electric heater[a]	(*nearly*) 100%	(*less than*) 1%
Incandescent lamps[b]	98%	2%
LED light bulb[b]	75%	25%

[a]U.S. Department of Energy. (n.d.). Electric Resistance Heating. Retrieved from https://www.energy.gov/energysaver/home-heating-systems/electric-resistance-heating

[b]Souza, D. F. D., Silva, P. P. F. D., Fontenele, L. F. A., Barbosa, G. D., & Jesus, M. D. O. (2019). Efficiency, quality, and environmental impacts: A comparative study of residential artificial lighting. *Energy Reports*, *5*, 409–424. https://doi.org/10.1016/j.egyr.2019.03.009

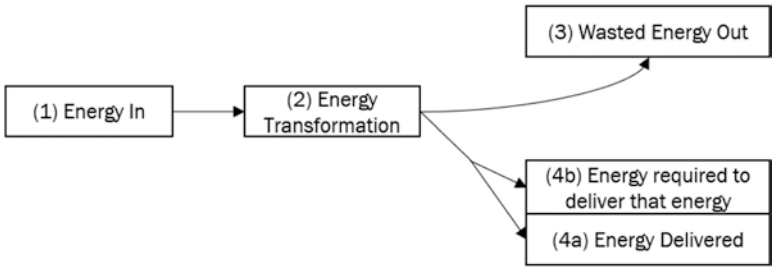
would never use an electric heater to light a room nor an LED light bulb to provide heat (Table 4.1).

Thus, energy efficiency calculations depend on the purpose of consuming the energy, the value proposition of the use. Only then can we evaluate the efficiency of the technology chosen to deliver on it. Does a company consume energy to manufacture products, keep employees warm, or run a data center? The energy efficiency of a corporation is the ratio between the output produced and the energy consumed to produce it. Anything consumed beyond that is waste.

Energy management initiative needs to start with a productivity outcome and work its way backward. The best energy solutions are those that meet the needs of a company with no wasted consumption beyond that. From a technical viewpoint, wasted energy is typically heat energy that needs to be dissipated. From a business viewpoint, wasted energy is resources consumed by nonproductive processes and operations. To eliminate waste, one first needs an energy budget to target. From that, one can back out the best devices, technologies, and fuel combination that most efficiently achieve the productivity outcome.

Energy Return on Investment: Different Definitions Create New Metrics

The conservation of energy is a highly flexible framework and can be used to demonstrate other energy calculations. The energy return on investment (EROI) calculates how much energy is needed to generate energy. Put simply, one needs petroleum to drive a tanker truck to deliver petroleum. The



$$EROI = \frac{(4a)\ Energy\ Delivered}{(4b)\ Energy\ required\ to\ deliver\ that\ energy}$$

Fig. 4.2 Energy return on investment. (Source: Author's creation)

more fuel one uses to deliver it, the less fuel is available for society to consume. We diagram this in Fig. 4.2 by separating out the *Useful Energy Out* into two components: (4a) the amount of energy delivered as a product and (4b) the energy required to transport it. The EROI is the ratio of these two numbers.

It is generally recommended that EROI has to be greater than three for a fuel to be worth pursuing (Hall et al. 2009). However, a limitation of this model is that there is sometimes little consensus in where to draw the boundaries for (4b). For instance, for biomass ethanol most would include the diesel for tractors and energy utilized for processing. Should one also include the energy used to manufacture the fertilizer used by the biomass? What about the energy utilized to manufacture the tractors and the human labor hours to run them? These boundary definitions affect the metric. As such, the EROI of coal ranges from 27 to 80, biomass ethanol from 0.64 to 30, and solar panels range from 1.6 to 12. These huge ranges demonstrate that the devil is in the detail—make sure the definitions and boundaries are clear and aligned before using EROI to draw comparisons.

What it's good for: The energy balance framework is a valuable tool to simplify the complexity of interdependencies of energy, a common challenge in the cleantech sector. It can help categorize disparate environmental solutions of solar panels, removing carbon emissions from the air, engine improvements, reforestation initiatives, and other ideas being evaluated. However, when using it for efficiency calculations, be careful that the definitions being used are the same across the analysis.

Sankey Diagram of US Energy Flow

Figure 4.3 is a popular graph known as a Sankey diagram, which depicts the flow of energy in the USA. At its core, it's an elaboration of **The Conservation of Energy** diagram as applied to the entire US. The International Energy Agency maintains other global and country-specific flows (International Energy Agency n.d.).

Each box is a separate industrial sector:

- *Energy In* is represented on the left-hand side with *Solar*, *Wind*, *Hydro*, and so on.
- *Energy Transformation* is denoted by *Electricity*, *Residential*, *Commercial*, and so on.
- *Energy Out* is shown as *Rejected Energy* and *Energy Services* on the right-hand side.

Each line represents a road, transmission line, pipeline, or other means of transporting fuel to where it's needed.

- Liquid fuels (natural gas, petroleum) are transported via pipelines, tanker ships, or trucks.
- Solid fuels (coal, nuclear) are transported via rail. However, since these are heavy or dangerous, it is cheaper and safer to convert the solid fuel to electric energy as soon as possible and transport the energy via wires.
- Electric energy (from all sources), are transported via wires from the source.

This chart reveals that energy is driven by constraints. This informs the decision process of what constraints to look for. Some examples:

- **Geographically**, this chart implies that the *source* of where an energy resource is located is not always near the *sink* of where it's consumed. A transportation network needs to exist to move energy from the source to sink. The further away the source from the sink, the costlier it is to transport it. Although solar and wind can be located closer to the consumption, there are also solar-rich and wind-rich regions of the world.
- **Financially**, each box represents a different industrial sector with a different business model. Electric utilities use a cost recovery model, roads are paid for by taxes and tolls and commercial businesses and are profit driven, and so on.
- **Regulatorily**, each box is regulated by different entities. The Department of Energy oversees nuclear and hydro issues, the Occupational Safety &

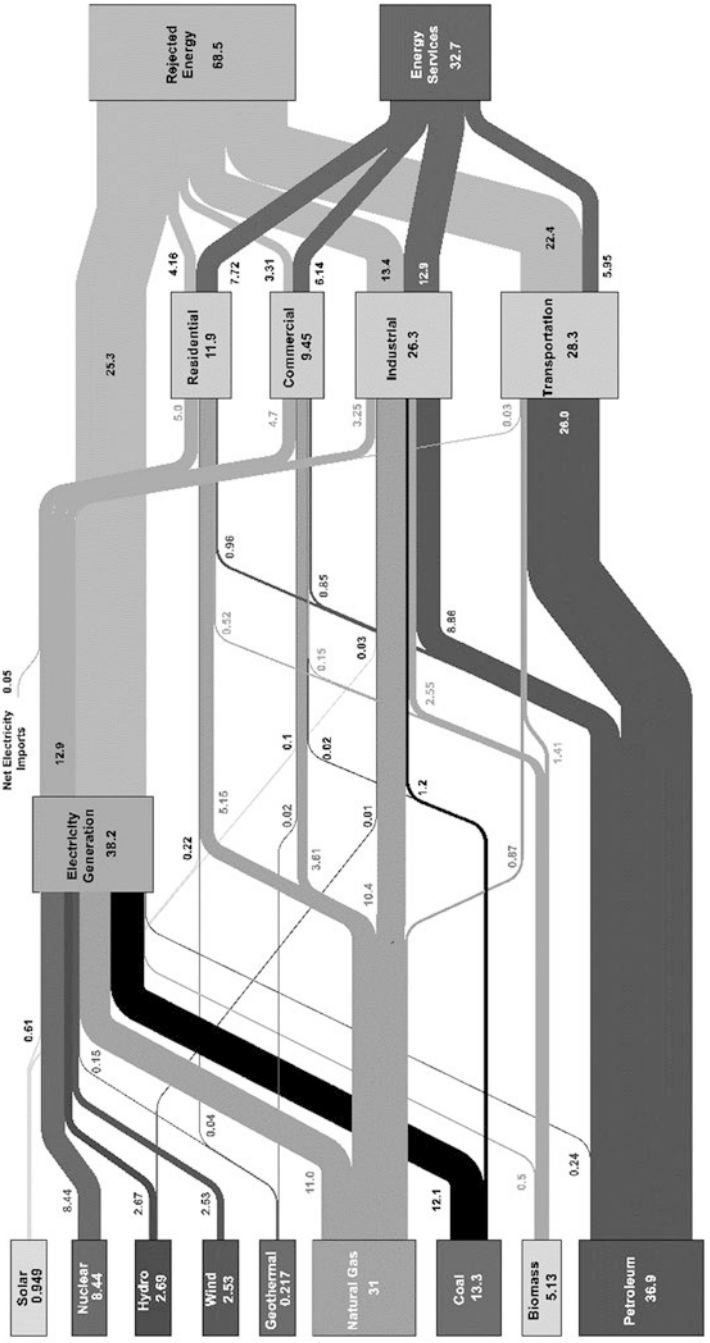


Fig. 4.3 Estimated US energy consumption in 2018: 101.2 quads. (Source: Estimated U.S. Energy Consumption in 2018: 101.2 Quads (2019) Lawrence Livermore National Laboratory, U.S. Department of Energy, LLNL-MI-410527. Retrieved from https://flowcharts.llnl.gov/)

Health Administration (OSHA) within the Department of Labor regulates commercial and industrial safety, the Environmental Protection Agency (EPA) regulates pollution caused by rejected energy, the Federal Energy Regulatory Commission (FERC) regulates the wholesale electricity markets, and state Public Utility Commissions (PUCs) regulate the retail prices.

What this is good for: Leaders can use this diagram to get a quick idea of what context their energy issues reside within and the other stakeholders who are involved in that area of the energy ecosystem).

Kinetic Energy: Transportation Constraints

The kinetic energy equation governs the boundary condition of the transportation sector. There are several factors that affect how much energy it takes to move something (Fig. 4.4).

- *Mass*: The heavier the vehicle and the object being moved, the more the energy consumed.
- *Distance*: The further away it needs to go, the more energy it takes.
- *Time*: The faster it needs to arrive, the more energy it needs.
- *Resistance*: The higher the friction, the more the energy lost.

Time and *Distance* are also related to density and congestion. If too many people travel in the same direction at the same time, the roads may become

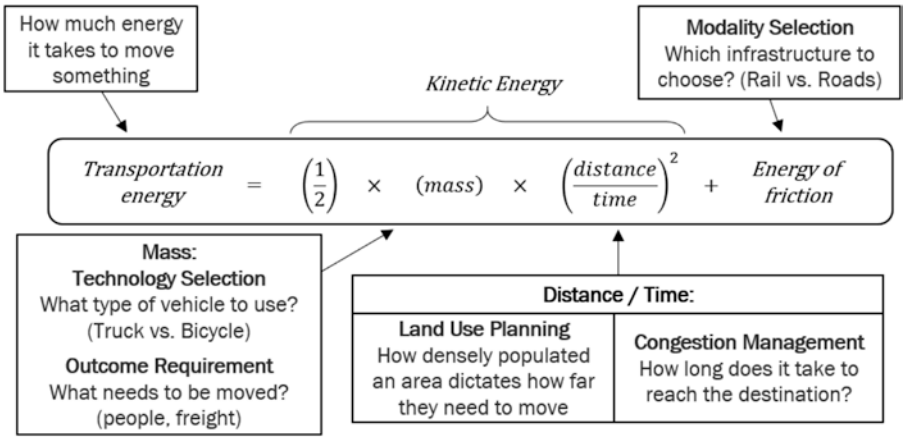


Fig. 4.4 Kinetic energy. (Source: Author's creation)

congested. One solution is to increase the density of people traveling by using buses and trains instead of automobiles.

Very quickly, one can see that different people have decision authority over the different variables. National policies affect the *resistance* variable. The USA's transportation policy is to build highways while Japan's transportation policy is to build rail. Rail travel is preferred for heavy objects, like freight, because it has a much lower friction than rubber tires on roads. Individual decisions affect the *mass* variable by picking which transportation technology they want to use (bicycle vs. mini-van). In expensive city centers, people may live close enough to walk to work (*distance*). Many states allow single drivers to pay a fee to drive in the less congested high-occupancy vehicle (HOV) lanes, shortening the trip's *time*.

What it's good for: This model helps categorize transportation ideas. For example, Lyft and Uber claim to reduce the number of cars (*mass*) and increase convenience (*time*) with their ridesharing product. On the other hand, they have also been criticized by increasing the number of cars driving around while waiting for customers, increasing the *distance* a car travels while idling.

Enthalpy: Heating (and Cooling) Constraints

Enthalpy is the measure of the total heat energy of a system. This version of the equation depicts how heating (and cooling) works. It's a complicated model and here are some important points (Fig. 4.5):

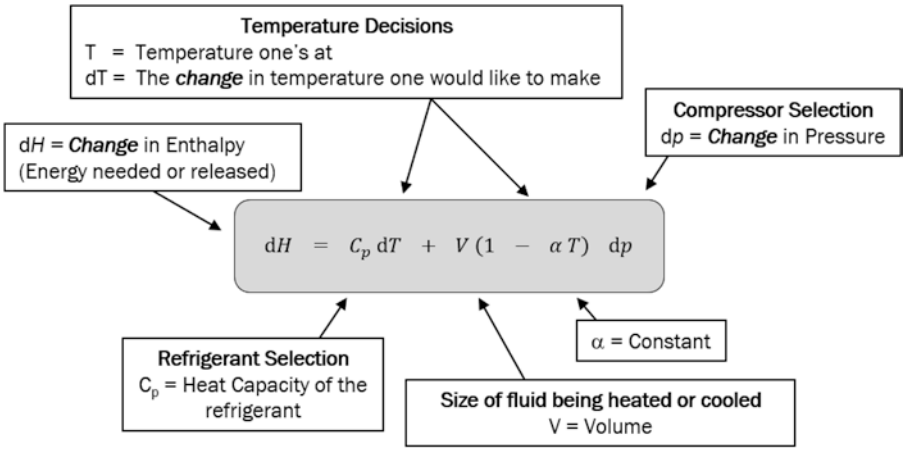


Fig. 4.5 Thermal energy. (Source: Author's creation)

- Heat is a comparative measure against a reference point. This comes from the "d's," which represent derivatives, and shows that *changing* temperature and *changing* pressure affects *changes* in enthalpy. One does not "have heat." One "has more heat than something else."
- The reference point is frequently implied and unstated. For instance, *generating heat* implies creating more heat than the surroundings (the reference point). *Feeling warm* implies that one's comfort preference is the reference point.
- *Temperature* (T) is the temperature one is at right now. It is frequently used as a proxy for heat, but as the equation shows, that is a mere simplification. The behavioral component of heat resides in the *Change in Temperature* (dT), or how hot or cold one wants to go. The larger the change in temperature, the more the energy required.
- *Change in Pressure* (dp) can be manipulated by technologies, such as compressors, to affect the temperature. The pressure change is usually driven by electric or fuel energy. The resulting temperature change can be positive (to heat) or negative (to cool).
- A *refrigerant* is a fluid that affects the heat capacity (C_p) term. The heat capacity of air is affected by the humidity. Other fluids can remove heat, as used in a refrigerator, or to store heat, as water can be used in a hot water heater.

What it's good for: Although this model is usually too complicated to use directly in business, it is a useful reminder that all energy is relative. Most energy innovations also have implied or unstated reference points (*see* **Absolute vs. Relative Metrics**). By understanding those reference points, one can understand the context and boundary of the system under analysis.

Electric Energy: Electrons as a Commodity

Electric energy is probably the most pervasive form of energy we use today. Fundamentally, it is calculated based on the number of electrons that flow through a wire over a given period of time across a voltage potential. The simplified equation is:

$$\text{Electric Energy} = \text{Current} \times \text{Voltage} \times \text{Time}$$

Voltage can be expanded into its constituent terms of current and resistance:

$$\text{Electric Energy} = \text{Current} \times \left(\text{Current} \times \text{Resistance}\right) \times \text{Time}$$

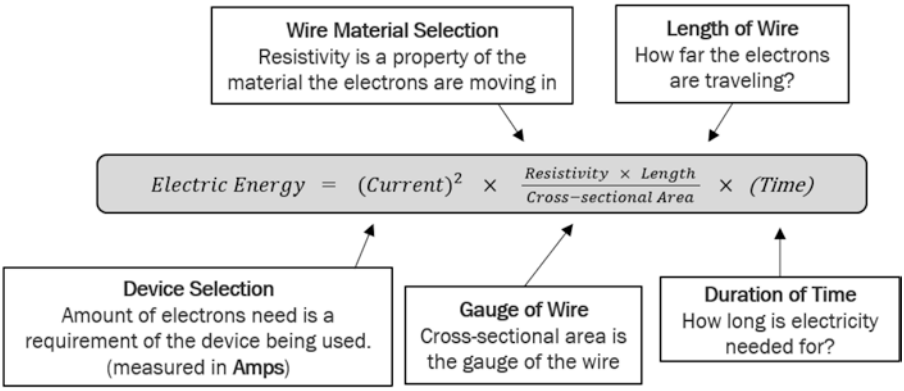


Fig. 4.6 Energy as a commodity. (Source: Author's creation)

Resistance can be expanded to reveal the material property of the wire, giving us the full equation in Fig. 4.6. Some observations:

- *Current*: Measured in amps (A), this is a requirement that is set by the device being used. Smart phones need less than 0.5 A, microwave can be 4.5 A, and a tumble dryer 10 A. Note the square, so twice the amps draws four times more energy!
- *Resistance*: To minimize the energy consumed, the wire should be made from low-resistivity metal and have a short length and a wide cross-sectional area. Copper is the preferred economical choice for its resistance.
- *Time duration*: For how long does one need to use electricity for? This is the behavioral component of energy that depends on turning the device on and off.

Although most electric management techniques focus on better equipment, one can also optimize consumption through better behavioral policies, such as automated light switches and timers on electrical devices.

What it's good for: This model shows how electric energy is provided by electrons. It is mostly a technical demonstration of energy consumed with the behavioral aspects embedded in the *time* variable.

Electric Power: Electrons On-Demand

Power is formally the rate of work done by an energy source and is calculated by dividing energy by time (Fig. 4.7). Power, measured in kilowatts (kW), gets frequently confused with energy, measured in kilowatt-hours (kWh). Perhaps if we used joules (J) for energy and horsepower (hp) for power, they would get confused less often.

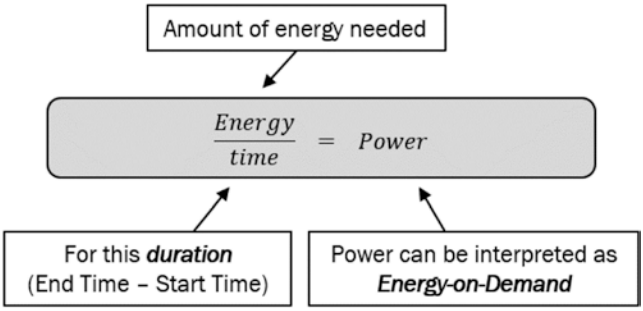


Fig. 4.7 Energy on-demand. (Source: Author's creation)

From a business point of view, electric power and electric energy are actually two different products. Energy is how *many* electrons one needs and power is how *fast* one needs them. By default, the electric grid provides both products at the same time, making it extremely versatile and device manufacturers can use either or both in their equipment. For instance, power drills, motors, and compressors value the power attributes of electricity, while electric hot water heaters, light bulbs, and ovens depend on the energy attributes.

Most end users want the freedom of choice to turn devices on or off. Although most people focus their attention on *electrons*, a feature of energy, the grid is also providing *electrons on-demand*, a feature of power. The power system was built to be on deck and ready at a moment's notice to meet this demand. Thermal power plants are adept at providing both power and energy while solar panels are good at providing renewable energy. This is one reason why batteries are critical to a sustainable future—it takes the renewable electrons and makes them available on demand, providing renewable power.

What it's good for: This model helps differentiate the key energy issues facing the grid—both availability and access to the commodity. Further, as we know from content providers, on-demand entertainment is more convenient to the end user and more expensive to buy as compared to that of the broadcast TV stations. Thus, *access* to electric energy should have a higher value than just electric energy as a commodity.

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5

Financial Statements: The Universal Language of Business

This chapter gives a cursory overview of fundamental financial and accounting principles. It reviews the three main financial statements for decision support as well as some criteria used in making long-term versus short-term decisions. Although based on a few simple concepts, the tools can be used to evaluate the viability of an organization, inform a strategy, and support a wide range of decisions.

Accountants have been keeping records of financial transactions since at least 3000 BC, well before Luca Pacioli, a Franciscan friar, formalized the double-entry bookkeeping system in 1494 in his book *Summa de Arithmetica*. Most notably, he invented the balance sheet as a way of keeping track of debits and credits. This method not only kept a record of transactions, it also reduced the number of errors because every transaction had to be entered twice. If a mistake was made in one location, it was unlikely that the same mistake would be made somewhere else.

Financial statements are formal methodologies for understanding a company's performance. Grounded in the principles outlined by Pacioli, they are full of definitions, categories, and standards. There are two main accounting frameworks used today: International Financial Reporting Standards (IFRS) is used in Europe and Asia, while Generally Accepted Accounting Principles (GAAP) is used in the USA. They have different requirements of how the data is presented.

Regardless of how the financial statements are formatted, they have become an essential and versatile tool. As an aggregation device, they consolidate various cycles of information, from daily cycles of cash liquidity to 30-year cycles of capital equipment depreciation. As a record of past activity, they create an

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_5

audit trail, enabling compliance and detection of fraud and helping to increase the trust in the management team's abilities. As a well-understood structure, they communicate performance to a wide range of stakeholders, from employees to investors to the general public. As a managerial tool, they connect lagging indicators to leading indicators, supporting leaders in their decision-making process. As a predictor of the future, a pro forma version can help evaluate what's attainable.

The success of the financial statements as a **Metrics System** framework can be seen in their ubiquity. They are used by the capital markets, day traders, executive decision-makers, departmental P&L managers, investors, macro- and micro-economists, insurance analysts, and every individual who needs to manage their home finances. Very few frameworks have achieved such a universal presence in our modern-day lives.

Why this chapter is important: Energy strategists need to speak in the language of finance, the common tongue of business. The terminologies and concepts are used by every department and used in nearly every decision. Fluency in its components, structure, and capabilities is critical when trying to craft, communicate, and implement strategy.

Elements of the Financial Statements

The three financial statements, in combination, represent the financial health of an organization. Structurally, the **Balance Sheet** is a *snapshot at a given point in time* of what a company has. A period is defined as the *time between two balance sheets*. The activities that occurred in the period are captured in the **Income Statement** and the flow of money is recorded in the **Cash Flow Statement**. The three reports help the decision-makers answer these basic questions[1]:

- Where am I/How much do I own/what do I owe to others? →**Balance Sheet**
- What did I do/What did I earn and spend? → **Income Statement**
- How much did I spend/Do I have the means to get there? → **Cash Flow Statement**

By comparing among *past* balance sheets, one can extrapolate much information about the path a company took and what decisions they made. It

[1] For further discussion on the reporting structure, please see the **T**rifecta of **S**tatements to **M**anage **A**ny **R**esource **F**low.

provides an audit trail of what happened and can be used to certify compliance to internal corporate policies or external laws and regulations. When projecting into the *future*, one can use these statements to depict where they wish to be. For instance, a forecasted cash crunch in the cash flow statement may be an indication of a critical emergency that needs immediate attention. The launch of a new product may increase revenue and profit, if it is advertised and positioned correctly in the market. Risk is therefore the uncertainty of achieving the future outcome.

What it's good for: Understanding the relationship of these three statements is fundamental to running a business. Conceptually, this model can be used to know where to look for answers based on the question one's trying to answer. Any question to do with operations goes to the **Income Statement**. Any question concerning current state/future state goes to the **Balance Sheet**. Any question concerning the amount of cash available goes to the **Cash Flow Statement** (Fig. 5.1).

Balance Sheet

A balance sheet is a snapshot at a given point in time of an organization's finances. According to the rules of *Double Entry Bookkeeping*, each transaction is recorded twice, once as an asset and once as a liability or shareholder equity. This means that the two sides must always be in balance:

$$\text{Assets} = \text{Liabilities} + \text{Shareholder's Equity}$$

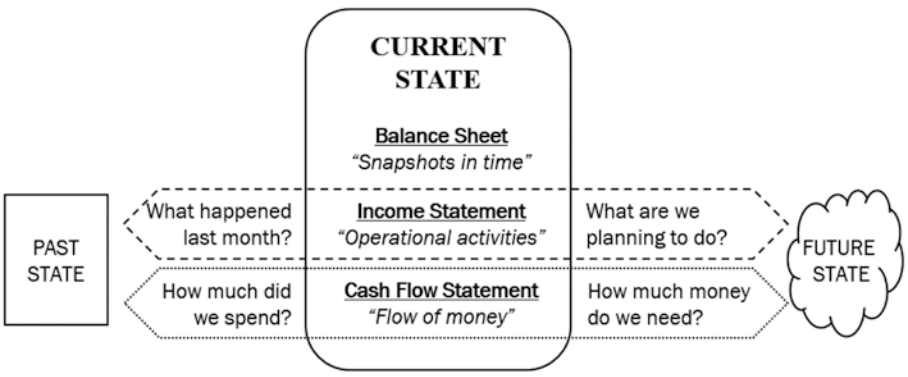


Fig. 5.1 Elements of financial statements. (Source: Author's creation)

The International Accounting Standards Board (IASB) defines the following (2012):

- *Assets* are resources controlled by the entity as a result of past events and from which future economic benefits are expected to flow to the entity. This includes cash, equipment, goodwill, and so on.
- *Liabilities* are obligations of the enterprise arising from past events, the settlement of which is expected to result in an outflow from the enterprise of resources embodying economic benefit. These include bills, payroll, loans, and others.
- *Shareholder's Equity* is the residual interest in the assets of the entity after deducting all its liabilities. This is split amongst the owners and shareholders of the company, in the form of dividends.

The balance sheet can be optimized to look good. For instance, an energy savings performance contract (ESPC) is an *off-balance sheet* financing mechanism because the company is purchasing the services of the equipment instead of buying the equipment itself. This can give the company flexibility to execute on projects. Relying too much on off-balance sheet methods can create large problems (i.e., the Enron bankruptcy).

What it's good for: Simplistically, the balance sheet tells what's available to play with for an organization. It shows the status of the company: what assets can be turned into revenue and what liabilities and obligations constrain the existing resources (Fig. 5.2).

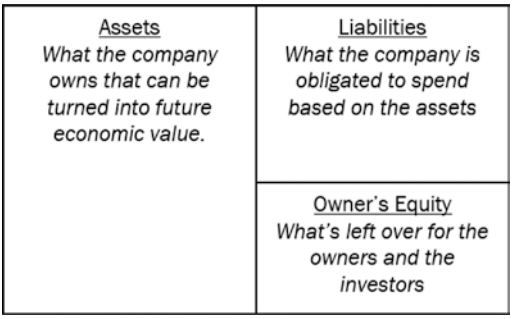


Fig. 5.2 Balance sheet. (Source: Author's creation)

Income Statement

An income statement, also known as a Profit & Loss or P&L, shows the *activities* undertaken between two **Balance Sheets**. It depicts the increases and decreases in both assets and liabilities based on tasks, investments, and actions taken. The activities taken are listed in categories that connect the top-line revenue to bottom-line profit.

- *Revenue* is the inflow of cash, primarily generated from income of products and services sold. Since it's at the top, it's also known as the *Top Line*.
- *Expenses* are any outflow of cash. The first type of expense, *Costs of Goods Sold*, is those directly pertaining to the generation of revenue. For instance, in selling lemonade, one needs to spend money on sugar and lemons. This gives us the *Gross Profit*.
- From the gross profit we subtract the second type of expense, the *Operating Expenses*. These are the costs to maintain the business, such as rent, a sales team, advertisement, and so on. We end up with the *EBITDA*, which stands for earnings before interest, taxes, depreciation, and amortization.
- The last section is composed of any activity that affects money that is not related to running the business, or *non-operating expenses*. After subtracting the interest payments, taxes, depreciation, and amortization, we end up with the *Net Earnings*. This is also known as *Profit* or the *Bottom Line*.

What it's good for: The P&L can be thought of as a financial version of a strategic plan. Activities should be funded based on company priorities. For instance, a company may decide to invest in marketing to boost sales, or focus on equipment to increase production. An investor can use the historical P&L to understand a company's strategy. An entrepreneur uses the future P&L (pro forma) to forecast the earnings potential of their business. A five-year strategic plan will usually have a forecast of what the P&L will look like over those years (Fig. 5.3).

Cash Flow Statement

A cash flow statement shows the exchange of *cash* between two **Balance Sheets**. Not every financial activity recorded in the **Income Statement** generates immediate cash. For instance, a utility bill received today that is due next month will not affect cash flow today. Likewise, a client contract signed today

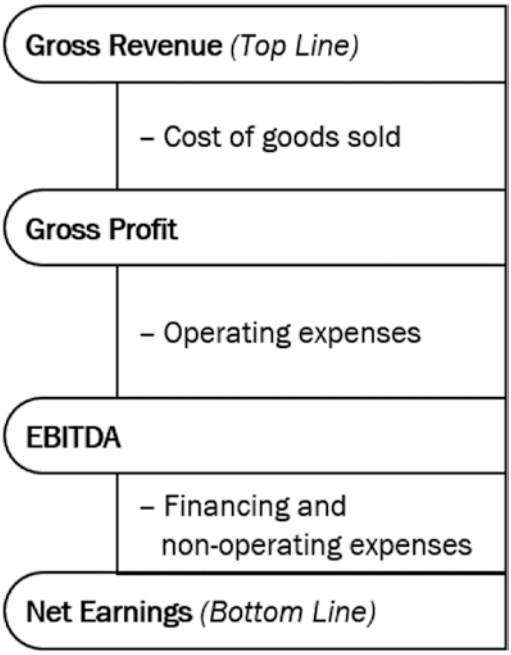


Fig. 5.3 Income statement. (Source: Author's creation)

for $1000 but paid upon delivery in three months also does not affect the cash right now. Thus, the cash flow statement reconciles the difference between operating activities and the bank account.

The corporate treasury department is usually the office that manages the flow of money for an organization. They make sure there is enough cash in the bank account when bills are due. When there is excess cash, they can earn some interest in bonds or other investments. When cash is needed, they can find a way to provide it.

When a company runs out of cash, it goes bankrupt, regardless of how much it owns in assets. This situation occurs when a bill is due and there's not enough cash to pay it. If a company declares bankruptcy, it can try to restructure the debt with the creditors or raise more money so as to consider operating (known as Chapter 11 bankruptcy). Otherwise, a company closes up shop, dissolves itself, sells all of the assets and uses the proceedings to pay off as much of the debts as possible (known as Chapter 7 bankruptcy).

What it's good for: Although profit is important, cash is king and critical to survival. Managing the cash flow keeps a company viable to make payroll or invest in the next new idea. No matter how involved a leader gets with bal-

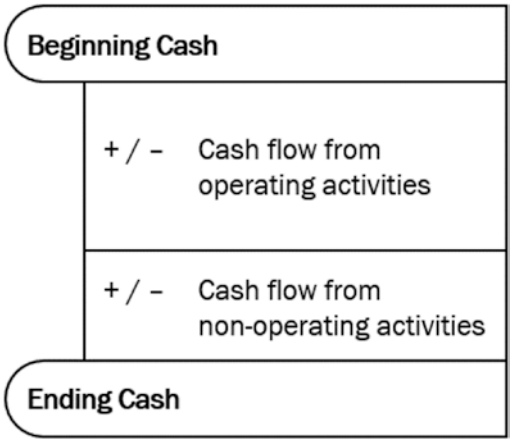


Fig. 5.4 Cash flow statement. (Source: Author's creation)

ance sheet and income statement management, the leader can't take their attention away from the cash position of the organization, lest risking becoming insolvent (Fig. 5.4).

The Value of Money

Does $1000 equal $1000? For a restaurant owner, are these four values in Fig. 5.5 treated as equals? Obviously not.

Here is why they are unequal:

- *$1000 in cash* is considered *liquid* because there are no restrictions on how it can be spent. It is highly desirable because it has the greatest number of options of how to be used.
- *$1000 in equipment* is a *long-term investment*. Assuming a restaurant generates $1 million per year in revenue and the equipment has a lifespan of 10 years, this equipment could contribute to as much as much as $10 million in future earnings.
- *$1000 in groceries* is a *short-term expense*. It can be used to generate revenue—let's say $5000 in meals. However, all of the groceries need to be used by the end of the week, lest it spoils. If it spoils, the money would have to be *written off* as a loss.
- *$1000 in the buffet* is a *sunk cost* because all of the resources have already been put into making it. If the food is not sold, then the $1000 will also need to be written off and considered lost. Therefore, it is better to sell the food at a steep discount than to let the food go to waste.

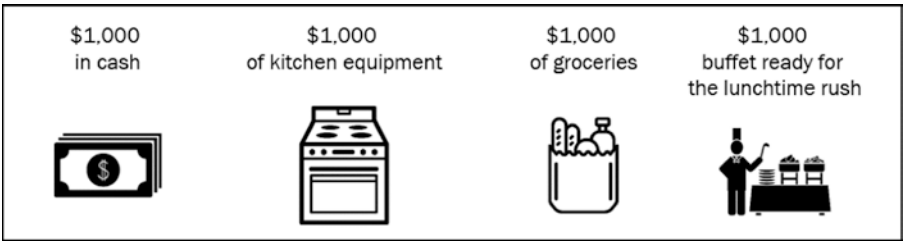


Fig. 5.5 Value of money. (Source: Author's creation)

One difference between each choice is the liquidity of the value. Cash can be spent however one wishes (high liquidity) but the kitchen equipment needs to be sold before the value can be spent elsewhere (low liquidity). A restaurant can have a high asset value in its food inventory, stove, and tables, but if it runs out of cash to pay wages to its staff, it still goes out of business.

What it's good for: One should make decisions based on the value of money. However, this isn't as simple as it seems. Each one of these examples shows how the value of money changes based on the context of when it gets spent. What's missing is how the value changes over *time*.

Discounted Cash Flow: The Time Value of Money

Is $1000 today worth the same as $1000 in ten years? Obviously not.

Every year, $1000 buys fewer Big Macs (The Economist 2019), as shown in Fig. 5.6. Similarly, the same amount of money buys fewer goods every year. If the restaurant forecasts earning $1 million per year, the earnings in Year 10 will have a lower purchasing power than the $1 million earned in the first year. The discounted cash flow (DCF) is a way to calculate the decreasing value of money in the future:

- *Discount rate* (r): Higher discount rates represent higher risk and lower value of money. Some risks are outside the control of the company (inflation), while others are internal (hiring competent staff). Typical discount rates are 6–15%.
- *Time* (n): Usually measured in years, this indicates that each year further into the future, the more risks it is exposed to, the lower the value of money for that year. For sure, one can have educated estimates for next year but ten years from now is anyone's guess.

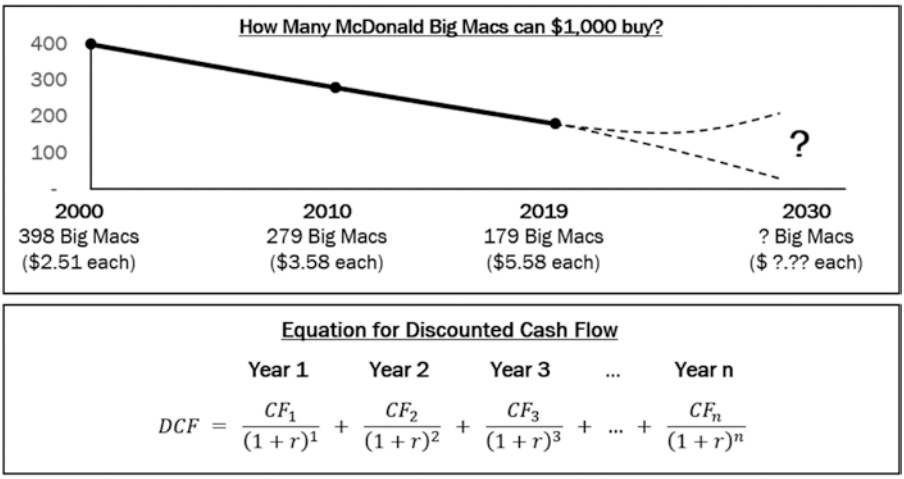


Fig. 5.6 Discounted cash flow. (Source: Author's creation)

- *The cash flow every year* (CF_{year}): Every year, there will be an amount of cash generated. The calculation discounts the future cash to today's value. (i.e., how many Big Macs do I expect to be able to buy in the future?).

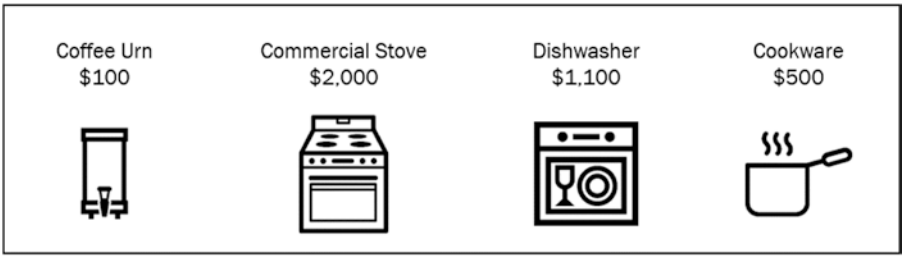
What it's good for: This incorporates time in calculating the value of future cash and compares it to today's cash. However, DCF assumes that the upfront cost is the same. How does a $100,000 investment for a commercial stove compare to the $1000 for groceries last week? What's missing is the *net value*, after accounting for the upfront investment.

Net Present Value: Different Upfront Costs

Do all investments in the restaurant cost the same amount upfront to achieve $1 million annual revenue? Obviously not (Fig. 5.7).

Net present value (NPV) is a calculation that adds the *initial investment* of a purchase to the DCF equation. The initial investment is negative because it represents an outward cash flow and does not need to be discounted because it is being spent today.

The NPV represents the amount of surplus cash generated due to an initial investment. A negative NPV means the investment is forecasted to lose money. The calculation can also be done in reverse. The *internal rate of return* (IRR) is calculated by setting NPV to zero (0) and solving for the discount



Equation for Net Present Value

$$NPV = -\text{Initial Investment} + \underset{\text{Year 0}}{\frac{CF_1}{(1+r)^1}} + \underset{\text{Year 1}}{\frac{CF_2}{(1+r)^2}} + \underset{\text{Year 2}}{\frac{CF_3}{(1+r)^3}} + \underset{\text{Year 3}}{\ldots} + \underset{\ldots}{\frac{CF_n}{(1+r)^n}} \quad \text{Year n}$$

Fig. 5.7 Net present value. (Source: Author's creation)

rate (r). It is a percentage term that represents when an investment is projected to break even. This method is preferred when the discount rate (r) is unknown or uncertain in the calculations.

How Financial Tools Support Decision-Making

Commonly, decision-makers try to maximize the future cash flow through NPV or maximize how quickly the project breaks even with the IRR. The IRR can further be compared to a *hurdle rate*, or a rate above which projects are approved. Unfortunately, the two methods don't always give the same answer. As shown in Fig. 5.8, in some situations, the NPV might be high but does not pass the hurdle rate. An expensive and durable stove will take much longer to pay off yet may generate profits for a longer period of time. On the other hand, high IRR projects may not have the highest future cash flow. This can occur if the initial investment is small. For instance, the investment of an ice cream machine might make a quick profit (high IRR), but there's only so much ice cream a restaurant can sell.

Although DCF, NPV, and IRR are the most common financial tools, there are also many others available. The financial toolkit also includes economic value add (EVA), return on investment (ROI), return on equity (ROE), price-to-equity (P/E) ratio, and others. None of these tools are superior to another per se and their application depends on the question to be answered. A good strategist will use multiple tools to validate and support their decision-making rather than relying on a single result.

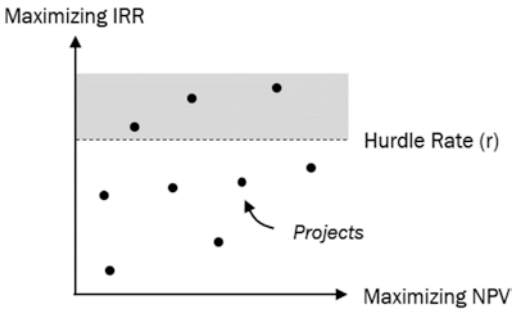


Fig. 5.8 Internal rate of return. (Source: Author's creation)

How Financial Tools Affect Environmental Decisions

Financial tools can be directly applied to environmental decisions. They can be used to calculate the value of energy efficiency and environmental investments. Unfortunately, when used this way, cost-reduction investments usually score lower than revenue-generating ones. Furthermore, an environmental investment usually lasts 10–30 years, saving money far beyond a typical DCF/NPV/IRR analysis of 5–10 years (*see* **Financial Risk Management**).

Financial tools can be modified to better meet the realities of environmental decisions. For instance, environmental measures decrease long-term risk exposure in reduced compliance, cleanup, and other uncertainties. This means that the environmental measures should be subject to a lower discount rate, *r*. Indeed, the Port of Seattle uses a 10% discount rate for infrastructure projects and a 6.5% discount rate for environmental projects. This puts environmental projects on equal footing with revenue-generating alternatives. A word of caution for this approach: good strategies reside on evaluating the results from a suite of tools and methodologies, not on the dependence of any one tool.

It is important to develop environmental tools that address environmental decisions. In the next chapter, we explore a new tool available to make energy strategies. In it, we adapt the best practices of managing the flow of money with the financial statements to managing the flow of energy with the creation of a parallel set of **Energy Statements**. The practice of *Energy as Strategy* results from these tools, helping bring management clarity to the finance, energy, and carbon nexus.

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6

Energy Statements: Mediating Decision Cycles

In this chapter, we describe a new framework for a metrics system that unifies the reporting of energy across an organization. We propose a set of energy statements that can consolidate varying scales, frequencies, duration, and impact of energy initiatives. This gives stakeholders a unified and more sophisticated view into energy decisions.[1]

The **Financial Statements** have many advantages that have led to their universal adoption in business. However, it is only one frame of reference view into our society. The rise of **Non-financial Indicators for Corporate Governance** (Part V) indicates that companies are searching for other views. The principles behind the financial statements are sound but limited in an energy context. This raises a question: if the three financial statements are a metrics system that manages the flow of money, why not create a parallel metrics system of three energy statements to manage the flow of energy?

Today, energy management as a discipline is focused primarily on the *flow* of energy. Most companies want their energy managers to save money on utility bills, but bills only represent this flow. In reality, energy-related costs occur on different *cycles* for different *durations*—monthly bills, ad hoc maintenance, yearly retrofits, and decade-long end-of-life equipment planning. Furthermore, the data is needed by a multitude of actors to do their jobs—accountants to pay the bills, engineers to diagnose equipment, impact investors who focus on environmental indicators, and so on.

[1] Special thanks to Dennis West of Oxford University for his major contributions to the development of the energy statements and the drafting of this chapter.

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_6

Energy statements is thus a shift from managing energy-as-a-commodity *flows* to managing energy as strategy *decision cycles*. By creating a comparable balance sheet and income statement, energy data can be organized into well-understood formats and can be comparable, transferable, and able to be consolidated from corporate divisions to national statistics. More importantly, these energy statements become a new frame of reference for corporate strategies. A company can create new processes, practices, and priorities that improve resilience, adaption, and competitive advantage.

Executives can use energy statements to improve the management of assets, risks, and opportunities of an organization to achieve a sustainable energy outcome. These statements can decrease transaction costs and barriers of misunderstand among stakeholders making energy decisions. The statements provide an audit trail so that one can connect the lagging to leading indicators of energy-related decisions. They also reveal areas of opportunity, both revenue-generating and cost-reduction ones. Executives can be armed with a new set of decision-making tools enabling better capital deployment of climate-resilient investments.

Why this chapter is important: The energy statements are the primary tools for the energy strategist. This framework can analyze a company's performance through a non-financial lens. They can provide a new and complementary oversight into a company's operations, identifying overlooked areas for improvement as well as new opportunities.

Relationship Between Energy and Financial Statement Frameworks

The proposed energy statement framework has direct corollaries to the financial statement framework. It adopts some of the organizational and categorization aspects of the financial sheets and applies them to energy principles. The financial statements have three components—a snapshot view, a list of activities and a report on the resource flow. The energy statements are structured in a similar format.[2]

First, as stated in Chap. 2, the flows of financial, energy, and carbon resources are interrelated. Finance is measured in dollars, euros, yen, and other currencies. Energy is measured in kilowatt-hours (kWh), joules, therms, British thermal units (BTUs), and other energy units. The conversion from finance to energy is made through the utility rate. Carbon emissions are

[2] For further discussion on metrics and reporting, please see **Trifecta of Statements to Manage Any Resource Flow**.

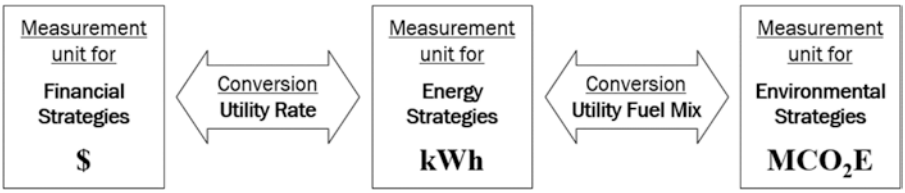

Fig. 6.1 Finance, energy, and carbon. (Source: Author's creation)

measured in tons of CO_2 equivalents (CO_2E). The conversion from energy to carbon is done through the utility fuel mix (Fig. 6.1). This chapter will focus on the intersection of finance and energy, although the same concepts apply for carbon management as well. Chapter 7—**Carbon Strategies: De-Risking Carbon** will cover carbon-related strategies in more depth.

Second, the financial and energy flows are both in balance. **The Conservation of Energy** governs the balance of energy, while the **Balance Sheet** determines the balance of financials. The two balances have similar forms:

Energy Balance: Energy In = Wasted Energy Out + Useful Energy Out
Financial Balance: Assets = Liabilities + Shareholder's Equity

Energy statements can consolidate the relationship between different departments that are making energy decisions, the different time cycles of their decision-making process as well as the different durations of the decision outcomes. For example, turning on a heater only when people are in the building, installing more insulation in the walls, and investing in an energy-efficient HVAC system are decisions that could have been made by operations, capital, and real estate departments that all result in keeping a room warm.

Energy statements also show how different tools work in conjunction with each other and what type of problems each is trying to address. In the financial world, short-term management of cash flow is accomplished with liquidity management tools and long-term management is done with asset management tools. We give two corresponding examples for energy management. First, state-of-the-art **Energy Storage** technologies are only able to shift resources up to a few days, paralleling a liquidity management solution. Second, energy can be stored for long term as **Embodied Energy** inside of products or as a physical asset, providing for a long-term management solution.

Energy statements is a new tool to diagnose the health of an organization, complementing existing financial tools with energy resource ones. It gives more oversight and compliance of energy-related activities, connecting the leading and lagging indicators to actions taken. Ratios and other per-unit metrics can be used to continuously improve energy decisions. For instance,

Table 6.1 Comparison of financial versus energy statements

Reports		
Snapshot view	Balance sheet	Energy balance sheet
List of activities	Income statement	Energy activity statement
Report on resource flow	Cash flow statement	Energy flow statement
Management		
Short-term management (shorter than 1 year)	Liquidity management tools	Energy storage technologies
Long-term management (longer than 1 year)	Financial management tools	Embodied energy in products

Source: Author's creation

an energy-per-revenue metric can demonstrate whether a company's revenue is coupled or decoupled from its energy footprint. To decouple the metrics, one can identify technologies and practices that keep the energy requirements flat while per-unit sales of products increase.

Table 6.1 demonstrates some of the relationship between the financial and energy statements. The rest of this chapter will explore the components of the energy statements as well as apply them to **Creating Holistic Energy Strategies**.

Elements of the Energy Statements

The relationship within the energy statements also parallels those of the financial statements, as depicted in Fig 6.2. The statements help answer basic questions: *What* consumes energy, describes the equipment and people. *How* one consumes includes operating hours and production cycles. *Why* one consumes includes keeping employees comfortable and meeting customer service requirements.

The snapshot at a given point in time is depicted in the **Energy Balance Sheet**. The energy assets and liabilities within are organized based on the ease of access to the resource.

The **Energy Activity Statement** categorizes the activities between two Energy Balance Sheets. Different departments manage the various cycles of energy and frequently do not coordinate with each other, creating areas of waste and inefficiencies. For instance, accounting may process the bills while facilities hire the mechanical contractors and the real estate team manages the capital upgrades.

Energy Flow Statement becomes a formal documentation of the bills and flow of resources through the organization. This can also include offsets to the flow, such as renewable energy credits (RECs) or carbon offset.

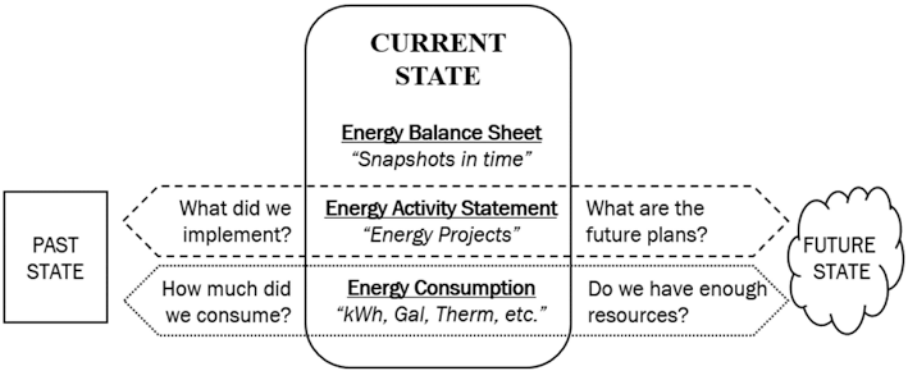

Fig. 6.2 Elements of energy statements. (Source: Author's creation)

What it's good for: Management teams need to know leading and lagging indicators for decision-making. The elements of the energy statement framework give managers a way of consolidating and categorizing energy activities in a familiar manner. It helps organize information into digestible chunks. It reveals how different stakeholders, who are responsible for different roles, can intersect to accomplish an energy initiative.

Energy Balance Sheet

We consume utilities because of the outcomes they enable. The true cost of utilities needs to include all of the costs that enable comfort, convenience, and quality of life. The Energy Balance Sheet (EBS) is the relationship between a company's internal and external factors that are directly or indirectly affected by resource consumption.

- *Energy Assets*: Resources controlled or contracted by the organization from which future benefits are expected to follow. It lists the capacity an organization controls to influence the future. This includes stored resources, self-generated, or contracted from external sources. Other assets include equipment that delivers energy services (i.e., cold air), reserve funds for equipment replacement, and the thermal envelope of the building that minimizes amount of contracted energy needed. For most organizations, *stored energy from previous period* will be zero.
- *Energy Liabilities*: Obligations arising that require the outflow of energy resources. These include utility bills, environmental compliance, and other support costs related to consumption. Liabilities due to the loss of energy access (blackouts) reside here.

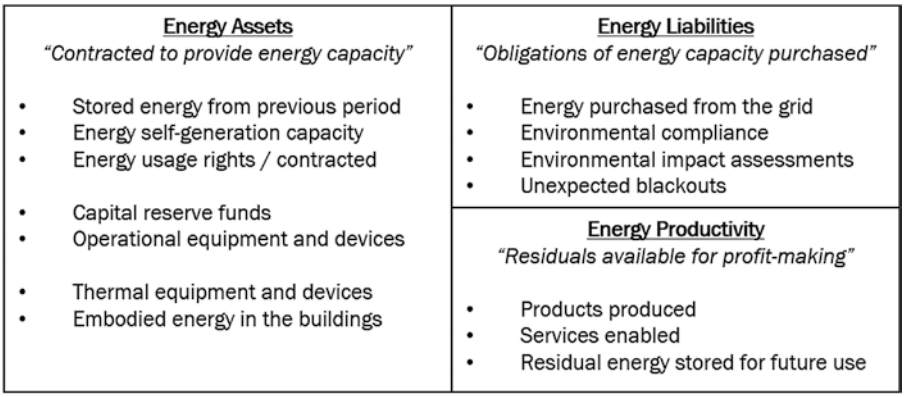

Fig. 6.3 Energy balance sheet. (Source: Author's creation)

- *Energy Productivity*: Residual energy that can be used to deliver on customer promises, other profit-making activities, or stored energy for future consumption. This can be viewed as widgets produced and/or business services enabled.

The order of the categories within the Assets and Liabilities follows an accessibility stack, akin to the liquidity stack of the financial balance sheet. The most accessible energy is at the top and the least accessible energy near the bottom. Thus, a diesel backup generator can be used for many functions, whereas the thermal envelope of the building can be used only for a few.

What it's good for: This shows the relationships between an energy asset and its associated liabilities and productivity. It consolidates energy decisions that have both long- and short durations and made on differing decision cycles. This can be used as a diagnosis tool to identify the total and true cost of energy consumption within an organization (Fig. 6.3).

Energy Activity Statement

Paralleling the **Income Statement**, the Energy Activities Statement (EAS) shows the consumption activities between two **Energy Balance Sheets**. These activities may cause an increase or decrease in both energy assets and liabilities.

The top line represents the *total energy* requirements for the time period. This could be self-generated from rooftop solar panels, stored in a diesel tank or purchased electricity from the grid.

- The first category of consumption for *energy on-demand*. This could be to support client needs and productivity, such as operating the stove for a restaurant, ramping up production at a manufacturing plant in response to demand, or jet fuel for an airplane.
- The second category of consumption is for *energy services*. This could be for facility management, real estate leases, but also business functions that need an energy-enabled work space, such as office workers.
- The last category of consumption is for *passive consumption* and functions that don't require any energy at all. This could be providing bicycles to travel between offices or increasing insulation in a facility. Financial instruments, such as debt payments on energy equipment, are listed here as these actions taken don't consume energy.

What it's good for: By classifying activities in this way, a company can understand the categories of how and why they are consuming energy. Client activity may be critical, some corporate activity may be preferential, and some activities may not be dependent on the consumption of energy at all. In separating out activities in this manner, a company can set energy targets for activities and understand the effects of any energy decision being made (Fig. 6.4).

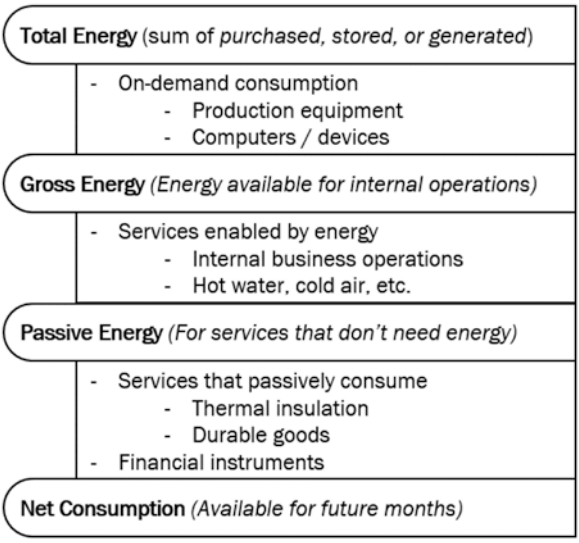

Fig. 6.4 Energy activity statement. (Source: Author's creation)

Energy Flow Statement

The Energy Flow Statement (EFS) reconciles the physical flow of energy across two **Energy Balance Sheets**. Not every item in the **Energy Activity Statement** will incur a change in the reported energy footprint of an organization. For instance, shifting from grid energy to self-generated solar does not change the energy flow in a building, only the source of the energy itself.

If a cash flow statement becomes negative, we say the company is bankrupt and unable to function normally. Similarly, if a company has a negative energy flow, their energy demand is higher than resources available and they are experiencing a blackout.

There are very few tactics to manage energy flow—reduce costs, reduce consumption, or offset consumption. Costs can be reduced by changing the rate schedule with the utility or, if one is large enough, by hedging energy purchases on the open market. Consumption can be reduced by pursuing energy efficiency or by turning devices off. Self-generation from a backup generator or solar panels are methods to offset consumption purchased from the grid. If one doesn't own solar panels, they can purchase renewable energy credits (RECs) as a way to claim to have purchased renewable energy.

What it's good for: Energy management traditionally manages the flow of energy and this model depicts the approaches available to leaders today. When combined with the other energy statements, one can unlock far more strategies that impact the entire organization (*see* **Creating Holistic Energy Strategies**) (Fig. 6.5).

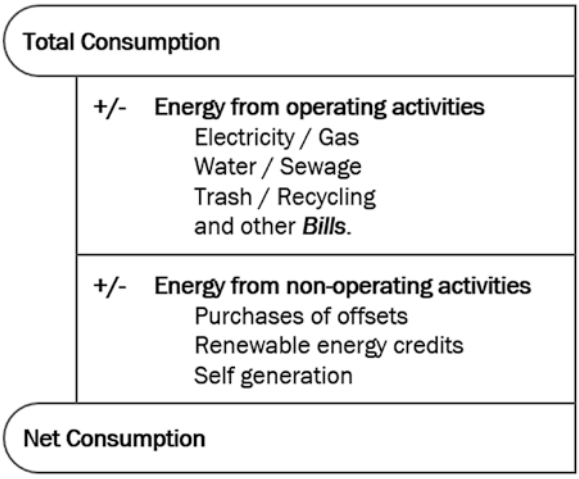

Fig. 6.5 Energy flow statement. (Source: Author's creation)

Energy Storage: Short-Term Time Shifting to Match Supply and Demand

Energy storage is part of a broader concept of time-shifting supply and demand so that they overlap. This shift can be just a few minutes to match the volatility of wind gusts, a few hours for daytime-versus-nighttime usage, all the way to a few months to account for seasonal variations in generation and consumption. As a note: *energy storage* frequently refers to the storage of *electric energy* and this section focuses primarily on this topic. Natural gas, coal, and other physical fuels can be much more easily stored and are far less sensitive to time shifts.

If we draw a financial analogy, energy storage technologies to manage energy flow are akin to liquidity management methodologies to meet cash flow. A company needs cash for daily activities but might wish to invest the money into a mutual fund or other investment until it is needed, earning interest in the meanwhile. Depending on how much and how fast money is needed, a CFO can use tools to unlock the investments back into cash. Similarly, surplus and deficit energy can be shifted with batteries, technologies, and managerial practices. Figure 6.6 is a selection of technologies for short-term shifts. For longer shifts, please see the next section on **Embodied Energy**.

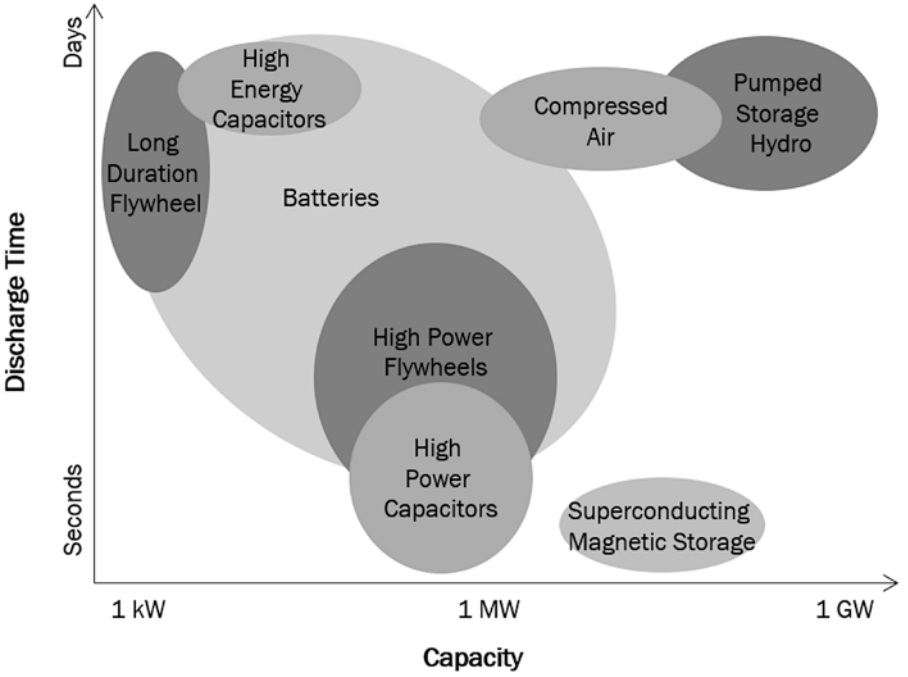

Fig. 6.6 Energy storage. (Source: Reproduced with permission of Cambridge University Press through PLSclear from: Jia, J., & Crabtree, J. (2015). *Driven by demand: how energy gets its power*. Cambridge: Cambridge University Press)

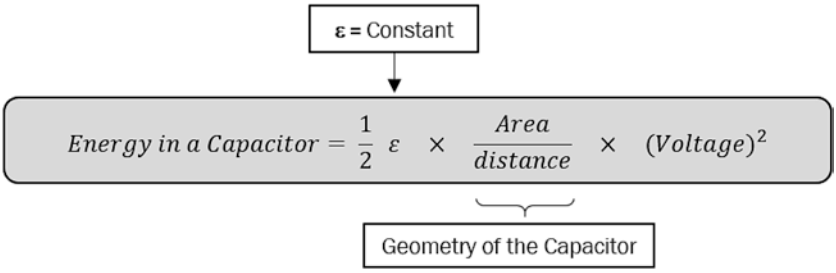

Fig. 6.7 Capacitors. (Source: Author's creation)

Store Electric Energy to Be Used Later

- **Capacitors** use the physical separation between two metal plates as a way to store electric energy. The energy stored is highly dependent on the geometry of the two plates. On the right side of the equation in Fig. 6.7, the larger the *area* and the smaller the *distance* separating them, the more the energy that can be stored.
- A **battery** is a chemical way of storing electric energy by moving electrons between different electrochemical pairs. There are many such pairs that might sound familiar—lithium–ion, lead–acid, nickel–metal hydride, to name a few. Others, such as *redox flow batteries* take advantage of the oxidation/reduction reaction to shuttle electrons between various chemical elements. There are many more battery chemistries and each has their own strengths and weaknesses of cost to store energy, maximum load, and cycle life of how many uses before the battery needs to be replaced.

Store Electric Energy by Converting It to Another Form of Energy Temporarily

- **Gravitational potential energy** (Fig. 6.8A) stores energy by moving heavy things uphill to be released into **Kinetic Energy** when it falls down again. Pumped hydro, or the pumping of water into a dam is the most common manifestation of this property. Other ideas include using ski lifts to move rocks and gravel up the side of abandoned pit mines. In both cases, the technology takes advantage of gravity. Heavier object moved higher up a hill will store more energy.
- **Rotational kinetic energy** (Fig. 6.8B), also known as flywheels, stores energy by spinning objects. To store energy, one spins a disc faster and to extract energy, one slows it down. Both terms in the equation depend on

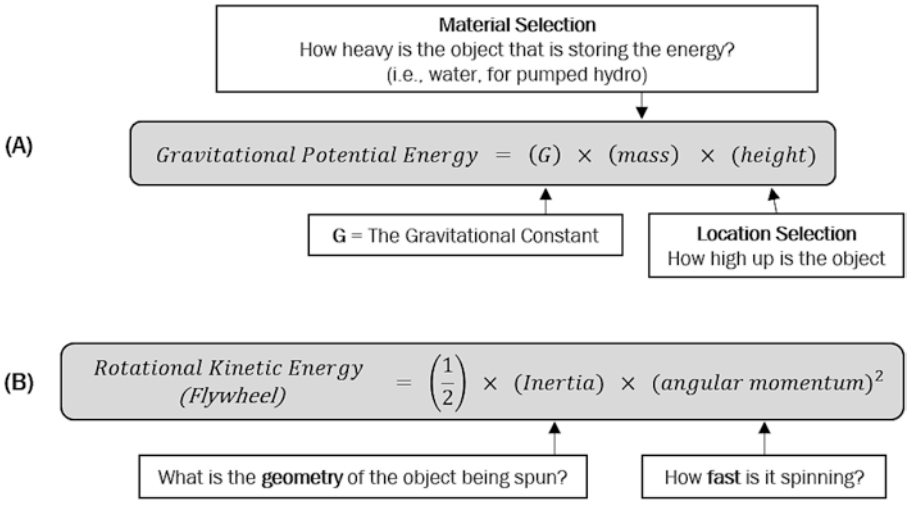

Fig. 6.8 Electric to other forms of energy. (Source: Author's creation)

the geometry of the object. *Inertia* is an object's resistance to being spun, while *angular momentum* depends on the radius of the spinning object. This technology is effective at rapid responses to grid conditions and there are a few pilot programs globally testing this technology at grid-scale.

Convert Electric Energy into Another Form of Energy Permanently

- **Heat** is a form of energy that constitutes 40–60% of our consumption. Heat can be stored in a hot water tank for a few hours, depending on the insulation. Therefore, it is viable to generate hot water when there's too much electricity on the grid, diverting the consumption of electricity from when there's not enough of it on the grid. This is known as *preheating*.

Shift Demand Consumption to Match Supply Availability

- **Demand response and time-of-use pricing** are two methodologies that shift consumption by sending the consumer a price signal. This is analogous to increasing bridge tolls during commuting hours as a way to encourage people to ride public transportation or drive during off-peak hours. Energy rates are higher during hours of high demand and lower when consumption drops. For large industrial and institutional users, the savings can

be very dramatic. For instance, one Southern California Edison rate schedule charges clients over $4.29/kWh in the afternoon of a hot summer day and only $0.020/kWh at 11 AM on a winter weekend.[3]

- **What it's good for**: This section describes a collection of techniques that shift energy for short durations. Most of these technologies are usable over periods of minutes, hours, or days. Finding the right storage solution requires knowing how frequently and for what duration to shift the energy. It is important to keep in mind that the right energy time-shifting solution could be technical (pumped hydro), behavioral (preheating), or economical (time-of-use pricing).

Embodied Energy: Long-Term Shifting of Energy by Storing It in a Product

Embodied energy is the total amount of energy consumed in the manufacturing and production of a product or in the delivery of a service. Commonly calculated via lifecycle costs, it takes into consideration all energy and climate impacts of a product. However, because of the interconnected nature of energy consumption, a challenge arises to determine what to include in the calculation. Any boundary will exclude some consumption, yet using no boundary renders the analysis incalculable because it will include everything.

However, one can also view embodied energy as a means to store energy for periods of years. For example, aluminum smelters and data centers are big business in Iceland. Iceland has a surplus of free geothermal energy, yet because of its physical location, it cannot export the electric energy to population centers in Europe and America. Instead, it hosts two of the most energy-intensive industries, thereby "storing" the energy into the products it sells.

Sometimes the embodied energy can be extracted again. For example, a house is constructed from wood, nails, drywall, and a variety of materials. After decades of use, the materials from a demolished house can be sorted. Combustible materials, such as the wood, can be sent to a waste-to-energy facility where the waste will be burned, extracting electricity from the material and leaving behind ash. Obviously, the amount of energy extracted will be far less than the amount energy put into constructing the house. This gives us a concept of the *time value of energy*: once energy is embodied into a purpose, if reconverted back to energy, less of it will be available for future energy purposes (Fig. 6.9).

[3] Southern California Edison. (2019, July 26). Schedule TOU-GS-1-RTP General Service—Small: Real Time Price.

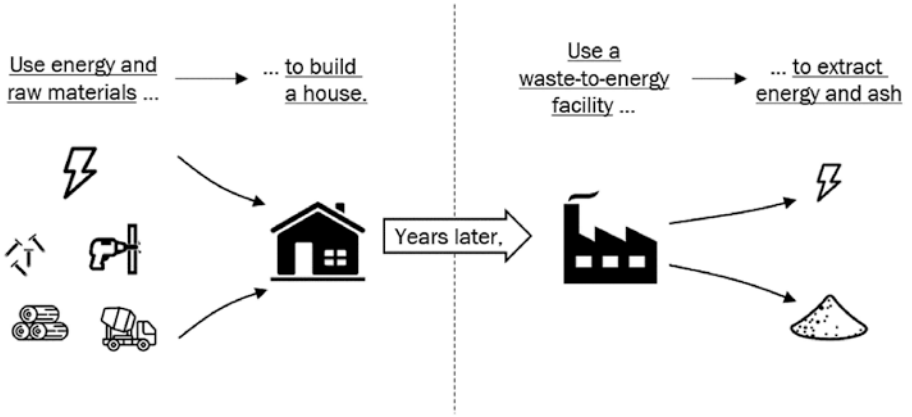

Fig. 6.9 Embodied energy. (Source: Author's creation)

What it's good for: This model demonstrates how energy can be shifted over longer periods of time by considering embodied energy to be part of our energy equation. Energy consumed to manufacture products can be extracted for other uses, giving it the ability to reenter our economic cycle.

Creating Holistic Energy Strategies

With the energy statements, one can now craft holistic energy strategies that are far more robust than merely optimizing for the flow of the resource. Rather than just revealing technical solutions, the energy statements can be used together to identify, manage, and sustain organizational change management initiatives that achieve a sustainable future.

Operating a Net-Zero Building

A Net-Zero building is one that generates as much energy as it buys from the grid. This is a common strategy used to sell solar panel as a sustainability product—generate energy during the day when the sun is shining and sell the excess back to the grid. The amount sold to the grid can offset the energy purchased from the grid when the sun isn't shining, either at night or on cloudy day. In the ideal case, the amount sold to the grid is the same or exceeds that which is purchased from the grid (Fig. 6.10).

On the surface, this seems highly sustainable but the major flaw in this approach is that it only considers the flow, not the assets or activities to enable

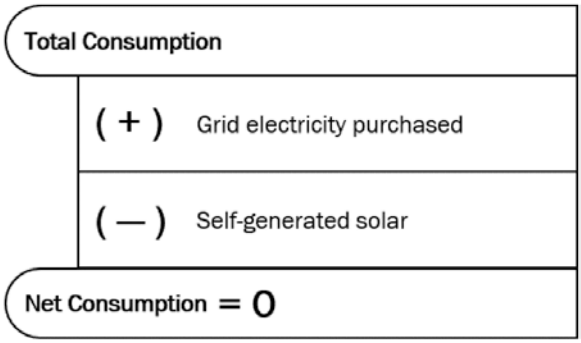

Fig. 6.10 Net-zero strategy. (Source: Author's creation)

that flow. In actuality, all we did was to change the ownership of the generation assets and the responsibility of operations and maintenance from the electric utility to the building owner. The building still needed to consume electricity and it has to come from somewhere. Furthermore, because the building owner's solar panel doesn't work at night, the utility still needs to manage and maintain the power plant for evening operations.

Rather than thinking of solar panels and net-zero goals as silver-bullet solutions that solve our sustainability problems, a better way is to treat them as critical component of organizational change management initiatives to achieve sustainable outcomes. To do so, we need to examine the complexities of the energy system dynamics. An analysis mapping the decisions onto the **Energy Balance Sheet** and **Energy Activity Statement** will reveal many more strategic opportunities, including how renewable infrastructure integrates into the larger picture.

Installing an Electric Battery for Energy Storage

A large-scale battery is a capital asset that can shift electricity up to a few days, improve power quality, and provide backup power during blackouts. On the EBS, the assets would increase as there would be more equipment owned by the company. Liabilities from the risks of temporary blackouts would decrease. Productivity, therefore, increases because of the net effect of assets and liabilities. In addition, the battery could store energy from one reporting period to the next, reducing the need to purchase in the future. Finally, the energy in the battery could have revenue potential if it was sold into the market during periods of high prices (Fig. 6.11).

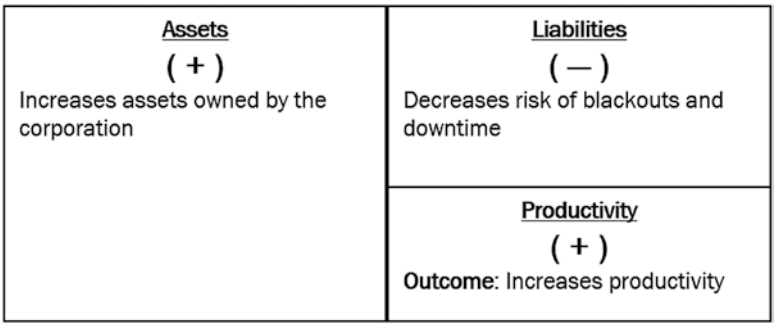

Fig. 6.11 Electric battery. (Source: Author's creation)

Outsourcing HVAC System Management

A company can outsource the total cost of ownership of their heating, ventilating, and air-conditioning (HVAC) equipment to a third-party mechanical contractor who assumes the responsibility for the upgrades, maintenance, and operations. The company then leases the benefits of the equipment, such as cold air, hot water, and indoor air quality from the contractor. These arrangements, known as energy savings performance contracts (ESPC), are both a financial off-balance sheet solution and an energy off-balance sheet solution.

On the EBS, there will be a decrease in equipment and assets owned by the corporation as well as a reduction in liabilities associated with owning the equipment. However, the company still needs energy services and there will be an increase in those purchases. The net effect on productivity depends how the changes in assets and liabilities resolve. If there is a larger reduction in liabilities than in assets, there will be increased resources available for productivity or a net savings of fewer resourced required (Fig. 6.12).

Installing Triple-Paned Windows for Improved Insulation

Increasing the thermal envelope of a building through insulation is an example of shifting down the accessibility stack of the energy assets. In effect, one is providing for indoor thermal comfort with higher insulation rather than purchasing electricity to run the HVAC system.

From an EBS perspective, it decreases the amount of energy purchased from the grid and increases the embodied energy within the physical assets of the company. As a consequence, purchasing less energy will also reduce the wear-and-tear on the HVAC equipment, possibly prolonging their useful life.

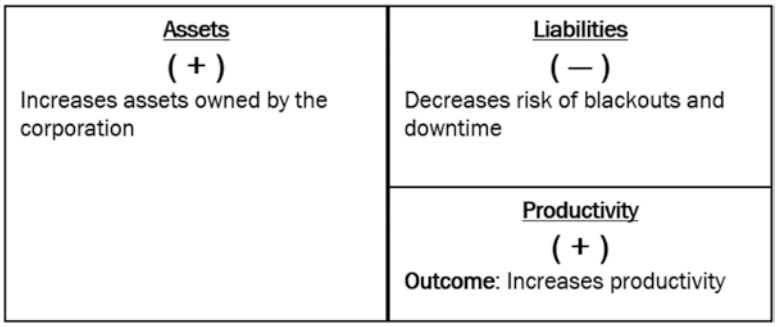

Fig. 6.12 Outsourcing HVAC operations. (Source: Author's creation)

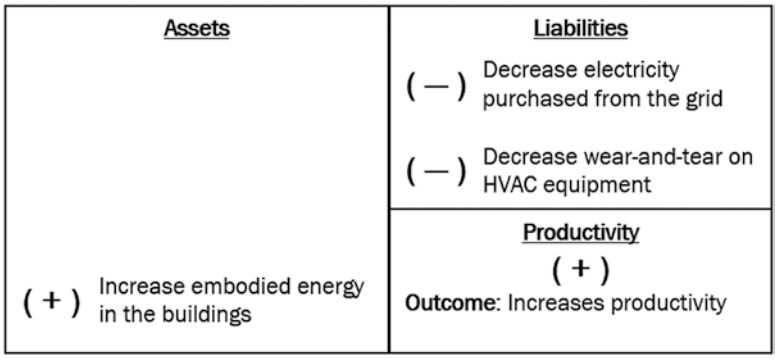

Fig. 6.13 Increased insulation. (Source: Author's creation)

Liabilities will also be reduced due to decreased exposure to grid electricity price volatility and other externalities. The company has locked in the cost of providing thermal comfort for the long term rather than be subject to regular increases in energy costs. The net effect on productivity is an increase in accessible resources available to meet the goals of the organization (Fig. 6.13).

Upgrading an End-of-Life HVAC System

A common quandary is the trade-offs at the end of life of an HVAC system. Buying a new system can run many millions of dollars, resulting in most companies seeking patchwork fixes to prolong the life of an old asset rather than invest in a new one. When the replacement cannot be put off any further, the company is faced with a decision: to purchase the lowest-cost system that meets their needs or to buy an energy-efficient system. Frequently, they overlook a third alternative: to investigate how to minimize the sizing of their HVAC system.

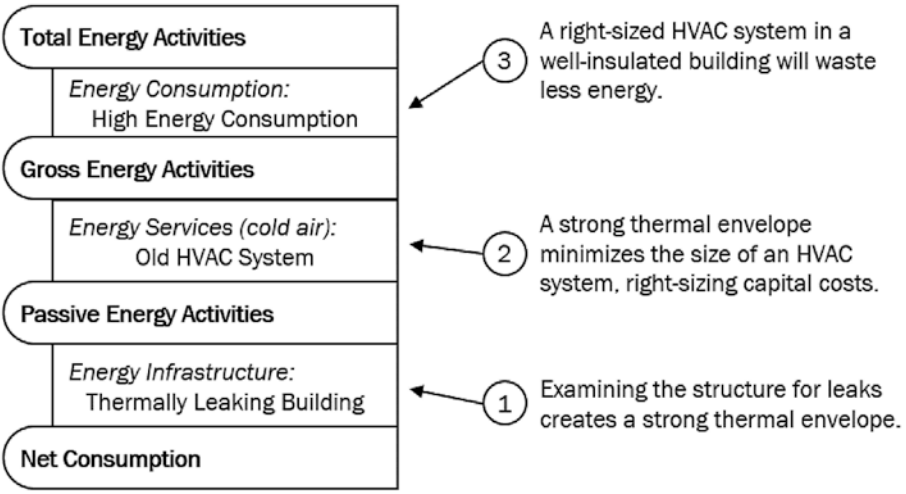

Fig. 6.14 HVAC end-of-life prioritizing decisions. (Source: Author's creation)

An EAS can depict the interactions between the various options. An HVAC system is one that provides services of indoor air quality by providing warm, cold, and fresh air. As a piece of equipment that delivers energy services, it falls in the middle category on the EAS. Running the HVAC system is what consumes energy, driving up bills. However, the amount of insulation in a building is what determines the size of the HVAC system. Investing in structural fixes of a building's thermal envelope will reduce the capital requirement for mechanical equipment, which will in turn minimize the need for energy consumption (Fig. 6.14).

What it's good for: With these examples, we demonstrated how the **Energy Statements** can be used to visualize and strengthen energy strategies that are beyond consumption management. Using the energy statements in tandem with **Financial Statements** will create more informed and holistic corporate strategies.

7

Carbon Strategies: De-risking Exposures

This chapter examines strategies that can decouple energy consumption from revenue, profits, and other financial indicators. Recall that in the nexus of finance, energy, and carbon, the constraints of one system are also constraints of the other systems. Similarly, the strategies, risks, and innovations in one system will also affect the other systems. We will use carbon-centered strategies to influence energy and corporate strategies.

Prevention of carbon emissions and carbon capture are two popular tactics for reducing the amount of carbon in the atmosphere. Yet these approaches only address the flow of carbon emissions. Instead, we can use the fingerprints of carbon emissions as an indicator of corporate strategy. Since carbon emission is a direct result of energy consumption, one can use the **Energy Statements** as a bridge between strategy, energy, and carbon management.

One approach is to use carbon emissions as an internal indicator of waste and inefficiency. Emissions are a direct result of burning fossil fuels for energy and have no economic value add to any company's products and services. A company's carbon footprint is therefore a form of waste. It is a by-product of energy consumption that did not go toward productive uses. The more an enterprise emits, the more money is being wasting. We can track these carbon emissions to find areas of waste and improve operational efficiency.

A second approach is to use carbon as an external indicator of climate-related risk exposures. Carbon is a contextual driver in our rapidly changing world. We are seeing major global trends due to a warming climate. Coffee farmers are noticing shifts in rainfall, and usable land in coffee-growing regions is shrinking. Billion-dollar climate disasters are slowly rising, due to growing population, more infrastructure being built, and an increase in number of

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_7

weather-related catastrophes. Meanwhile, millennials and the younger workforce are using a company's climate action plan as a factor in accepting or staying at a job, affecting a company's ability to hire and retain talent.

One can use carbon emissions as a means to prioritize decision-making. Solutions that emit less carbon will, by definition, generate less waste, have lower fuel costs, and be better for the environment. Other benefits may include reduced environmental compliance requirements and fewer environmental health and safety issues. These decision frameworks can be embedded into a climate action plan or help evaluate climate resiliency during capital investment decisions.

Why this chapter is important: The energy strategist needs to know the decisions and prioritizations that can reduce carbon risk exposure as well as decouple carbon emissions from financial indicators. The frameworks presented here can help a company meet their outcomes while having a positive impact on carbon emissions.

What Is Carbon?

In sustainability and environmental contexts, *carbon* is used as shorthand for *carbon dioxide* (CO_2) *emissions*. It is considered a greenhouse gas (GHG). A greenhouse gas is one that traps the sun's heat within the atmosphere. Thus, the more greenhouse gas in the atmosphere, the more heat is trapped and the hotter the planet becomes.

The global warming potential over 100 years (GWP-100) is a measure of how much a gas contributes to global warming over a century-long period. By definition, CO_2 has a GWP-100 of 1. Since other gases trap different amounts of heat, the GWP metric standardizes to the equivalent amount of CO_2 needed to have the same warming effect. Thus, the unit of *carbon equivalents* (CO_2E) has become a common metric to describe the global warming effects of all emissions. Table 7.1 lists the GWP-100 for a few common chemicals.

Table 7.1 Hundred-year global warming potential (GWP)

Chemical	Lifetime in the atmosphere (years)	GWP-100
Carbon dioxide (CO_2)	Varies	1
Methane (CH_4)	12.4	34
HFC-134a	13.4	1550
CFC-11	45.0	5350

Source: Intergovernmental Panel on Climate Change. (2014). Anthropogenic and Natural Radiative Forcing. In Climate Change 2013—The Physical Science Basis: Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 659–740). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9781107415324.018

Although carbon dioxide is necessary for life, we are emitting far more carbon dioxide than what is absorbed by the planet. The carbon cycle is the natural absorption and emission of carbon dioxide from land and water sources. Both of these processes are fairly well balanced. However, emission from fossil fuels due to human activities is far outstripping its absorption into the deep oceans and by geology. Figure 7.1 shows that annually, the atmosphere accumulates 4.1 gigatons CO_2E of additional emissions. This is causing a net increase in atmospheric carbon.

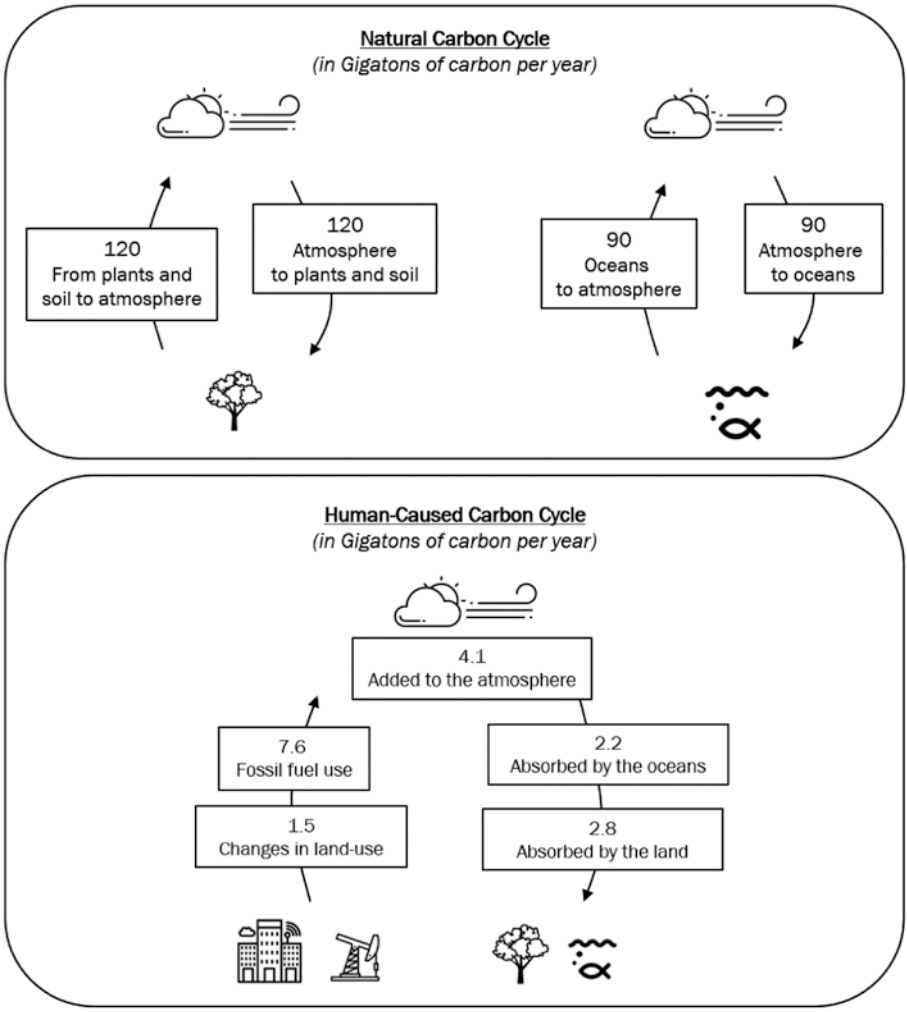

Fig. 7.1 Carbon cycle. (Source: Author's creation)

Climate change refers to a change in the long-term trend of average conditions that our planet experiences. *Weather*, on the other hand, is the short-term range of variations in daily patterns. On a daily basis, it would not be out of the ordinary if the temperature swung between 15 and 20 °C (roughly 60–80 °F). However, a 2 °C (3.6 °F) increase in climate over a period of 30 years will unleash record-breaking highs and lows in daily weather patterns.

Carbon Inventory: Scope 1, 2, and 3

Corporate and national reporting of carbon emissions are generally disclosed in the form of Scope 1, 2, and 3. First created by the Greenhouse Gas Protocol (GHGP), it is a widely used metric for carbon accounting, including for corporate reporting, carbon trading markets, and calculating carbon offsets (World Business Council for Sustainable Development 2004). The methodology was created from a wide stakeholder engagement process that included environmental groups and industry stakeholders.

The advantage of this methodology is that the categories draw a distinction between carbon emissions under a company's control and those that it cannot impact. The three categories are defined thus (Fig. 7.2):

- *Scope 1 Direct*: Emissions from sources that are owned or controlled by an organization.
- *Scope 2 Energy Indirect*: Emissions resulting from the purchase of electricity, heating, cooling, and steam that is consumed by an organization.
- *Scope 3 Other Indirect*: Emissions that occur outside the organization, including both upstream and downstream from the supply chain. Scope 3 suffers from double counting as one company's Scope 3 may be another entity's Scope 1.

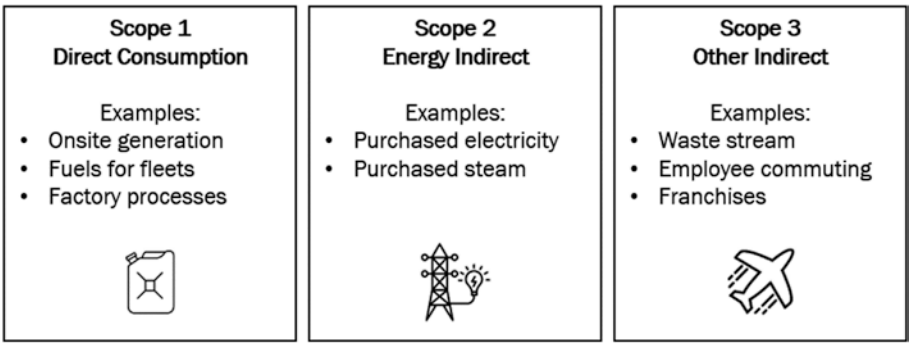

Fig. 7.2 Scope 1, 2, and 3. (Source: Author's creation)

The standards have brought consistency into carbon accounting, creating a common language for practitioners. Environmental reporting bodies, such as the **Global Reporting Initiative** (GRI), the **Sustainability Accounting Standards Board** (SASB), as well as standards organization such as ISO (International Organization for Standardization) utilize or coordinate their definitions with GHGP.

What it's good for: This is the standard of how carbon emissions are communicated. One needs to be familiar with these terminologies as a basis for carbon management.

Flow of Energy Decisions

Buildings and skyscrapers are engineering systems and *energy* flows through them. Companies are organizational systems and *decisions* flow through them. The two systems naturally converge as companies work inside buildings. Unfortunately, the flow of energy isn't always matched with the flow of decisions. The gap between the two systems creates inefficiencies that result in wasted energy consumption. To help close this gap, we need to trace the flow of decisions, looking at all functions across an organization and examining their interactions and effects on resource management.

This gap can be demonstrated by how roles and responsibilities for energy-related decisions are spread out across an organization. For instance, automated light switches may be an electrician's concern, a window retrofit is a real estate decision, while solar panels are capital financing decisions. It is these individual actions that are usually the driver for consumption variability that results in waste.

Usually the first place where these responsibilities converge is at the C-suite level, yet executives rarely concern themselves with such minutiae. Instead, executives are setting the corporate goals, divisional units are deciding how to best reach those goals, and operational units are purchasing the equipment that results in energy consumed. It is these strategies that are dictating the energy requirements of the organizations.

What it's good for: This model demonstrates that a method to mitigate this gap is to trace the decision-making process. The **Chief Utility Officer** or an energy strategist needs to acknowledge the organizational system and leverages that for organizational change as a means to affect the energy system. The **Energy Strategy Maturity Cycle**™ is one way to coordinate actions and activities (Fig. 7.3).

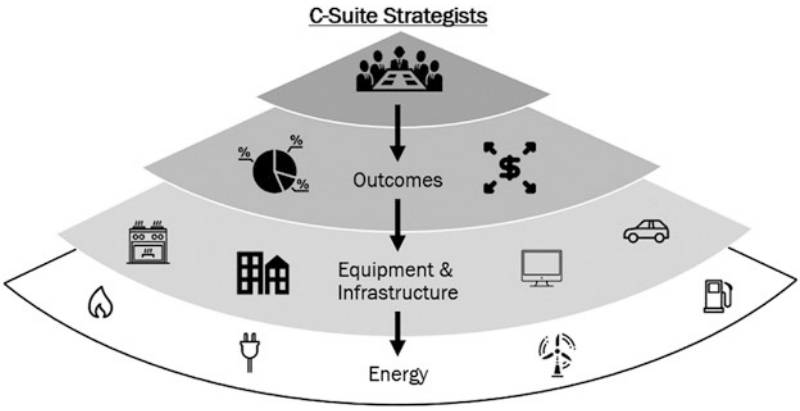

Fig. 7.3 Flow of energy decisions. (Source: Author's creation)

Energy Strategy Maturity Cycle™

Energy as Strategy is a way for companies to bridge the energy-organizational systems gap. It is common for green initiatives to be uncoordinated across an organization, ranging from recycling, solar energy, bike-to-work, carbon credit purchases, and so on. The Energy Strategy Maturity Cycle™ (ESMC) is a workflow that can synthesize hundreds of activities into an overall strategy, vision, and organization that manages and strengthens them (Fig. 7.4).

- *Set a Vision*: Align internal stakeholders on the strategic goal by setting a strategic vision for why the organization is consuming energy and utility resources.
- *Gain Certainty*: Consolidate information on the assets using the **Energy Statements**, understand the organizational structure using **Galbraith's Star Model™**.
- *Reduce Risk*: Take actionable steps based on the **Carbon Resource Prioritization** to reduce carbon exposure.
- *Initiate Innovations*: Uncover new and better ways to accomplish the same tasks. It is common for innovative solutions to surface while implementing ideas. **Questionstorming** and **Brainstorming** are two possible practices.
- *Increase Productivity*: Systematize the process of generating ideas, testing possible solutions, and scaling adoption across the organization. **Lean Manufacturing** can help streamline an idea while **The Discipline of Scaling Adoption** can help spread it across an organization.

The end result can be as dramatic as decoupling carbon from revenue or the creation of carbon-neutral products. This enhances the organization's competitive advantage, enabling higher levels of productivity.

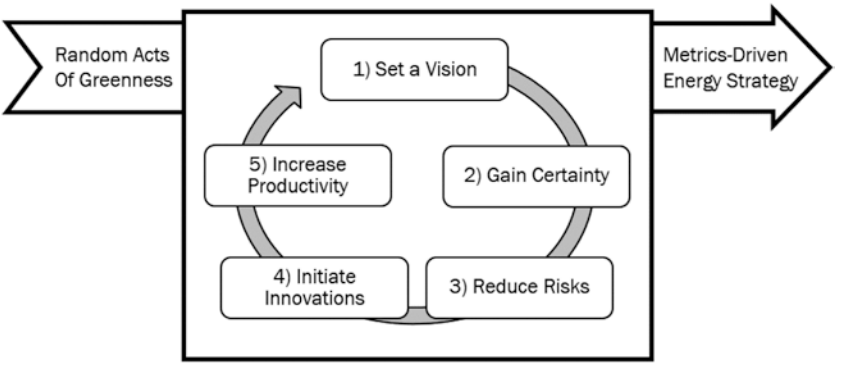

Fig. 7.4 Energy Strategy Maturity Cycle. (Source: Author's creation)

What it's good for: This workflow depicts how sophisticated an organization is in their approach to carbon management. It helps determine what tangible next steps the organization can take to improve their carbon footprint.

Principle of Strategic Energy Management

The energy resource management function can become a complex organization itself. Here are some organizing principles gathered through observation of leading companies and their approach to utility management. Overall, the utility function needs to support the entire organization in improving their ability to do their job.

- The *strategy components* need to be clear with goals that align with the corporate vision, mission, and values.
- The *organization components* need buy-in from fellow executives and the authority to make decisions on behalf of the organization. Bonuses and incentives need to be aligned to the achievement of strategic goals.

The seven attributes below show which functions should be centrally managed, such as responsibility and budget control of utility decisions. Others, such as planning, implementation, and engagement call for multidisciplinary perspectives from throughout the organization. To build buy-in, leading companies create mission/vision statements for their utility resource plan. This helps align stakeholders on the program outcomes and informs the tracking of key performance indicators (KPIs).

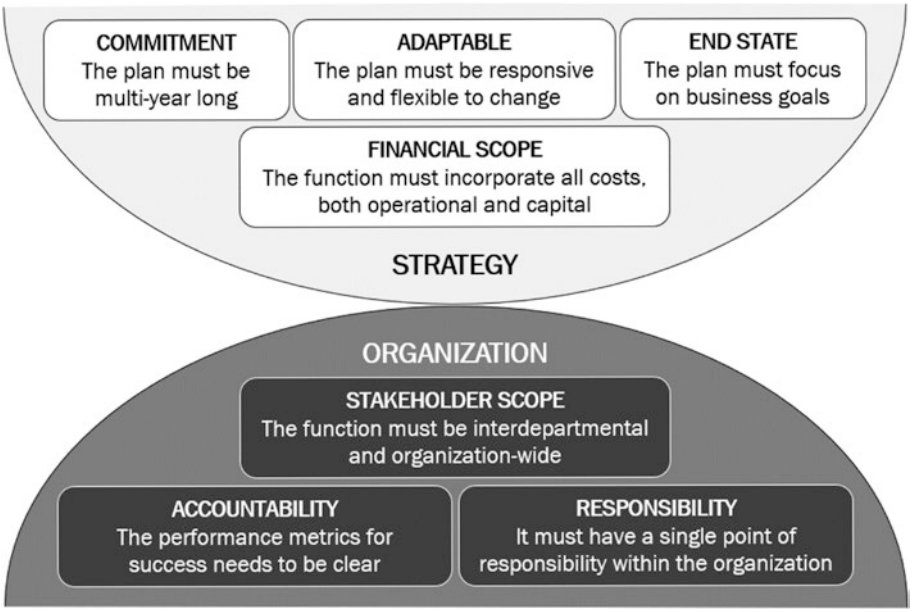

Fig. 7.5 Principles of strategic energy management. (Source: Author's creation)

What it's good for: This model can be used to evaluate an organization's functional capabilities. Typically, these functions are spread across an organization. The first step toward consolidating them is to uncover where they reside within an organization (Fig. 7.5).

Kaya Identity

Kaya Identity Regular: Quantifying Carbon Emissions

Developed by Japanese energy economist Yoichi Kaya, this equation defines carbon dioxide emissions by using other well-understood and measurable indicators (Kaya and Yokoburi 1997). It is a mathematical identity because the terms on the right cancel each other out, resulting in:

$$CO_2 \text{ emissions} = CO_2 \text{ emissions}$$

The power of this equation is that it reveals the decision levers that affect carbon outcomes. It deconstructs the carbon problem into population, economic, operational, and energy components, making the complex problem

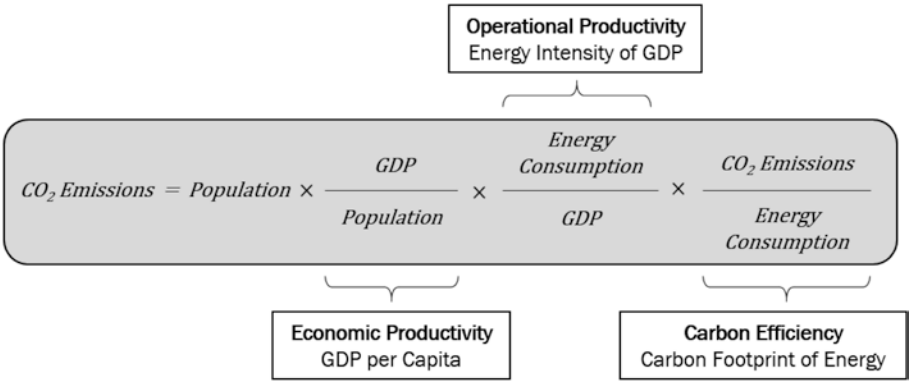

Fig. 7.6 Kaya Identity: regular. (Source: Author's creation)

much more manageable. It also demonstrates that it's possible to decouple carbon emissions from growth in GDP, making it possible to achieve both goals simultaneously.

Example decisions criteria that will reduce global carbon:

- The economy becoming more energy efficient (*Energy Consumption/GDP*).
- Energy becoming more carbon efficient or free (CO_2 *emissions/Energy Consumption*)
- In assuming a growing economy, the *GDP* per capita will grow, resulting in higher carbon emissions. The other terms need to reduce carbon emissions faster than the increases caused by economic growth.

What it's good for: This equation tells us which factors are under our control and helps us predict the future trend of carbon emissions. It was used in the Intergovernmental Panel on Climate Change (IPCC) in their Special Report on Emissions Scenarios (Fig. 7.6).

Kaya Identity Differential: Decoupling Carbon Emissions from Economic Growth

Don't be afraid of this equation! This equation probably looks the most daunting in the book, full of calculus symbols. Remember: intuitively, energy is about relative change and relative intensity. The partial derivatives (δ) is just a mathematical way of representing that idea (Deutch 2017).

The right side has our three intensities—economy, energy, and carbon. Each term can be positive or negative, with positive representing an increase

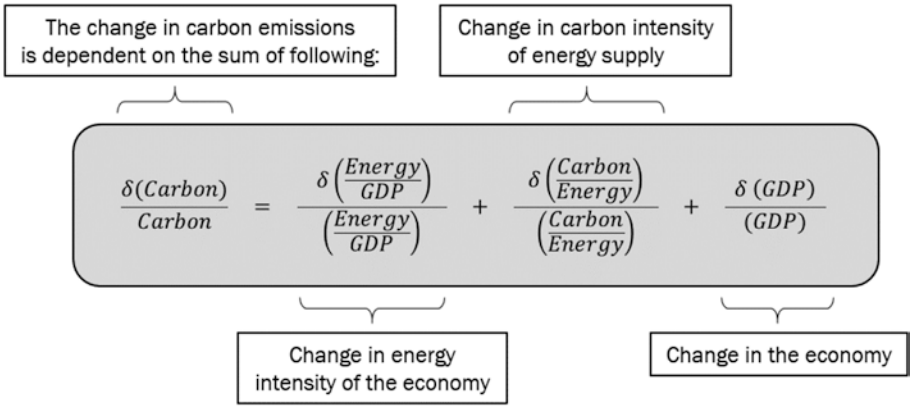

Fig. 7.7 Kaya Identity: differential. (Source: Author's creation)

and negative representing a decrease. By adding the three together, we can determine if the economy is becoming more carbon intensive or less carbon intensive. If the latter, then it is theoretically possible to decouple carbon from the economy.

What's important is whether the equation is positive or negative.

- If this equation is *positive*, then carbon emissions are growing at a faster rate than our economy is growing, or that carbon is coupled with the economy.
- If the equation is *negative*, then the economy is growing faster than the carbon emissions, or that carbon is decoupled from the economy.

What it's good for: This equation gives us a few simple variables to know if carbon emission is trending upward or downward. If the equation is positive, carbon is growing and vice versa. If applied to a corporation, it can be used to show if a company has decoupled their top-line revenue from their carbon footprint (Fig. 7.7).

Kaya Identity: Adopted for Corporations

The Kaya Identity can be adopted for use by a corporation to show how common business metrics affect the carbon footprint. This gives strategists a metric for setting goals and governance policies for achieving the targets.

Start with the original equation and replace *Population* with *Widgets produced* or *Services rendered* and *GDP* with *Revenue*. This gives us the carbon footprint based on easily available corporate data. The first fraction, revenue

per widget, is the measure of the per-unit economic productivity of the corporation. The second, energy consumed per revenue, is the operational productivity of the energy inputs. The last fraction, CO_2 emissions per energy, is the same as in the original equation. This demonstrates that there are three avenues to reducing carbon emissions:

- *Economic Productivity*: Increase the revenue per widget sold. Business process optimization strategies that increase business efficiencies will reduce carbon.
- *Operational Productivity*: Use less energy to achieve the same financial productivity. Energy efficiency strategies that reduce energy consumption will reduce carbon.
- *Carbon Productivity*: Reduce carbon emissions of the energy consumption. Strategies to shift to lower carbon fuel sources will reduce carbon.
- *CO_2 Emissions*: The sum of the above needs to exceed growth in widget production.

We can also modify the differential version and apply it to a corporation as well. In doing so, we can see if the carbon footprint is coupled or decoupled from the revenue line.

What it's good for: For executives, these are the key performance indicators that can show if one's environmental initiatives are having an impact or not. It can inform strategists and help focus investments on initiatives that have a positive impact on the company's carbon footprint (Fig. 7.8).

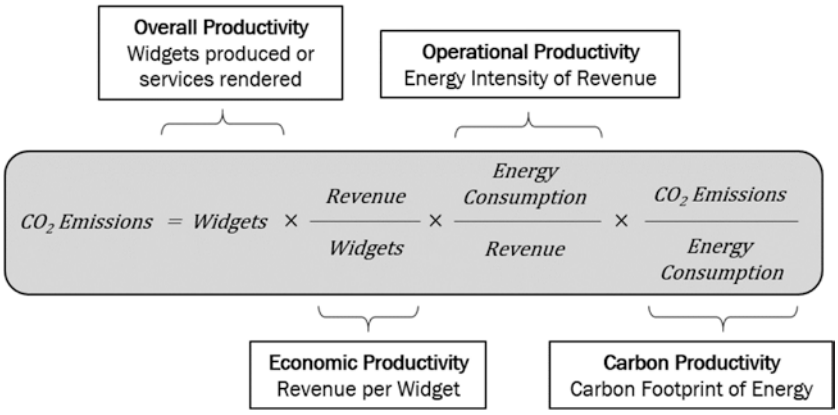

Fig. 7.8 Kaya Identity: adopted for corporations. (Source: Author's creation)

Waste Resource Prioritizations

Starting from the early 1990s, Germany adopted a waste resource framework that has successfully reduced landfills to less than 0.5% of municipal solid waste. As a comparison, the US landfills are more than 50% of waste. Key to this success was declaring landfills a negative externality and repositioning the entire waste management sector to minimize them. Success came from prioritizing activities to maximize economic value of the resource before burying it underground.[1]

The German system had the following steps:

- *Waste Prevention*: Strategies that include *avoidance* (only use what one needs), *source reduction* (build it to last), and *reuse* (use it more than once).
- *Waste Minimization*: Strategies such as *quality improvements* (upcycle the product once its lifespan is over), *recycle* (if it can't be upcycled, then recycle it), and *waste-to-energy* (extract the embodied energy from the materials for electricity, thus diverting from the burning of fossil fuels).
- *Waste Disposal*: Strategies to be pursued once all other approaches have been exhausted. These include *incineration* (burning of trash purely for volume reduction) and *landfilling* (burying the trash).

Higher-level strategies have more economic value and create fewer negative externalities than lower-level strategies. This gives a prioritized order to an all-of-the-above strategy. All higher-level strategies should be pursued and exhausted before pursuing the next one in the priority.

What it's good for: This framework has been so successful at extracting value that the German resource management sector is a €50 billion industry, much larger than the landfill sector itself. In doing so, they maximized the value from their resource supply chain (Fig. 7.9).

Carbon Resource Prioritizations

Carbon emissions are a negative externality that can be minimized using analogous principles to the **Waste Resource Prioritizations**. Carbon has little economic value to society and we should maximize the economic utilization

[1] Reproduced with permission of Cambridge University Press through PLSclear from: Jia, J., & Crabtree, J. (2015). *Driven by demand: how energy gets its power*. Cambridge: Cambridge University Press.

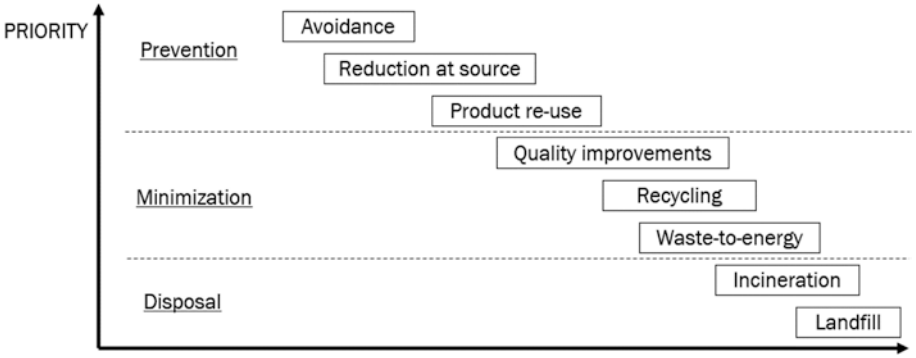

Fig. 7.9 Waste resource prioritization. (Source: Reproduced with permission of Cambridge University Press through PLSclear from: Jia, J., & Crabtree, J. (2015). *Driven by demand: how energy gets its power*. Cambridge: Cambridge University Press)

of it before releasing it into the atmosphere. This is accomplished by focusing on outcomes that minimize carbon emissions and maximize economic value.

A carbon emissions prioritization looks like this:

- *Carbon Prevention*: achieving outcomes without consuming any carbon. *Land use planning* for high-density, mixed-use neighborhoods eliminates the need for transportation carbon. *Passive housing* is a technology that reduces the energy needs for heating and cooling.
- *Carbon Minimization*: consuming the least amount necessary. This includes *energy efficiency* and reusing *waste heat* for additional purposes. Consume *non-carbon power* sources first, such as those from solar and wind.
- *Carbon Management*: for activities that require fossil fuel generation (i.e., backup power, off-grid applications). Implement *cogeneration* facilities first to reuse heat, and use *clean fuels* next if cogeneration is not an option. *Carbon sequestration*, which removes carbon from the air, is a technology that cleans up the carbon messes already created. These should be pursued last.

What it's good for: This brings order and prioritizes the all-of-the-above strategy for carbon management into a holistic framework. Based on this, we can see the mutual interactions of public transportation planning to carbon capture in salt caverns. This model can be used to help a company or government balance, organize, and prioritize disparate carbon initiatives into a cohesive strategy (Fig. 7.10).

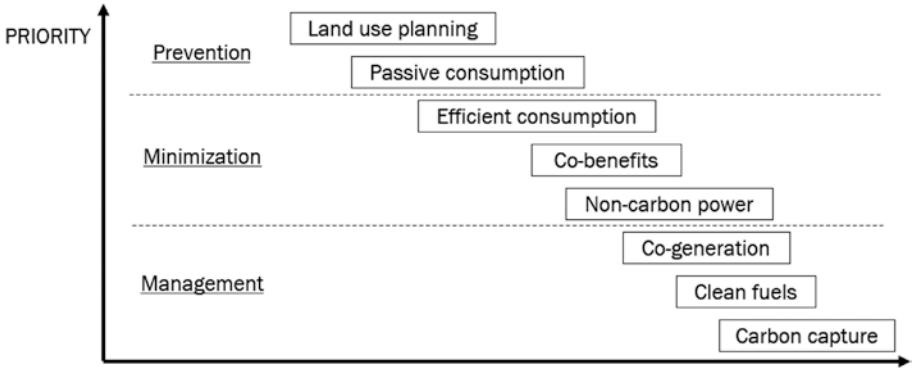

Fig. 7.10 Carbon resource prioritization. (Source: Author's creation)

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Part II

On System Properties

8

Introduction to Part II: What Is a System?

A system is a group of interacting and interrelating objects that function as a whole. On the inside are *processes*. Anything excluded from consideration is part of the *environment*, or context. These two are separated by the boundary. The ways in and out of the system are the *inputs* and *outputs*. Frequently, not only is it easier to describe the boundaries of a system rather than the internal functions, the *boundary condition* is probably the best way to define any system. Boundary conditions can also be thought of as definitions, tags, and any descriptors of how the system works. Once known, it encourages possible solutions to emerge from within. In fact, this entire book is grounded in the principles of using boundary conditions of frameworks to solve problems (Fig. 8.1).

The energy issue is a large systems problem and energy strategists need to have a grasp of system properties to be effective in making change. How much time does one waste searching for a nonexistent solution or for those outside of one's purview? Random approaches to problem solving, even under good intentions, run the risk of creating solutions that are superficial, incomplete, or relevant only under special circumstances. The shared constraints between energy, finance, and strategy means we need to examine how these systems overlap. How do these boundaries behave when they're combined?

Boundaries can be a limiting constraint, eliminating distractions and focusing the team onto what's important. Without deadlines, who would ever finish a manuscript of a book? **Brainstorming**, drawing, and thinking are all creative exercises that lay the foundational ideas of a manuscript. But a deadline compels the adoption of a disciplined regime of writing every day. It is a forcing function to make decisions, adopt priorities, and deal with trade-offs, instead of spending more time on analysis and discussion.

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_8

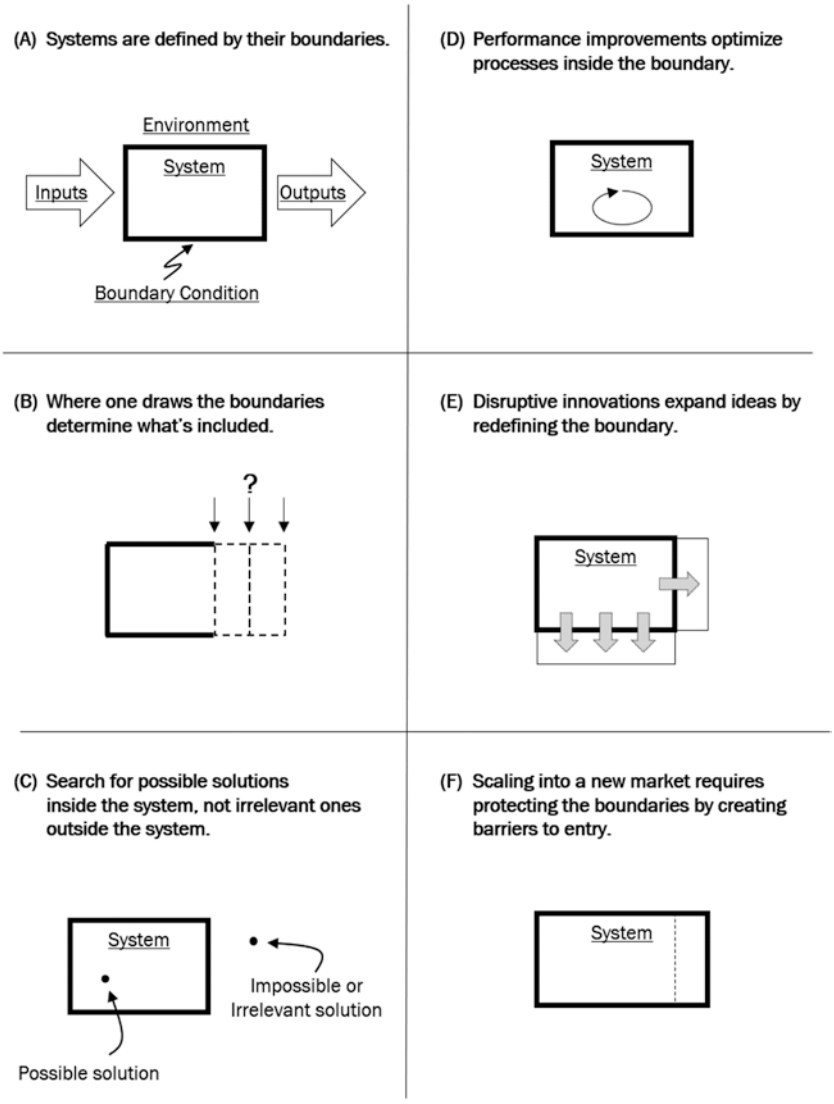

Fig. 8.1 Boundaries and system properties. (Source: Author's creation)

Boundaries can be an enabling constraint, giving an anchor for exploration and unlocking play. It may sound counterintuitive that reducing options can be a forcing function for innovations but we see it all the time. By mixing and matching a mere five ingredients, a coffee shop can serve over 3000 different drinks, from a quintuple-shot espresso to a coffee with cream, sugar, hazelnut syrup, and cinnamon. George Washington Carver, in the early 1900s, needed to find new applications of peanut oil to support farmers who shifted their

crops away from cotton. He invented peanut-based milk, cheese, soap, grease, and hundreds of other agricultural and industrial products. When options are limited, one can be truly creative with the resources at hand.

Start by examining the boundary conditions and defining what's within the scope that's being investigated. Be clear in the reasoning in why the border is being drawn at one place instead of the other. These justifications are often based on the underlying assumptions of any system. Don't try to solve an unbounded problem as there will probably be no solution.

If solutions are possible, then ask what a solution should "look like." By defining the criteria upfront, one knows when to stop searching. Otherwise, one may not know they've found an answer even when they're staring right at it. Then the serious work to look for answers can begin. Ideas can be filtered for impracticalities, ranked by priorities, and judged based on how well they fit the needs. Having these boundaries in place eliminates impractical ideas and reveals where gaps in knowledge might exist (see **White Spaces**).

A small boundary shift can disrupt the whole system. Therefore, know which boundaries are movable and which ones are not. **The Conservation of Energy**, the most fundamental of systems, has immovable boundaries since it's based on the laws of physics. On the other hand, the boundaries of the **Energy Literacy Matrix** are designed to be expanded by the user. A frame of reference can be considered a boundary condition for social issues and **Wicked Problems**. A **Focal Question** is a boundary condition that frames an issue based on the line of inquiry.

Performance improvements happen inside the boundaries. They may be improvements to a specific component or a streamlining of interactions among components. Leaders can find more efficient use of resources and achieve better productivity. These frameworks are a form of decision support that helps leaders organize data, information, and knowledge into manageable options (see **DIKW Pyramid**).

Disruptive innovations happen at the boundaries, for that is where ideas from outside the system can influence the system. When innovation occurs, it creates new systems that redefine the boundaries. Understanding system boundaries of frameworks helps shift paradigms of business practices, creating competitive advantage. When looking for new ideas, examine the boundaries and the assumptions underlying them.

Market barriers to entry are boundaries erected to protect an idea from new entrants. One can strengthen these boundaries by streamlining processes, being diligent at defining what's inside and outside, and maintaining strict practices to protect what's within. Customer segmentation, customer loyalty, and control over the supply chain are all methods to create artificial boundaries within the new system.

Communicating the boundary conditions can communicate entire systems. How frequently does one have a frustrating conversation with someone only to realize that their definition or the context of the same system is different? Boundary conditions very quickly reveal underlying assumptions, biases, and social norms that might otherwise be left unsaid. This can help align teams, reduce misunderstandings, and create a more effective team.

Part II has three chapters that examine systems, their boundaries, and how to use them.

- **Chapter 9** discusses *basic properties of systems* and how they work.
- **Chapter 10** looks at *metrics systems*, as these are used to determine a boundary's location.
- **Chapter 11** teaches *how to create new frameworks* by using system properties.

9

Systems Literacy: How to Think in Systems

This chapter explores how systems react under extreme circumstances so that a leader can decide which risks to prepare for and which ones are acceptable. Thinking in systems is to think in boundary conditions as a method to predict how a system will behave when under stress.

There are general properties of how systems work, no matter how seemingly complicated they are. External solutions are best applied when the systems are similar, but the similarities can be nonobvious. For instance, who would have thought that the hotel and taxi sectors faced similar challenges? Yet both were disrupted by the sharing economy when Airbnb and Uber enabled people to sell the excess capacity of vacant guest bedrooms and empty car seats, respectively.

System thinkers are those who can utilize system properties, even in unfamiliar circumstances, to deduce what's possible, what will break the system, and how to protect it. They are holistic in their approach, synthesizing the connectedness of components, flows, and processes that become part of the greater whole. They appreciate the dynamic nature of systems and are mildly comfortable in a constantly changing environment. They question everything so as to constantly probe what has shifted.

The constraints of a system are usually the easiest to spot, and novices to systems thinking use these as an excuse to not take any action. Their approach is to minimize unintended consequences by delaying the decision and continuing to gather data. Yet taking no action is an active choice itself with its own unintended consequences (*see* **Muddling Through**). They are yet to be able to use system properties to predict the future.

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_9

Systems management is a balancing act—when one component improves, others may weaken. A leader needs to quickly understand the situation they are in, apply the proper solution, at the appropriate speed, while questioning the assumptions around them and adjusting quickly when negative externalities emerge. Are the metrics and indicators behaving as expected? Is their motion due to coincidence or because of an interaction? Should that interaction (or lack thereof) be a concern?

Understanding how systems work can also be a shortcut to evaluating someone else's ideas. For instance, how a person presents a problem statement will reveal much about their underlying assumptions and boundary conditions. Do the boundaries they profess actually contain the problem at hand? One can also stress-test the solution to determine its true boundaries. How might the solution fail when it's in an extreme scenario? Finally, do the boundaries of the problem match the boundaries of the solution? If they do, the idea is well-thought-out. If not, there are probably additional problems with the idea.

Why this chapter is important: Energy strategists will be called upon to make decisions about scenarios that are beyond our experiences to manage. This chapter teaches how to do a quick and robust diagnosis of any general situation. One can search for solutions in a comparable system with similar properties or generate their own unique solution by using system fundamentals. The strategist now will have options to pick among that could potentially address their problem.

Boundary Condition Analysis: What Is at the Boundaries?

Systems are defined by their boundaries. The boundaries can be artificially created (a deadline as a boundary condition) or they can be naturally existing (the speed of light as a boundary condition).

One way of understanding boundaries is to do a thought experiment of how to exceed or break them. If we can create two scenarios—one that is true and a second that is false—then we know the boundary is somewhere between those two scenarios. Similarly, we can examine extreme scenarios to see how the system would need to perform as a way of stress-testing a system. This is a way to learn *under what conditions will our assumptions no longer be valid?*

Another way is to imagine a 0% and 100% scenario. For instance, what is a zero-waste organization? This implies complete consumption of its resources

Fig. 9.1 Boundary condition analysis. (Source: Author's creation)

with nothing left behind. One way of achieving this would be intentionally to buy nothing, an impractical situation. The opposite, an all-waste organization implies that all purchases are intentionally thrown away, a similarly unrealistic solution. Yet by looking at these situations, we can see that both initiatives require *intentional* actions. Thus, the best practice for minimizing waste may be to have a purpose in mind before buying an object and to have a justification before throwing it away.

Another example: What are the customer service requirements based on number of clients? The least number of clients possible is 1. This company is probably a monopsony and probably maintains a strong customer relationship team. On the other hand, the greatest number of clients is the world's population, or 7.6 billion people. Customer service may need to be a large team, staffed with every language and time zone handling many inquiries all day. Thus, small customer bases can imply an intimate relationship with each one of them while a large customer base implies being supported by the latest technologies for routing calls.

What it's good for: By understanding the conditions of the extremes, one eliminates impractical solutions that are beyond what's feasible. This exercise helps the executive focus on what's possible rather than what's ideal. If the needed solution is not within the boundary, then one needs to redefine the problem or search for a new solution (Fig. 9.1).

Perceptual Anchors: What Is Between the Boundaries?

Perceptual anchor is a technique to gain an intuitive feel for the context of a number. It is a way of understanding a representation of what lies on the spectrum between the two extremes of a **Boundary Condition Analysis**.

Most people probably have an intuitive feel for what they could buy with $1. It's the approximate value of a travel-sized tube of toothpaste or something

off of the dollar menu at a fast food restaurant. On the other end, most people probably have a hard time visualizing $15 trillion. It's the approximate size of the US GDP. One million dollars is approximately the annual revenue of a single-location restaurant and one billion dollars can buy the franchise to a sports team.

The exercise goes something like this:

1. Pick a metric (such as dollars or meters) and put 1 unit of it on a line.
2. Draw out other order of magnitudes (10, 100, 1000, etc.) of the line as far out as reasonable. Note that one can also draw the line in the smaller direction as well, (0.10, 0.01, 0.001, etc.). For the example in Fig. 9.2, that is not relevant.
3. Because we're only concerned with order of magnitude, round everything down to the nearest order of magnitude. For instance, annual revenue for Walmart ($512 billion) and Costco ($129 billion) would both round to $100 billion because both companies represent revenues of large retail chains that earn $100 billion or more.
4. Examine the spectrum as a whole to see if it makes sense.

What it's good for: Familiarity with perceptual anchors gives leaders the ability to quickly understand the situation. For instance, managing 5000 retail store locations might be easy for a former Starbucks executive who had 24,000 locations in their portfolio, and might be a challenge for a former REI executive who only had 150 locations to oversee.

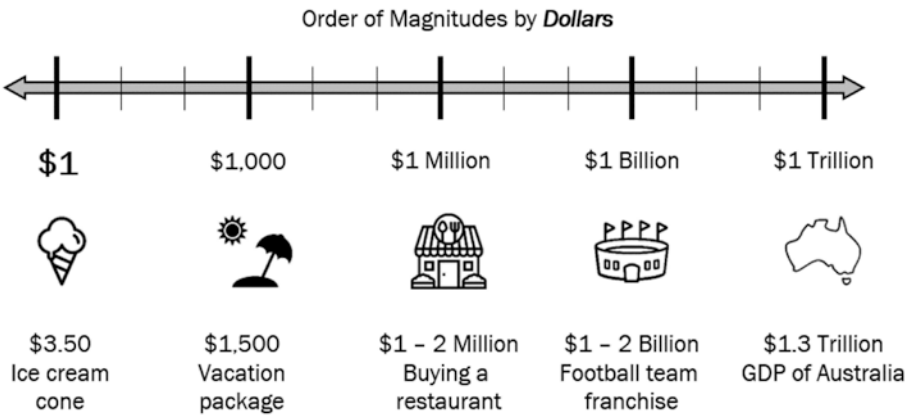

Fig. 9.2 Perceptual anchors. (Source: Author's creation)

Average vs. Variance: The Context of Results

Implied in our discussion of **Boundary Condition Analysis** and **Perceptual Anchors** is that we are analyzing an average. However, when studying change, we also need to evaluate the variance of the system.

- *Average* is generally considered to be the central point of a group of results. The average is generally treated as "the result" representing the group.
- *Variance* is how spread out or inconsistent the results are as a whole. The variance generally describes "the context" that the results reside in.

For example, most people consider climate change to imply an increase in *average* global temperatures. Climate change is also increasing the *variance* of global temperature, hence more extreme cold and extreme heat events. Climate skeptics frequently point to extreme cold events as evidence that the *average* temperature has not substantially changed, even though the *variance* of temperatures has changed substantially.

This is the challenge that **Wicked Problems** face—both the average (results) and the variance (context) are changing at the same time, making the changing situation more complex to quantify. Unfortunately, most standard statistical techniques assume a linear relationship between cause and effect and that variance stays the same before and after implementing a solution. In fact, linear regressions require *homoscedasticity*—or that the variance of data in groups is unchanged! This is rarely true in wicked problems.

What it's good for: Most innovations are pitched as a solution that will change the average, yet most problems require an understanding of the variance in the context. This model reminds us that we need to understand the context (variance) to understand the effectiveness of a proposed solution (Fig. 9.3).

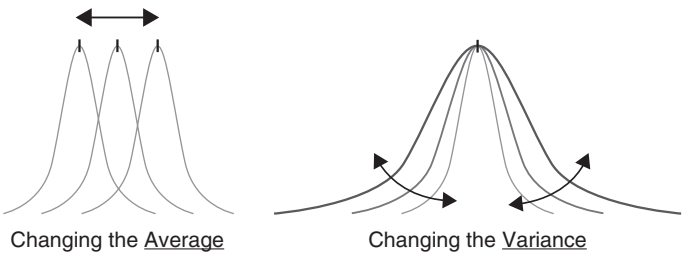

Fig. 9.3 Average versus variance. (Source: Author's creation)

Gaussian vs. Pareto Worldviews: Linear vs. Holistic Approaches

Implied in our discussion of averages is that they represent the group. What if it doesn't (Savage 2009)? For instance, on average, the container ship industry loses approximately 50 containers per year across 3000 freighters globally due to improperly securing the containers. Yet the loss of an entire ship, which happens once every three to four years, could result in the loss of over 1000 containers, blowing the average out of proportion. The techniques used to manage average container losses won't work on the destruction of an entire ship.

A linear, Gaussian world, where the bell curve resides, depends on one key assumption: that a change to one variable affects only one other variable. This makes it possible to isolate cause and effect. One must be careful to design experiments knowing which variables are independent and which are dependent. An average can then be used to represent a group and the variances in measurements can be reduced by gathering more data.

A nonlinear, Pareto world, where the 80/20 rule is a reality, has a different key assumption: that the feedback loop from the interconnectedness of the system will create a skew of the outcome. This was first observed by Italian economist Vilfredo Pareto in 1896 who noted that 80% of the land in Italy was owned by 20% of the population. This has since been observed in many aspects of the social sciences, from wealth distribution, to revenue distribution among a client base, to economic damage caused by natural disasters. The interconnectedness makes it impossible to isolate cause and effect, resulting in sometimes spurious correlations among the data (Mckelvey and Andriani 2005). Thus, arises the caution, *correlation does not imply causation*.

In a nonlinear, Pareto world, it is possible that the average doesn't actually represent anything and that the variance could be infinite. For instance, Fig. 9.4 depicts the annual energy consumption by departments for a small city. The average consumption across all of the departments is $120,000. This means that the police and fire department, two petroleum-dependent functions, are average consumers. Yet is either department a representative middle ground, between the electricity-consuming pumps of the wastewater treatment facility and the light bulbs of the bus depot? Obviously not. At the extreme, in a Pareto world, every case is unique and requires its own solutions.

To make a change in a Gaussian world, one merely needs to find the relationship between two independent variables and make the necessary adjustment. To make a change in the Pareto world, one needs to modify the feedback loop in

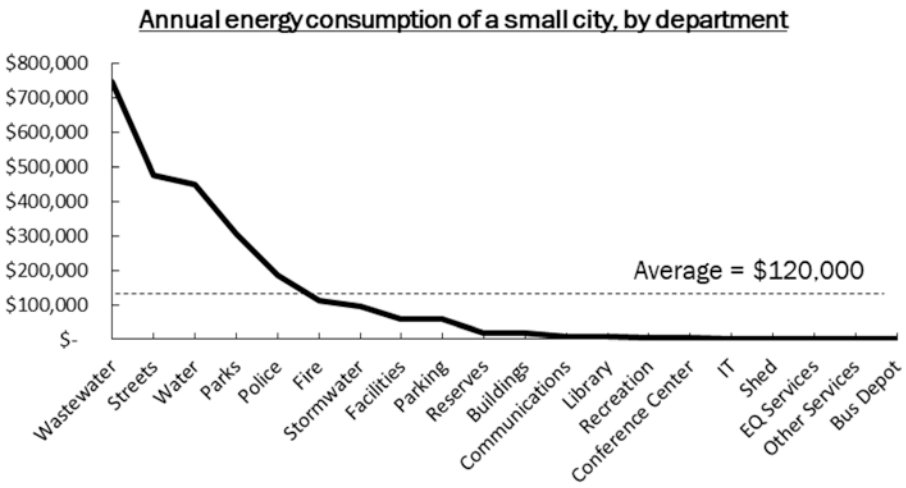

Fig. 9.4 Example Pareto distribution. (Source: Author's creation)

the whole system. This requires a holistic diagnosis of the resource flows, organizational structures, productivity outputs, challenges and issues, among others. The diagnosis needs to focus on the key interdependencies in the system and evaluate both positive and negative consequences that might arise from an action.

In the Pareto world, one needs to prioritize the consequences of possible actions so the decision-maker can evaluate the value stack among possible solutions. Key to this step is to have clarity and alignment on the negative outcome one is trying to avoid or the positive outcome one is trying to maximize. The **Waste Resource Prioritizations** is an example framework that follows this general form (Fig. 9.5).

1. *Prevention*: outright prevent the occurrence of the negative outcome. For an earthquake, this can be compliance with building codes.
2. *Minimize*: for what can't be prevented, minimizes the impact of the negative outcomes if it does occur. This could be keeping an earthquake preparedness kit at home.
3. *Manage*: for what can't be minimized, manage the negative outcome. This could be to agree on a central location a family can gather at should a disaster separate the individuals.
4. *Recover*: for what can't be managed, put into place emergency response and recovery plans. This could be buying earthquake insurance to finance the rebuilding of one's home.

Fig. 9.5 Systems management Pareto context. (Source: Author's creation)

What it's good for: A leader needs to understand whether they are facing a Gaussian situation where average describes the system or a Pareto situation where the variance is so large that all solutions are special cases. In the Gaussian case, the leader needs to change a variable or two. In the Pareto case, the leader needs to change the system-wide feedback loop.

Variance Spectrum: A Boundary Condition Analysis of Variance

A **Boundary Condition Analysis** of the extremes of variance reveals the tension between centralized and decentralized systems. A *centralized* system gains efficiency by reducing variance and reducing waste. A *decentralized* system gains robustness by giving individuals control over their domain. However, this has the side effect of increasing the variance in the responses. These boundary condition properties include (Fig. 9.6):

- *Centralized* networks are more efficient and have a lower cost to operate. They reduce the network connections by flowing information through a central hub. This improves quality control and ensures everyone is on the same page. On the other hand, if a single node is removed, the system could crash. The system needs to be carefully managed because a mistake can quickly cascade, bringing it down.
- *Decentralized* networks are based on individual functions. Everyone is connected to everyone else, sharing ideas and best practices. It is better at generating new ideas. The redundancy of every node functioning independently makes the system robust—no node is critically important. It has a higher cost to operate because of the redundancies. However, it has a lower cost to implement since no one player has to wait for the entire system to agree before being able to participate.

For instance, centralized air-conditioning (AC) can cost millions of dollars to implement for a whole residential building. A window-based AC unit is only $100 and any resident can make the purchase. Yet if every resident bought their own AC unit, the total amount of energy consumed in the building would be far higher than in a centralized AC solution. If optimizing for

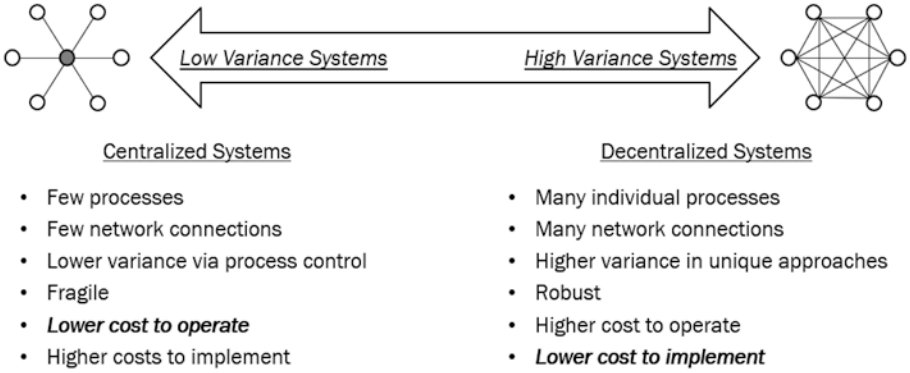

Fig. 9.6 Boundary conditions analysis of variance. (Source: Author's creation)

long-term operational costs, choose centralized solutions. If optimizing for short-term upfront costs, choose decentralized solutions.

What it's good for: This model demonstrates that some combination of properties is not possible to achieve (i.e., a robust and centralized system). It can be used to reveal and clarify potential conflicts in the tactics being evaluated as well as synergies of strategies to achieve outcomes.

Innovation vs. Risk: Optimizing Variance

Innovation and risk are also at opposite ends of the **Variance Spectrum**, warranting its own discussion. Negative consequences are considered risky while positive consequences give organizations the competitive edge. Yet they are just two sides of the variance extremes.

It's impossible to minimize risk and maximize innovation *within the same system boundary*. Minimizing variance decreases risks and decreases the appetite for innovation. Increasing variance increases opportunities for innovation but is prone to failures. This creates a natural tension for the right mix of innovative pursuits and risk tolerances (Fig. 9.7).

For instance, electric utilities have mitigated risk so well that in the USA, an average person will only experience one hour of downtime once per year, for an uptime rating of 99.99%. This is even more impressive considering that the US grid is a 2500 × 1500 *square mile man-made machine*. It is managed by thousands of companies, regulatory bodies, and financial entities. Yet for their successes, they are also blamed for stifling sector innovation. After all, any change made anywhere in the system would interact with millions of components, increasing the possibility of a failure somewhere.

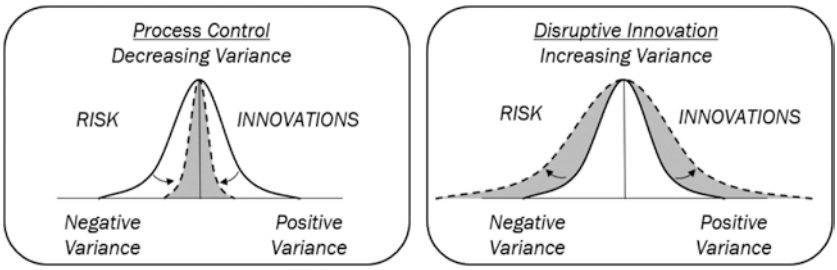

Fig. 9.7 Innovation versus risk. (Source: Author's creation)

On the other hand, technology startups are classic examples of innovation, yet most companies fail to make it past their fifth year. The trade-off for the innovative mindset is an acceptance of higher risks.

What it's good for: This model depicts innovation management and risk management as two ends of the same spectrum. Therefore, the general rule of risk management is to reduce variance while that of innovation is to increase variance. It is virtually impossible for a person or a company to do both *at the same time*. It is important to separate variance-reducing activities to variance-increasing initiative. This dynamic is important enough that we dedicate **Part IV—On Innovation** to its exploration.

Maslow's Hierarchy of Needs: Boundaries of Physiological Needs

Maslow developed the Hierarchy of Needs as an explanation for human motivation. Developed in 1943, it wasn't until 1960 that it appeared in the now-familiar pyramid (McDermid 1960). The theory is usually wrongly interpreted as one where the lower levels of motivation must to be satisfied before the higher levels are attempted. Instead, Maslow used it to postulate that the lower levels are more satisfied in daily life than the upper levels. For instance, a typical person may be 85% physiologically satisfied while only 10% self-actualization satisfied (Maslow 1954).

- *Physiological needs* are the most fundamental needs for a person's survival. These are generally food, water, shelter, sleep, and sex.
- *Safety needs* address personal, physical, and emotional security to feel peace of mind. This includes protection from violence, abuse, and economic stress.

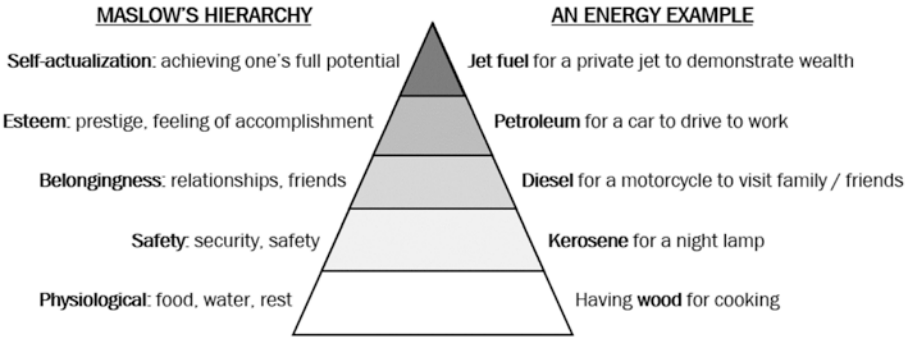

Fig. 9.8 Maslow's hierarchy. (Source: Author's creation based on McDermid, C. D. (1960). How Money motivates Men. *Business Horizons*, 3(4), 93–100. https://doi.org/10.1016/s0007-6813(60)80034-1)

- *Social belonging* describes friendships, family, and intimate relationships. Lacking a connection to a larger community can result in loneliness, anxiety, and depression.
- *Self-esteem* involves needs driven by the ego. There are two forms: first, respect from others for one's accomplishment manifests itself in status, recognition, and fame. Second, self-respect results in self-confidence and strength. The first can give one confidence to work harder, while the second gives one freedom to pursue whatever they believe in.
- *Self-actualization* is the ability of one to realize their full potential. This can include seeking happiness, fully utilizing talents and abilities, and freedom to pursue goals.

What it's good for: When developing energy products, it's important to keep this hierarchy in mind. Problems lower on the hierarchy are more fundamental and their solutions may be more essential and stickier to the buyer. For instance, energy products that provide food and shelter solve basic needs, while having fuel for a private jet may be an esteem or self-actualization need (Fig. 9.8).

Wicked Problems: Shifting Social Contexts

A Wicked Problem describes a set of problems that are *ambiguous* to define, *temporary* in nature, and *fluid* with constantly shifting requirements and in attention paid to it. They are Pareto-type problems where averages may be

meaningless, variances are high, and any solution merely shifts the problem definition. The opposite, a *tame problem*, such as a game of chess, ceases to exist once a solution is reached, as there are no rules governing how to play after a checkmate (Rittel and Webber 1973).

Wicked problems are defined by the frame of reference of how it's being viewed. This frame of reference is the boundary condition! Energy is a classic wicked problem because it's different based on how it's defined. For instance, renewable energy (RE) reduces carbon in the energy supply while energy efficiency (EE) reduces carbon by reducing consumption. Proponents of RE may argue that their solution will decarbonize supply, while the EE community will argue that wasting less will reduce carbon emissions. Both arguments are valid from their own frames of reference. The problem is that the underlying assumptions are not being articulated or discussed, resulting in a lack of alignment of priorities and proposed actions.

What it's good for: Wicked problems need to be managed, not solved. They can be approached using **Clumsy Solutions** and by using an incremental approach (**Muddling Through**). This framework also implies that the easiest way to find a new approach is to shift one's frame of reference. By doing so, one adopts a new set of assumptions, revealing opportunities not considered before (Fig. 9.9).

The Ten Properties of a Wicked Problem

1) There is ***no definition*** of a wicked problem (defining wicked problems is itself a wicked problem).
2) Wicked problems ***do not 'stop'*** being problems.
3) Solutions to wicked problems are not true-or-false, but ***better-or-worse***.
4) There is ***no test of a solution*** to a wicked problem.
5) There is no opportunity to learn by trial and error. ***Every solution changes the problem***.
6) Wicked problems do not have a describable set of potential solutions nor describable set of actions.
7) Every wicked problem is essentially ***unique***.
8) Every wicked problem is a symptom of another problem.
9) The description of the problem is through a ***frame of reference***. Any proposed solution only meets the ***need of that frame***.
10) Planners are liable for the consequences of the actions they generate. [***There will always be unintended consequences***]

Fig. 9.9 Wicked problem. (Source: Author's creation)

Clumsy Solutions: Balancing Approaches

The Clumsy Solution is a model that advocates for a balance between managerial approaches rather than the application of a single solution. It addresses **Wicked Problems** by examining the interactions between hierarchical, competitive, and egalitarian approaches. Most solutions have aspects of all three approaches, even if it may be weighted toward one of them (Rayner 1995).

- *Hierarchical*: uses processes and rules to create the pathway for an outcome without passing a value judgment for what the outcome should be. For example, a new government regulation may require public commenting before being implemented.
- *Competitive*: finds the 'best' solution by pitting many solutions against each other. Businesses, using free market principles, will compete for market share with the assumption that the best solution will also be the most widely purchased by consumers.
- *Egalitarian*: is centered on values and social goods. Some groups advocate for an idealized solution, subjecting them to criticism as being impractical. Others provide unbiased analysis to promote technocratic solutions. Regardless, they are good at drawing a line in the causes that they represent.

Any system becomes distorted if it is biased strongly in any one of these directions. For instance, stringent government regulation of electric utilities (strongly hierarchical) has kept prices low. Yet it has also hampered innovation (competitive) and raised the bar for renewable integrations (egalitarian). Opportunities are created for solutions that rebalance the system. A solar business that taps into an individual's environmental concern is a competitive-egalitarian approach that counterbalances the hierarchal utility regulatory system.

What it's good for: This model can be used to scan the balance of approaches current within a sector and determine which one is missing. Each approach also has their set of tools that can be used. Figure 9.10 depicts example frameworks from this book mapped to the Clumsy Solution.

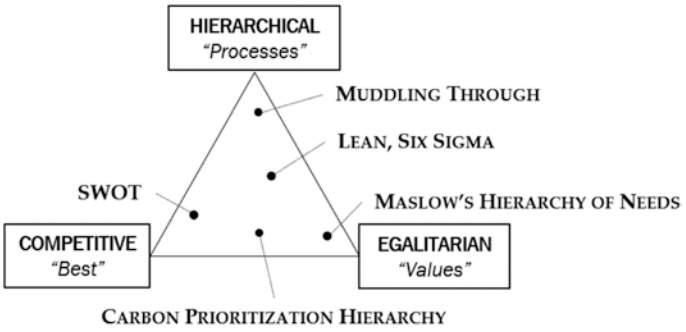

Fig. 9.10 Clumsy solution. (Source: Author's creation based on Rayner, S. (1995) *A conceptual map of human values for climate change decision making*, in: A. Katama (ed.) *Equity and social considerations related to climate change*. ICIPE Science Press, Nairobi, Kenya)

Energy Literacy Matrix: Socio-technical Model for Energy

The Energy Literacy Matrix facilitates a leader's quick understanding of both the technical and social context of any energy resource problem. It merges the energy balance in **The Conservation of Energy** and the balanced approaches of the **Clumsy Solutions**. The basic model is depicted in Fig. 9.11.

I developed the matrix to help give students a guide to understand sustainable energy problems. At Presidio Graduate School, we developed over 50 lectures covering a range of topics among utility regulation, nuclear power, international water treaties, waste management, district heating, energy storage, mineral rights, advanced manufacturing, marine freight traffic, and so on.[1] This matrix became glue that mapped the individual topics to system concerns. Thus, the business model of waste-to-energy facilities that extracted embodied energy (a competitive/pollution issue) can be relatable to utility transmission line planning (hierarchical/transportation issue) and issues advocated for by renewable energy nonprofits (egalitarian/generation issue).

I've since applied this model to help leaders understand the interdependencies of the energy decisions they are facing. Frequently, leaders are asked to take positions on multiple seemingly good ideas that each has inherent value. Yet, the tactics to achieve each idea may be unintentionally opposed to each other. For instance, creating an incentive program for large solar farms in the desert

[1] Many of these lecture notes have been open sourced and can be found in my GitHub repository: https://github.com/JJia/Master-Lecture-Slides

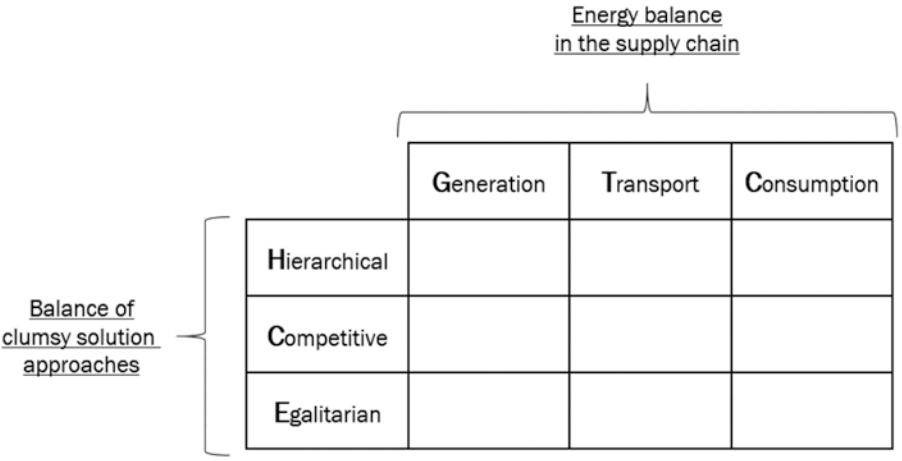

Fig. 9.11 Energy literacy matrix. (Source: Author's creation)

could be a viable non-carbon *government/generation* approach. Advocating for using rooftop solar to increase net-zero housing is an *egalitarian/consumption* issue. Although both are renewable solar solutions, the former case benefits utilities who support centralized control of the grid while the latter promotes a decentralized vision and individual freedom.

Leaders can use this framework to quickly grasp the context for any proposed solution. Each box dictates the set of stakeholders, competitors, regulators, and business models to be found. They will have different challenges, constraints, and winning conditions to achieve an outcome. Second, the matrix can be used to evaluate a portfolio of technologies or companies to detect any imbalance in the system. By identifying possible conflict among solutions early, one can avoid costly situations of unwittingly investing in multiple solutions that are at odds with each other.

Extending the Energy Literacy Matrix

The Energy Literacy Matrix is a model whose boundaries are purposefully extendable (*see* Six Steps of Innovation). This gives the model a sense of flexibility to adapt to the situation at hand. For instance, adding a time axis enables the discussion of historical issues, present-day concerns, and future opportunities. Adding a step before generation (*mining*) and a step after consumption (*pollution*) gives a more comprehensive view of the supply chain. Other possible extensions of this framework are to apply it to other resource supply chains, such as water, agriculture, or materials (Fig. 9.12).

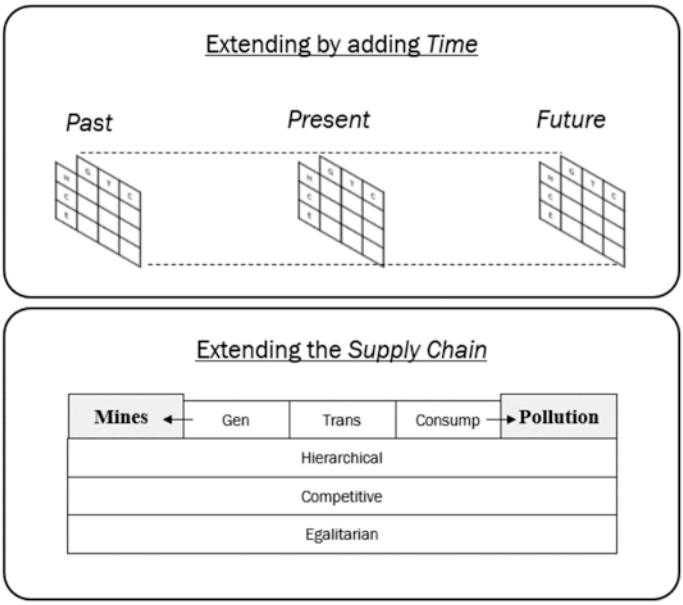

Fig. 9.12 Energy literacy matrix extended. (Source: Author's creation)

What it's good for: This matrix can be used to analyze the comprehensiveness of a portfolio of solutions. This could be applied to a suite of government policies, corporate initiatives, venture capital investments, and so on. Holes in the solution space will always leave untapped opportunities and inform the leader where to search for their next solutions.

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10

Metrics Systems: Managing Resource Flows

This chapter explores how to create a system of reports to monitor any situation. Metrics systems are far more than just keeping track of a numerical value. They also include the data acquisition processes, calculations, presentations, interpretations, and information storage for future use. For sure, a threshold is a numerical boundary condition that determines what's in and out. A metrics system also implies how the threshold got set at that specific value, the process to change it, and the consequences for missing it.

A good metrics system provides a way to judge progress toward a purpose or a goal. A number by itself (such as 7) is irrelevant without a goal or intention (such as *how many runs did the winning baseball team score tonight?*). For a metric to act as a judge, it also needs to be comparable. One way to set a comparable is to use a diagnostic test to generate a baseline. This gives us a starting point comparable. Another way is to use a goal as an ending point comparable. A third way is to use market data or external indicators to create a relative comparable.

Metrics are frequently abused or misused. Frequently, it's because categories that sound comparable aren't. When Michael Phelps won his 23rd gold medal at the 2016 Olympics, some declared him to be the best Olympian ever. However, Phelps usually competes in six to eight swimming events per Olympics. Marathon runners, on the other hand, will only participate in one event per Olympics, limiting the number of golds those athletes could win.

System-wide metrics might incorporate too many different variables, rendering them difficult to compare. Revenue might seem like a standard definition, but revenue at the Coco Cola Company, based on repeat sales of soft

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_10

drinks to billions of people, is very different than the revenue of Boeing, where only a handful of customers can afford to purchase a $300 million airplane.

Component-specific metrics are usually tightly constrained in their definitions, making them highly comparable. However, they lack the ability to describe the holistic system, leaving important attributes unmeasured and unmonitored. For instance, annual growth rate of revenue is agnostic of the industry sector, making it highly comparable between companies. Yet a rosy picture of this one metric may be misleading if the profits, market share, employee retention, and customer satisfaction are declining.

Because there are so many nuances to good metrics, it's important for any leader to continuously question and verify that the metrics system is relevant to and representative of its purpose and intention. This includes questioning the key performance indicators being monitored, the units being measured, the collection systems being used, the analysis methodology chosen, and the underlying data being analyzed.

Why this chapter is important: Energy strategists need to know what they are measuring and why. Frequently, what they are measuring has never been monitored before. Creating effective metrics and reporting systems will enable the continuous monitoring of operations, gathering critical data to support a strategic goal.

Tips for Data Granularity

Data granularity is the question of how much detail one needs to make a decision. If one drives from San Francisco to Los Angeles, it's important to know the total distance is 431 miles. It's irrelevant to know the location of every mile marker along the highway. As the joke goes, *measure with a micrometer, mark with a chalk, cut with an axe*. If one's cutting tool is an axe, investing in micrometer-level monitoring devices is pointless.

One of the promises of the Internet of Things (IoT) is that it monitors everything all the time. Frequently, people make the mistake of believing more data equals better decisions. Unfortunately, this usually results in analysis paralysis as leaders are overwhelmed with unfamiliar information. As a result, decisions are delayed or avoided while more analysis is conducted.

In reality, more *relevant* data is needed to inform better decision-making. Determining a data's relevance means the leader has to interpret the data for the context and have a firm grasp of the priorities being weighed.[1] On the road trip from San Francisco to Los Angeles, the number of red cars passed is extraneous data, unless one is counting them in a game to pass the time.

[1] See the **DIKW Pyramid** for further discussion on data relevance and synthesis.

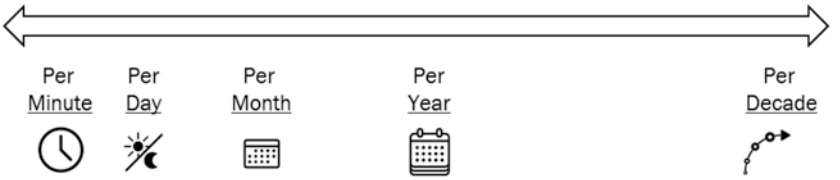

Fig. 10.1 Tips for data granularity: frequency of analysis. (Source: Author's creation)

Frequency of Analysis

How frequently should one gather data? Hourly consumption data is probably too much information for an analysis of seasonal trends. Annual energy budgets are probably too coarse to calculate the trade-off between automated and manual light switches (Fig. 10.1).

- *How frequently does the decision get reviewed or monitored?* At a minimum, the data should be measured on that frequency. A monthly meeting may only need monthly figures for decision-making.
- *How quickly does on need to react to the data, should there be an emergency?* An operator that needs to respond within a few minutes of an outage will need data on the minute scale.
- *How detailed does the insight need to be?* An hourly plot of energy consumption is usually good enough to understand daily consumption. Conversely, a minute-by-minute metric may be too granular for annual capital purchases.

Unit of Analysis

How granular should data be gathered? Putting a sensor on every plug, light bulb and outlet is an expensive endeavor but it can capture every behavior possible in a building. Installing a whole-building utility meter is the cheapest option to monitor energy but gives almost no visibility into possible behavioral actions to improve consumption.

Plug-load data is relevant if a property manager needs to know which apartment needs repair. Building-by-building consumption is needed when evaluating portfolios in aggregate. Capital equipment decision can affect an entire company and should be analyzed on that scale (Fig. 10.2).

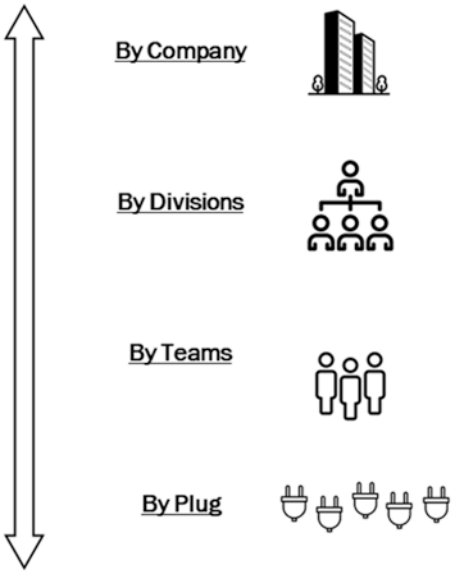

Fig. 10.2 Unit of analysis. (Source: Author's creation)

Data Quality

The more times data is requested and transferred, the more opportunities for errors to creep into the dataset. For instance, in the study of medical data entry, manual single-entry systems, where the data is entered once by one person, can have eight times more errors than a double-entry system, where two people enter the same data each and compare (Paulsen et al. 2012). Once, when analyzing a dataset of utility bills for over 300 properties, I found nearly 10% of the data was of questionable quality, rendering any analysis meaningless.

The larger field of *Information Quality/Data Quality* includes many metrics of quality, including verifiability, objectivity, integrity, validity, reproducibility, and so on. Although their details are beyond the scope of this book, leaders should know that these issues increase in importance the more information they need to manage. More data might result in better visibility but it also might be distracting, noisy, or just plain full of mistakes.

What it's good for: To set a good metric, start by understanding at what level of granularity is the decision being made, in terms of both frequency and unit of analysis. Where would one access data with these attributes? To utilize the metric, satisfy one's confidence that the data is of high quality. These two factors will help with setting the proper oversight system for any metric.

Absolute vs. Relative Metrics: Setting Comparables

The statement *I have $10* is somewhat meaningless without any context. In a developing country, $10 can be a month's salary while in downtown Manhattan, it may be enough for a cup of coffee. Unfortunately, most of the time, the comparable is tacit and assumed to be understood. Being clear on the metric and its comparable can help avoid confusions.

Absolute metrics are comparisons made to the boundary—0% or 100% achievement. In these cases, the comparable is frequently unstated and assumed. For instance, manufacturing plants will frequently have signs displaying how many days since the previous accident as a way of encouraging workers to perform their work safely. The implied comparison is to zero accidents.

Relative metrics are made in comparison with something else that is also changing with time. The purpose is to compare how they've changed relative to each other. For instance, one may want to know if their stock portfolio outperformed the Dow-Jones Industrial Average (DJIA). In this case, one needs to calculate if their stocks grew or dropped faster or slower than the DJIA. Similarly, one may want know if their energy expenses grew slower or faster than the rate of inflation.

A single fact may seemingly support two opposing arguments when the appropriate context is not supplied. Energy decisions frequently fall into this trap, where advocates of solutions are using different assumptions of comparisons. For instance, proponents for solar as a clean energy source implies the use of an absolute metric for zero carbon generation during operations. Meanwhile, advocates for using natural gas to generate electricity imply a relative scale—that it's cleaner than coal. To address this, one should first come to an agreement of which methodology to use. Should we *eliminate* carbon or *reduce* carbon from our generation assets? The set of technologies for each goal is quite different (Fig. 10.3).

What it's good for: Absolute metrics are good for goals, whether visionary goals or purposeful goals. As a visionary goal (i.e., a zero-waste policy), the metric implies the decision matrix and how one should prioritize to minimize or maximize activities. Relative metrics are good for continuous improvements. One can track one's current state and find ways to improve.

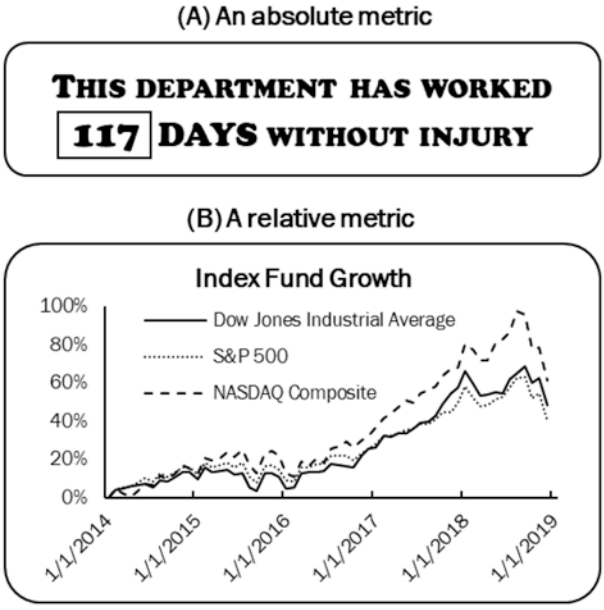

Fig. 10.3 Absolute vs. relative metrics. (Source: Author's creation)

Cross-sectional Metrics: Comparisons to Your Peers

Whether running a marathon or constructing an energy-efficient building, it's important to know one's competitive advantage to one's peers. A cross-sectional benchmark depicts a distribution to see if one's ahead or behind.

These benchmarks are highly sensitive to the definitions of the boundary and the metrics used. For instance, Meb Keflezighi won the 2014 Boston Marathon Men's race in 2 hours, 8 minutes, and 37 seconds, as shown in Fig. 10.4A. It is somewhat pointless to make a judgment on Keflezighi's time based on the results of a completely different race. Similarly, one may want to know the energy intensity of their office building. To make the appropriate comparison, one may want to compare the same type of building, geography, end use, and so on. Energy Star Portfolio Manager™ maintains a cross-sectional database for US energy consumption in commercial buildings just for this purpose (Fig. 10.4B).

What it's good for: When one is below average, cross-sectional benchmarks are a great way to motivate a team to do better. On the other hand, the opposite is also true. When one is ahead, there is a tendency to relax, slow down, and become complacent. The exception is if one is *in it to win it*. The top-tier contestants of both examples are hyper-competitive, resulting in very impressive performance.

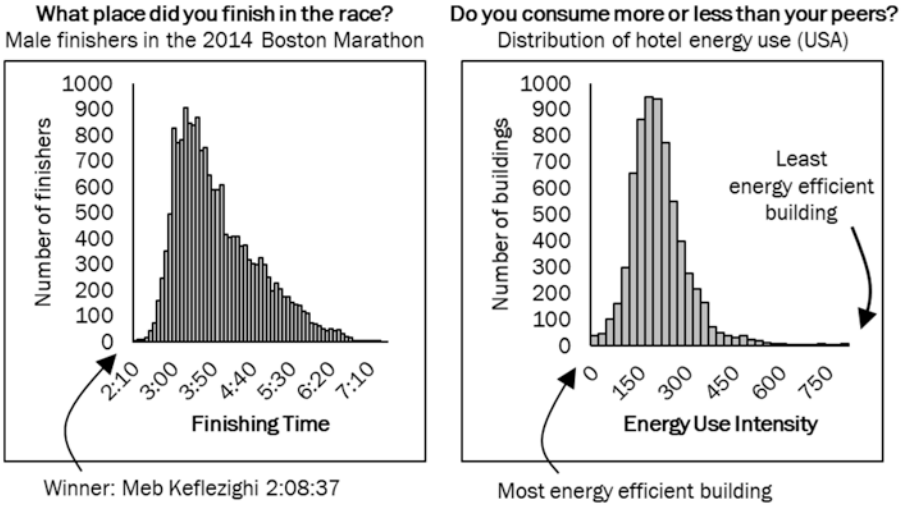

Fig. 10.4 Cross-sectional metrics: comparisons to your peers for (A) a marathon runner and (B) a building's energy consumption. (Source: runnerstats.net and Energy Star)

Longitudinal Metrics: Comparisons to Yourself

When trying to improve performance, a program needs to be compared to past performance. By using long-term trends, one can see the consistency of performance and predict the likelihood of success on the day of the race.

The challenge is to ensure that the operating conditions are similar enough to make the benchmark comparable. For instance, Fig. 10.5A compares different marathons that Keflezighi ran between 2004 and 2015. His running times are within a five-minute window. Yet the course layout and weather condition for each marathon may have been quite different and could have affected his running time.

For energy, since consumption never ends, one can also track the continuous consumption. Figure 10.5B depicts of consumption in a small city. Utility consumption rose roughly 2–4% per year, giving us a snapshot of how the organization did compared to itself. Thus a good year is one where consumption increases less than this.

What it's good for: Use longitudinal benchmarks for continuous improvement programs and to learn from long-term trends. Be careful to make sure operating conditions are similar so that the data is comparable.

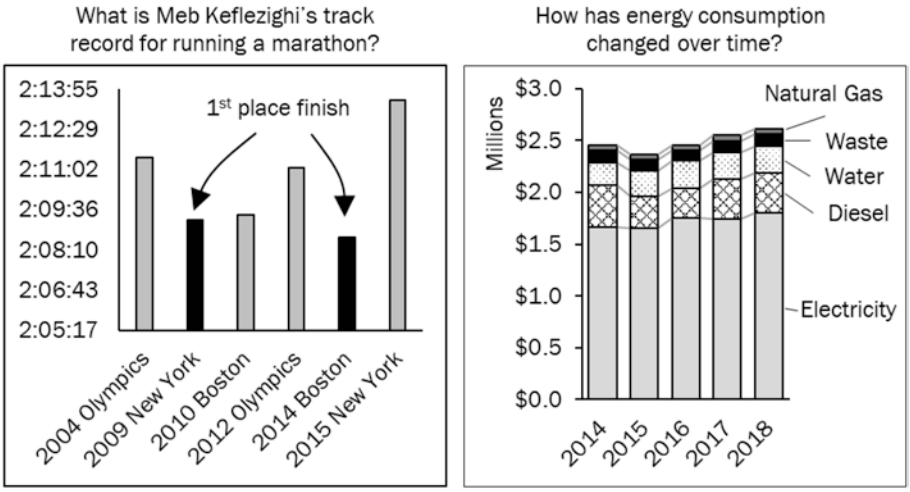

Fig. 10.5 Longitudinal metrics: comparisons to yourself for (A) a marathon runner and (B) a building's energy consumption. (Source: runnerstats.net)

Per-Unit Metrics: Comparisons of Productivity

Per-unit metrics are a relative measure comparing a result to a standard unit of measure. By looking at the rate of relative change, this helps to make data more comparable across different sets of conditions. As a rate metric, it also helps maintain a culture of continuous improvements, since one can always become faster, better, and cheaper.

For instance, a runner may do a 5-mile, 10-mile, and a 12-mile run in a week. The total amount of time taken to do each race will be incomparable. However, a per-mile pace may be comparable. This per-mile pace could also inform possible places for improvements, race conditions, or mental fatigue that is not visible by using the total run time. Figure 10.6A shows my pace per mile for a recent run.

Similarly, a company may want to know how much energy they consumed per widget produced or per revenue. Figure 10.6B shows the energy efficiency of revenue for an entire company. If revenue increases faster than energy consumption, then the company is becoming more efficient over time. This can inform leaders where they should invest their time and money to manage their consumption and carbon footprint. The graph below on the right shows the intensity of energy on revenue.

What it's good for: A rate metric lets teams improve productivity with the resources they have available. It becomes a good way to compare between teams. It also helps one identify possible discrepancies for improvements and can correlate activities to results.

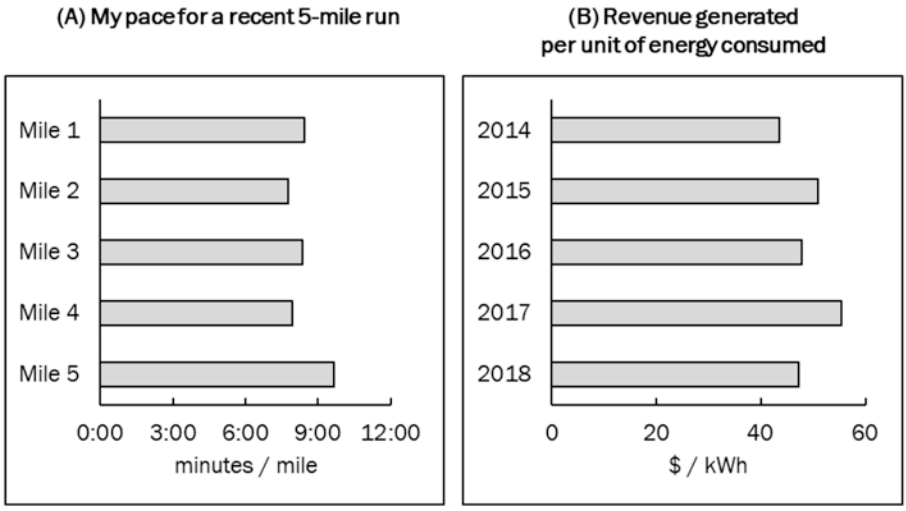

Fig. 10.6 Per-unit metrics: comparisons of productivity—(A) my pace for a recent 5-mile run and (B) revenue generated per unit of energy consumed. (Source: Author's creation)

Trifecta of Statements to Manage Any Resource Flow

A challenge with any reporting systems that tries to capture flows of resources is just that—they need to capture a dynamic, fluid system that is constantly changing over time relative to many other indicators. The metrics system needs to be strict in how it draws its boundaries (Fig. 10.7).

1. Understand the metric that one is trying to track. The *snapshot at a given moment in time* of this metric will be reported regularly.
2. Draw a strict time boundary between two snapshots. This is known as the *period of reporting*. Financial reporting commonly uses monthly and annual periods.
3. Those activities that started and ended within the same period can be reconciled to the *resource flow report*. This is because the outcome of those events is known.
4. Activities that are ongoing between periods are notated in the *activity report*. These activities will be reconciled to the resource flow report when the activities come to an end.

Metrics alone lack context to a larger picture. A metrics system creates a context that can be used to evaluate progress. These boundaries give us three reports—a snapshot report, an activity report, and a resource flow report.

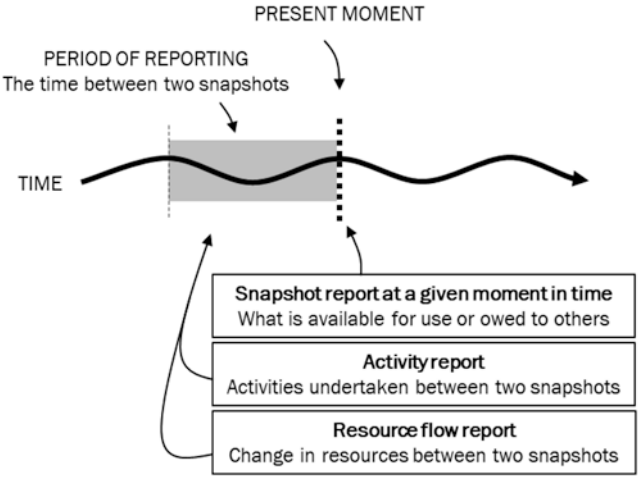

Fig. 10.7 Conceptual relationship of any metrics system to manage a flow. (Source: Author's creation)

This should sound familiar. Within the **Financial Statements**, the **Balance Sheet** is the snapshot in time, the **Income Statement** represents the actions taken, and the **Cash Flow Statement** reconciles the flow of monetary resources. We extended this methodology in the creation of the **Energy Statements**, with the **Energy Balance Sheet**, **Energy Activity Statements**, and the **Energy Flow Statement** as reports within this trifecta.

This conceptual trifecta can be extended into a reporting system to manage the flow of any resource. We can also apply this metrics system for water, natural gas, supply chain, waste management, to name a few. Furthermore, we can also extend it to nonphysical resources. For instance, the pathway of career progression at a company can be considered a *flow* of individuals as they rise through an organization. The *snapshot* can be the responsibilities at each seniority level—number of people managed, size of project budget, and so on. The *activities* could be the training and mentoring programs available to the staff that can help them expand their skillsets and knowledge base.

When we turn a metric into a system, we instill many of the benefits of system management, many of which are outlined in Chap. 1 under **What are Frameworks Used For**? and in Chap. **8: Introduction to Part II—What is a System**? It connects the leading indicators that inform what will happen to the lagging indicators of past activities. When viewing the past, it tells the story of what happened. When projecting the future, it informs strategy and goals. It creates an audit trail allowing certification that past activities complied with

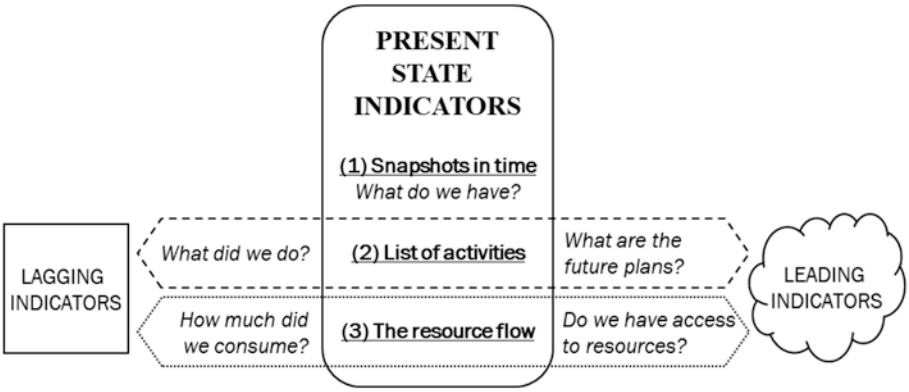

Fig. 10.8 The three reports for any resource management metrics system. (Source: Author's creation)

intended policies. It creates the organizing principles of how to manage that flow. It becomes a mediating instrument that aligns actors and stakeholders.

We also will incur the natural weakness of system management, namely, that anything not defined within the system is not tracked. For instance, financial statements are a poor tool for environmental management, because climate is considered an externality with no visible place in the existing reports.

What it's good for: Use this framework to create a robust system to manage any flow. Rather than just measuring and monitoring one metric, it creates a contextual system that the metric operates within, improving the ability to manage and create strategies to influence the resource (Fig. 10.8).

Reference

Paulsen, A., Overgaard, S., & Lauritsen, J. M. (2012). Quality of Data Entry Using Single Entry, Double Entry and Automated Forms Processing—An Example Based on a Study of Patient-Reported Outcomes. *PLoS ONE*, *7*(4). https://doi.org/10.1371/journal.pone.0035087

11

How to Create Your Own Framework

In this chapter, we will describe several techniques to creating new frameworks. Not every situation will have an off-the-shelf method ready for use. Even this book, which lists over 120 frameworks, does not cover every situation to be encountered. As such, one needs to know how to create one's own custom solution or adapt a tool such that it's fit for purpose.

Designing a new framework is a form of innovation and one can apply these principles to many situations. This chapter is a case study of how to apply innovation concepts to create a framework. Just like the concepts discussed in **Part IV—On Innovation**, frameworks can be incrementally improved (**Micro-Innovation**), combined (**Meso-Innovation**), or scaled into new applications (**Macro-Innovation**). In this chapter, we will break down frameworks into their constituent components, examine them individually, and recombine them to solve new problems.

Just like any system, one needs to experiment with the boundaries, test to see which ones are real, and which ones merely have yet to be explored.

- A *bad framework* is haphazardly created, leaving behind gaps, holes, or situations where the model breaks down. Those holes are places where future innovations can come along and displace one's idea.
- A *good framework* will organize the information and show the underlying logic of what's there. They are well-targeted to the value proposition, robust in their features, and clearly communicate the benefits.
- A *great framework* can utilize the underlying logic and reveal what's missing. It is these missing gaps that will reveal disruptive innovations, seemingly

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_11

appearing out of nowhere and threatening the incumbents. Thus, when one is innovating ideas, one is searching for holes and gaps in existing solutions while trying to leave behind as few gaps of one's own.

How does one search for what's missing? One can analyze the underlying logic of the framework and try to identify **White Spaces**. One can stress-test the boundaries with a **Boundary Condition Analysis** to see under what conditions it would break down. Examining the failure modes might reveal structural deficiencies that can be improved. One can perform a thought experiment of achieving the exact opposite of one's goals, such as in the **Null Hypothesis**. This can inform what bad practices to watch for and avoid when trying to make improvements.

Why this chapter is important: Energy strategists will encounter new problems where no framework exists to manage it. The strategists will need to analyze the system properties of the problem and try to craft their own boutique solution. As energy strategy, climate management, and sustainability are still fields in their infancy, there is still a strong demand for new tools.

Furthermore, since this chapter will apply the innovation process to the creation of frameworks, strategists will also gain a familiarity in how to apply innovation to any other situation. Although each individual step seems small and incremental, the aggregated outcomes can be a large improvement and disruptive to business-as-usual.

White Spaces: The Gap Between Frameworks

White spaces are areas where current ideas, practices, or processes are absent. They are the intellectual wild west, where anyone can lay claim with a new idea. With all the ideas and innovations already out there, sometimes it seems like everything that could be invented has already been invented. So how do we know white spaces for ideas exist?

In a nutshell, all ideas exist within systems. By definition, all systems have boundaries. The boundaries of ideas leave behind gaps. Gaps are the nurseries for new ideas. By comparing the boundaries of two systems, one can find gaps full of ideas, waiting for the *aha!* moment to be noticed.

As ideas are discovered and their attributes described, the boundaries of knowledge will shift. Frequently, there are many ideas within the same field or concept. For example, situational analysis can be done using **SWOT** or the **Five Cs of Marketing**. Processes can be improved using either **Lean Manufacturing** or **Six Sigma**. Each technique will claim a different area of

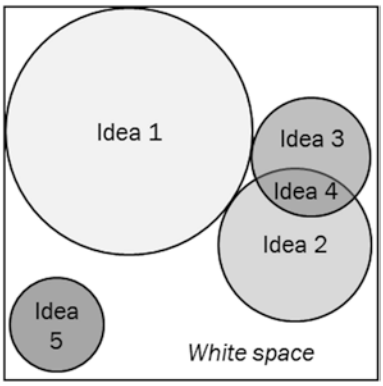

Fig. 11.1 An idea or concept map with ideas and white spaces. (Source: Author's creation)

the field. Sometimes, these concepts will overlap and at other times they will leave behind gaps. It is quite impossible for all ideas to cover all possibilities. Even in mature fields where most of the space is already claimed, new entrants can emerge, causing massive disruptions.

Direct white space analysis: One can empirically observe a system and look for gaps within an existing space. Figure 11.1 depicts an idea map or concept space with four ideas. Three of the ideas are original and one of them, *Idea 4*, is an overlap or synthesis of *Idea 2* and *Idea 3*. In scholarly research, a literature review creates a map of ideas based on prior work. One can then examine the map for topics yet to be researched or discovered. Marketing departments can do a brand map of a sector to understand the message behind each offering. A missing value proposition may be a way to position a new product. In a third example, in the innovation sector, a patent map examines claims to find areas that have yet to be patented. In this case, areas of overlap are minimal, and if they do exist, can result in patent infringement cases. A word of caution: the strength of this method depends on the size of the literature review. Ideas that were missed in the research could create a false white space.

A second way to find white spaces is to investigate how the system evolved over time. Whereas an idea map is a *snapshot at a given point in time*, evaluating common historical roots and different operational pathways can also reveal system boundaries and its functions. To do so, one needs to understand the similarities and differences between systems to identify the gaps. Figure 11.2 depicts how these evolutionary factors result in an idea map.

Looking for similarities between two systems: One can examine the initial conditions to examine how two systems diverge. As my colleague Dennis West once said, "Questions create the initial conditions for system thinking.

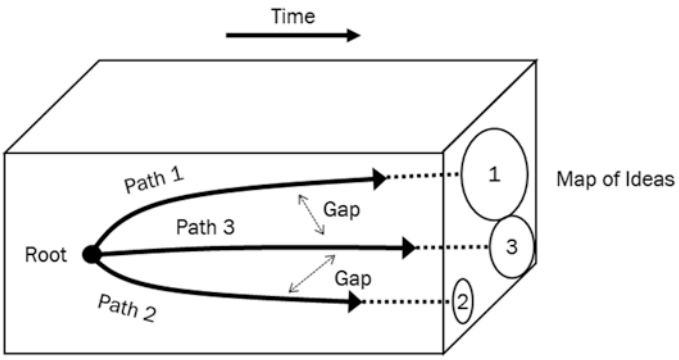

Fig. 11.2 The evolution of ideas over time. (Source: Author's creation)

Change management is resetting those initial conditions by asking a different question." When trying to understand why a framework behaves as it does, examine the question it was designed to answer. Here are some suggested possible common roots:

- *Textbook definitions*: Different definitions can create gaps in the systems. For instance, in **Part V**, we look at how materiality is defined differently by compliance organizations, influencing the way climate disclosures are documented.
- *The original problem being addressed*: Frameworks that try and solve the same problem may have similar characteristics, even if their actualization and application look completely different. For instance, water infrastructure and waste management were both created to solve public health crises. How did this influence the solution designed?

Comparing differences in operational conditions: One can look for overlaps and gaps of two systems by examining the differences in the boundary conditions and operating parameters.

- *Theoretical or best-practice model* vs. *current operations*: This is also known as a *Gap Analysis*, and is probably the most frequent usage of a framework to find white spaces. The **Energy Literacy Matrix** helped identify gaps in my sustainability curriculum, giving students a more holistic view of resource infrastructure interconnections.
- *Different operating conditions or processes*: Optimizing for waste reduction (**Lean**) is different than optimizing for reducing defect (**Six Sigma**). The two methodologies created the white space for Lean Six-Sigma that combined the best of both systems.

- *Different questions of the same data*: When multiple people or organizations try to address the same problem, it is not uncommon for them to use the same data. Differences may arise if they have different analytical assumptions for their questions. This is further explored in **Part V** where we examine how energy is reported by several different functions.

Concept-Knowledge (C-K) Theory

One myth about innovations is that ideas appear in a flash of inspiration. In reality, they are the result of many small, incremental steps that, when viewed in aggregate, looks like a giant leap. Concept-Knowledge (C-K) theory of design tries to explain how creativity is a building block in problem solving. When applying C-K theory to innovation, it can explain the paradox, of how discontinuous, surprising, and unexpected innovations emerge from many series of small steps.

Knowledge (K) is defined as what is known to the designer, society, and the public at large. It is the logical progression between current state and end state. *Concepts* (C) are defined as without-logic. These could be random ideas, conjectures, or components that, when combined, make up the existing knowledge. Concepts also can be incrementally improved and these improvements are generally done in a knowledge silo of a discipline or expertise.

C-K theory has four basic steps (Hatchuel and Weil 2003):

1. *Disjunction*: Taking existing knowledge and breaking it into multiple constituent concepts.
2. *Concept Expansion*: Examining, experimenting, and iterating the concepts individually. These may result in newer concepts with many different options of achieving the same outcome.
3. *Conjunction*: Combining the new concepts into a new solution that becomes new knowledge.
4. *Knowledge Expansion*: The journey of (1) to (3) can be accomplished directly through improvements in knowledge or through incremental improvements to concepts.

In *Reinventing classics: the hidden design strategies of renowned chefs*, the authors applied C-K theory to the creation of a new dish. Chefs face a similar problem to technology innovations: How to create a dish that is both instantaneously recognizable by the public yet unique enough to be branded to a single chef? For instance, a hot dog is comprised of a sausage, a bread roll,

ketchup, and onions. One could use those exact ingredients to make sausage and onion stir fry with bread roll croutons served with slices of tomato. No one would consider those two dishes to be the same, even though they both have the same ingredients.

By analyzing recipes from Chef Alain Ducasse for over a 30-year period, the authors were able to track how he modified each step of a traditional dish to make his own signature dishes. Figure 11.3 is an adapted analysis that demonstrates how the recipe was broken down into its constituent parts—brightness, acidity, structure, and so on. Each concept was tweaked or modified slightly, making the final product recognizable as a variation of the traditional fish dish. Yet taken in aggregate from the *Knowledge Space*, the new dish was unique and distinctive.

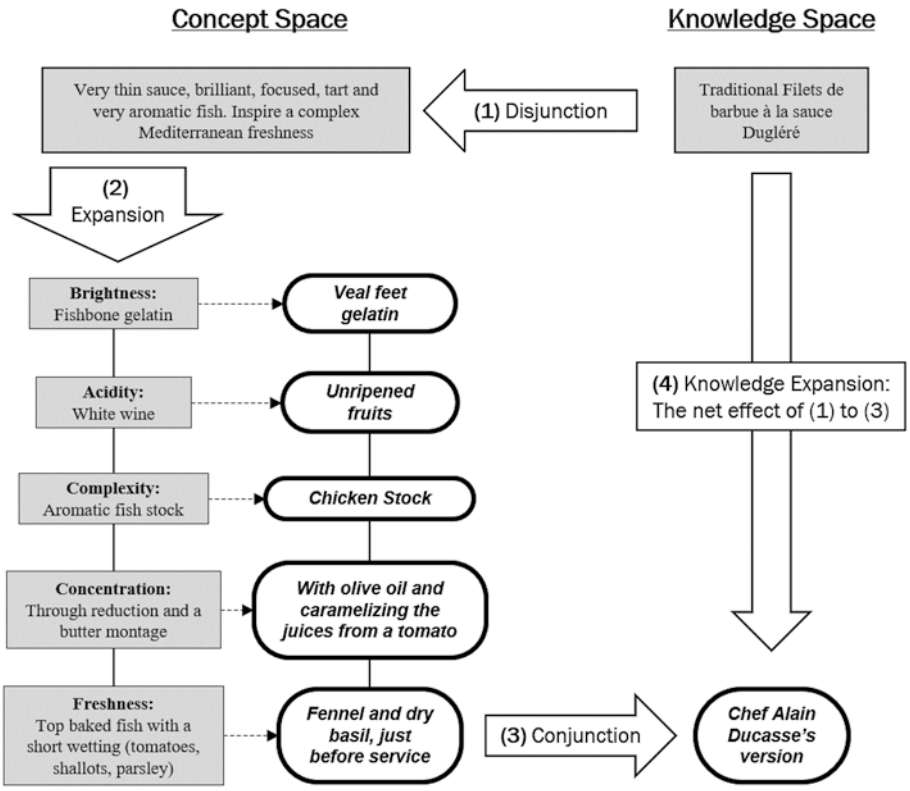

Fig. 11.3 Inventing a new recipe, depicted using a C-K diagram. (Source: Author's creation based on Agogué, M., & Hatchuel, A. (2016). Reinventing classics: the hidden design strategies of renowned chefs. *Research in Engineering Design*, *27*(2), 165–177. https://doi.org/10.1007/s00163-015-0210-3. Reprint by permission from Springer)

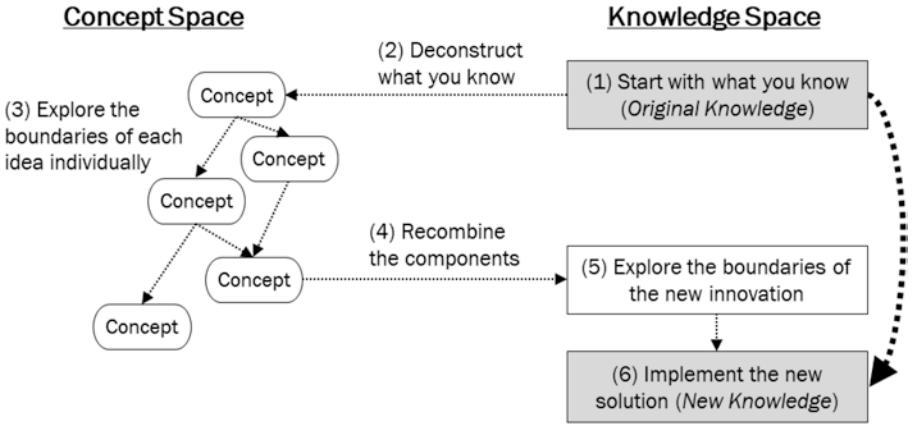

Fig. 11.4 Six steps of innovation. (Source: Author's creation)

Six Steps of Innovation

Using C-K theory, we can diagram the innovation process of creating a new framework (Fig. 11.4). This six-step process demonstrates how innovators can examine a situation and come up with seemingly radical ideas in a simple and straightforward manner. When viewed from the outside, the journey from step 1 to step 6 seems disjointed. Yet the innovation process is incredibly incremental.

1. *Start with what's known*: Spend some time to define the problem and the way the current solution is applied. Starting with a known solution acknowledges there are some components that are working, even if there are critical ones that are not.
2. *Deconstruct what's known*: Take that solution and break it down into its constituent parts. There are essentially three basic forms of frameworks: flows, categorizations, and matrixes. All frameworks are combinations or derivatives of these basic ideas.
3. *Explore the boundaries of each idea individually*: Push, expand, swap, and vary the boundaries of each component. One can easily see the assumptions that are hidden inside the original knowledge and one can quickly question the validity of those assumptions.
4. *Recombine the components into new knowledge*: Take the new concepts and recombine them into a new solution.
5. *Explore the boundaries of the new knowledge*: Stress-test the new solution to see if it solves the original problem and holds up under new conditions as well.

6. *Implement the new knowledge*: This innovation should now look radical as compared to the original knowledge but the process to get here is straightforward.

To create new and boutique frameworks, we can apply these steps to define or redefine any new system we wish to describe. The rest of the chapter gives some suggestions for approaching framework creation.

The Seven Basic Shapes

In steps 1 and 2 of innovation, we need to deconstruct a framework into its constituent parts. A framework is made up of simple shapes. According to Dan Roam, there are only seven basic shapes to any drawing (Roam 2016). In fact, every framework in this book is comprised of combinations of these seven shapes, found in Fig. 11.5.

- *Dots*, *circles*, *triangles*, and *squares* can represent ideas, groups, widgets, locations, or any static object to be represented. These can be thought of as the noun.
- *Lines* represent a connection between two ideas, a flow between two objects or an action. These can be thought of as an action verb between two nouns.
- *Arrows* are a special type of line that represents a direction of an idea. These imply an order in a process or a direction of the flow.
- *Blobs* represent ideas that have yet to be organized. This could be raw data, information, brainstorms, brain-dumps, and ideas-with-no-home. The

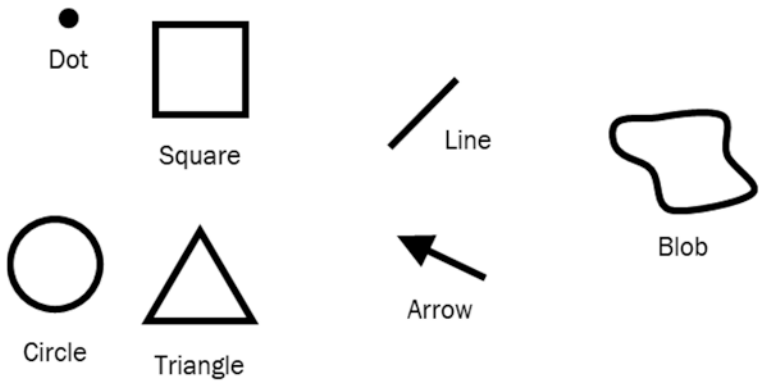

Fig. 11.5 Seven basic shapes. (Source: Author's creation)

blob will need to be simplified into combinations of the other six shapes in order to be expressed more clearly. These are great for getting ideas on paper before iterating the ideas into final form.

At the beginning of a brainstorm, it is useful to simply start by drawing boxes, triangles, circles, and arrows. It is not uncommon to make many sketches during the brainstorming phase as blobs of information organize into more recognizable shapes. These shapes are powerful in clarifying understanding of the situation and to start revealing hidden concepts and assumptions buried beneath the existing methodologies and solutions.

Basic Frameworks

For steps 3 and 4 in the innovation process, the unformed blobs of ideas need to organize into shapes. They will start forming one of three fundamental frameworks—flows, categorizations, or matrixes. During this process, ideas may merge to create even more interesting frameworks.

Flow Frameworks

Flows frameworks are used to trace the beginning to end of any process, creating boundaries at entry and exit points. Flows depict movement, process steps, or an order of action. However, these frameworks do not contain social situations or the context of the decision being made. They can be used in a number of ways:

- *Time Flow*: depicts what happens first, second, third, and so on. These are good to describe processes. For instance, an invoice may travel through multiple people within mail handling, finance, department approval, accounting, before being mailed as a check back in the postal system.
- *Material Flow*: geographically based models on how objects interact with locations. This could be electricity transmission, natural gas pipelines, mail in the postal service, or the global banana supply chain.
- *Money Flow*: A specific material flow. This is useful when one is trying to trace a business model or a new business idea. It shows the relationship between people, who has responsibility and what types of decisions need to be made at each step. Frequently, money flows in the opposite direction of any material flow.

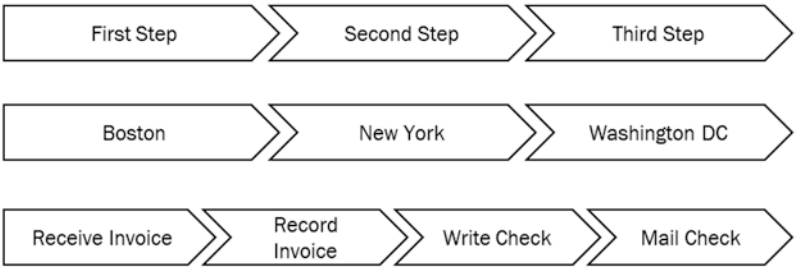

Fig. 11.6 Flow frameworks. (Source: Author's creation)

- *Information Flow*: A specific material flow. This one is useful when trying to figure out who reports to whom, who needs to know what, the communication channels, and so on.

Example flow frameworks in this book include (Fig. 11.6):

- **Sankey Diagram of USA Energy Flow** (Energy flows left to right)
- **Income Statement** (Money flows from top to bottom)
- **Energy Strategy Maturity Cycle**™ (Process flows around the circle)

Categorization Frameworks

Categorization frameworks help to make sense out of large sets of information by grouping them into like-ideas. Venn diagrams are a standard example of these types of frameworks, where one examines different attributes and their overlap. Two or three category Venn diagrams are fairly common, although four and more categories exist. Practically speaking, anything more than four is too complex for quick understanding of a concept and one should stick with two or three. Categories may or may not overlap depending on the situation.

Category frameworks can also be used to generate content in a *fill in the box* method. For instance, in **Porter's Five Forces of Industrial Analysis**, the five categories remind the user of all the considerations and questions to ask when creating a map of industrial competitive advantage. Many categorization frameworks can be applied to the same set of data. Each one will result in a slightly different answer because each will examine the situation from a slightly different lens.

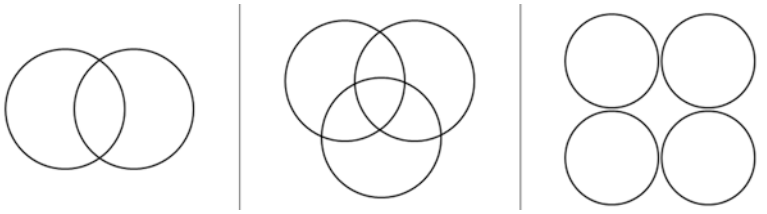

Fig. 11.7 Categorization frameworks. (Source: Author's creation)

These are good for covering the basis of information, of making sure one's asking all of the questions. Don't skip over any box or category when using these. Each box has a purpose and can ensure appropriate attention is paid across all of the issues. The main advantage of these frameworks is that it describes the context of the situation. One weakness is that the framework is only as strong as the information available (Fig. 11.7).

Example categorization frameworks in this book:

- **Business Model Canvas** (10 boxes for a startup enterprise)
- **PEST (or PESTEL)** (a 4- to 6-category analysis)
- **Maslow's Hierarchy of Needs** (5 categories that are drawn in the shape of a pyramid)

Matrix Frameworks

A matrix framework commonly uses two axes as factors to show the relationships between possible solutions. The outputs are four distinct scenarios or situations. They become *descriptor of worlds* of what's possible given the combination of the factors being considered. Sometimes, the exercise reveals scenarios that were previously unknown or unaware of. In fact, **Scenario Planning** is a formal discipline that uses 2×2 matrixes to predict the future.

When used with boxes, such as the example on the left in Fig. 11.8, they imply four distinct categories for the information or decision that needs to be made. When used with axes, on the right in Fig 11.8, it implies relative intensity of the options available.

Matrix frameworks help one explore the boundaries of the situation and reveal combinations that were not previously considered. As a result of their inclusivity, they can be more socially just. Because the two axes are chosen at will, they are highly customizable. However, because of the freedom of options, the results sometimes feel arbitrary.

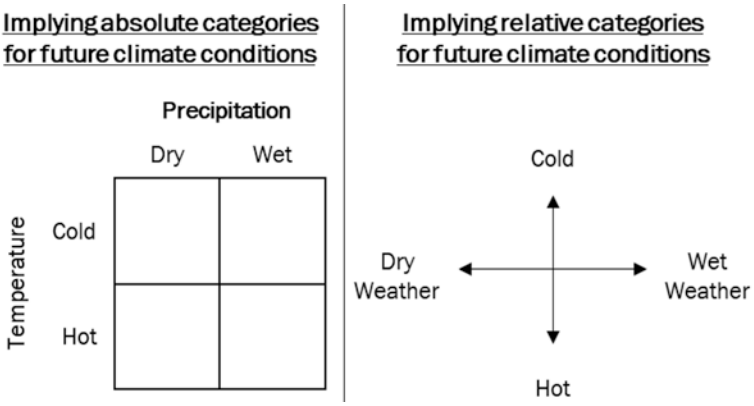

Fig. 11.8 Matrix frameworks. (Source: Author's creation)

Examples of matrix frameworks used in this book include:

- **Johari's Window** (A 2×2 matrix that describes uncertainty)
- **Energy Literacy Matrix** (A 3×3 matrix that merges the energy supply chain with societal approaches to problem solving)
- **Responsibility Assignment Matrix** (A 4× or 5× matrix of the roles for decision-makers)

How to Simplify Ideas

In steps 5 and 6 of innovation, one needs to test the new idea and see if it's recognizable as a step forward in the discipline. If too few people understand, the improvement is probably not obvious and few will adopt it. Simplifying ideas is a way of exploring boundaries. If one can explain the same concept with different words, the boundary did not change but the understanding of the idea could improve.

A quote attributed to Einstein: "Everything should be made as simple as possible, but not simpler." However, to the person who came up with the idea, it usually seems simple and obvious already. To the public, it may come across as convoluted, complicated, and incomprehensive. Here are some tips on how to test for simplicity of an idea.

The Grandmother Test: Any idea should be simple enough to explain to your grandmother. A variant of this is explaining an idea to a five-year-old. Although the notion is funny and often true, this method only points out that an explanation is too complicated. It doesn't inform the writer how to simplify an idea. To do so, use the other tests described here.

The Crayon Test: Any idea needs to be able to be explained with a single piece of paper and a box of crayons. If not, it is too complicated and we don't understand it well enough yet. Physics Nobel laureate Richard Feynman was once asked to explain why spin one-half particles obey Fermi–Dirac statistics. After working on it for a few days he said that he couldn't reduce it to a freshman lecture. Feynman reflected, "That means we really don't understand it."

The Symmetry Test: In my observations of frameworks, nearly all of them are symmetrical in their representation. This has led me to adopt the rule: iterate on an idea until the physical drawing of it is symmetrical. Even rather complex frameworks, such as the **Business Model Canvas**, is drawn in such a way that it is symmetrical.

Beauty Test: Building upon the Symmetry Test, frameworks are not done until they look beautiful. Things that look good are frequently quite simple. The simplicity means that you as the author have distilled the idea to a single message. It strengthens communications because fewer things can be misinterpreted or misunderstood.

The Laughter Test: Do others laugh at how obvious my idea is? Laughter is a good thing! Usually when an idea is simple enough, it'll elicit a chuckle or a question *if it's so simple, why hasn't anyone done it yet?* Usually, the simplest, most obvious thing in front of us is the hardest to see. Laughter is a form of realization of how simple one needs to be.

How to Clarify Benefits

Step 6 synthesizes the new knowledge and introduces it to the world. One now has to test how this new knowledge will fit into the current expectations. *Features* are how one describes one's own idea or product. *Benefits* is how the customers describe what problems the idea solved. This implies that it is very hard to identify one's own benefits. Instead, it must be gathered, through careful listening, from people who bought the solution.

When simplifying ideas, it is tempting to stop when someone else gets excited. Yet how frequently has one convinced a person of an idea (a host), but that person is unable to convey the excitement along to the rest of their team (the host's peers)? In this case, the idea suffers from a communication issue. The inventor may have the right vocabulary and terminology to explain what they do, but the receiver did not understand it enough to pass along the explanation.

Using the language of one's customers is key to overcoming this challenge. The benefits and value propositions should be those perceived by the customer, not those proposed by the inventor. Here are some tips of what to listen for when clarifying benefits.

Mirror Game: In this game, one is listening to how the host repeats back the idea after hearing it for the first time. The words mirrored back are the ones that the host heard, signaling comprehension. Any subtle differences in vocabulary can indicate differences in how to describe the underlying problem. The point isn't to correct the words mirrored back but to adopt them as a way to iterate on these ideas.

Telephone game: In this game, listen to the vocabulary being used by the host when they describe the idea to one of their peers. The host and peer will already have the same context and vocabulary. Listen to how they adopt the idea to their situation. It doesn't matter if they used the inventor's words or not. What's important is that they understood each other and were able to convey the idea. By adopting the words they use, one can absorb the benefit as well as understand the context that the host and peer function within.

The $25,000 Pyramid: Once one has had enough conversations and one's quite sure of the benefits, string the benefits into sentences and concepts. Based on a popular game show, the goal was for a team member to guess the category based on words and clues given. When at this stage of ideation, try to see what prompts are necessary to make the other person say the benefit themselves. If an idea survives to this stage, it's bound to be fairly robust.

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Part III

On Leadership

12

Introduction to Part III: What Is a Leader?

The role of a leader is to unlock the possibilities within each individual, be the nexus of information for their surroundings, and communicate ideas verbally and nonverbally to make the entire team stronger.

The Energy strategist is an emerging leadership role for those who wish to grapple with the realities of sustainability and climate change. These leaders need to tame the **Ambiguous Uncertainties** of a company's exposure to climate risks over decade-long time horizons and help define a new vision for the future. Although energy subject matter expertise is necessary to understand technical trade-offs, leadership skills are just as important to mobilize a team for implementation.

Once a leader takes responsibility for themselves, the leader can take responsibility of others, giving permission to pursue their own ideas and initiatives. One of my favorite frameworks of leadership is the Co-Active model, identifying five key ways of leading and scope of responsibilities that an individual can embody (Kimsey-House and Kimsey-House 2015). These five styles are always present, and a person moves through them based on the team and people that surround them.

- *Leader Within*: Firmly rooted in personal values, the Leader Within gives a person the authority and capacity to lead. Out of this comes self-confidence and self-esteem.
- *Leader in Front*: This type inspires into a vision of the future while inviting others to join them in what they see. They foster collaboration and develop leadership qualities in others. The Leader in Front simultaneously points to where the work should go while reaching back to their people to bring them along.

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_12

- *Leader Beside*: Leadership can be a lonely job, and the Leader Beside is a sounding board and partner. In this position, leaders can co-create and build upon each other to create something bigger and bolder than what could be created alone.
- *Leader Behind*: The Leader Behind chooses to follow a Leader in Front's path. Without Leaders Behind, Leaders in Front are left alone. Nothing can be accomplished without people who are willing to follow. The Leaders Behind make things happen by listening and collecting the pieces that make up the greater whole.
- *Leader in the Field*: Guided by instincts, Leaders in the Field recognize what's needed in the field to make it more complete, more whole, more pristine. They notice the piece of trash on the ground and pick it up. They guide others into action based on the lessons they've learned.

Every person's comfort level is different based on the type of leadership style they embody. Each style has a different set of responsibilities that come with it. Leadership grows as the individual expands his or her scope of responsibility. By understanding one's preferred style, one can look for partners with complementary approaches. It also helps one know what skills to sharpen within their style as well as identify opportunities for growth beyond it.

Leaders are part of organizations and organizations have decision-making processes. When in a group, it is important to coordinate activities such that everyone is working in conjunction with everyone else and there is little overlap and conflict of efforts. Organizational tools help keep people aligned to tasks, and decision-making tools help keep people aligned to goals.

Leaders sit at the nexus of information. They pick the frame of reference of the larger vision, giving them a decision matrix through which all information can be evaluated. Individual actions are coordinated to meet the needs of the larger picture. This gives team members someone to turn to when there's uncertainty in a task. The individuals can do their own jobs while the leader gathers information from all those around.

An absent leader is perhaps the best demonstration of the importance of communication. I've been in one situation where the leader told me that there was no need to lead because the project was so important that the individuals should self-organize and get everything taken care of. The leader then left for the day. During his absence, chaos ensued. Team members scrambled for hours, not sure as to what had already been done, what people were doing, or what still needed to get done. People wondered whether they should appoint a new leader, wasting valuable time instead of furthering the project. In his absence, the team struggled because there was no one to coalesce the individual actions into a bigger picture.

A leader's ability to communicate is perhaps their most important skill. As information whizzes by, the leader needs to know how to route the signals to the right person in a timely manner. An orchestral conductor excels at this skill. Each musician is an expert at their own instrument, whose skill surpasses that of the conductor on the same instrument. The conductor waves a wooden stick, says no words, makes no sound, and yet is the undisputed leader of a team whose purpose is to make music. This is because the conductor communicates simultaneously to the many dozens of people in an orchestra, synthesizes the sounds produced by each individual expert, and mixes them in real time based on the intentions of the musical score.

Part III has three chapters that will help strategists become better leaders and communicators.

- **Chapter** 13 discusses *organizational tools* and *decision-making approaches*.
- **Chapter** 14 improves the *sending of messages* through using common narrative structures.
- **Chapter** 15 offers tips to synthesize *received messages* for improved comprehension.

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13

Organizational and Decision-Making Tools

This chapter includes a selection of organizational management, decision-making, and business process frameworks. It delves into the people, teams, and structures designed to manage the flow of information, resources, and decisions. As much as an energy strategist needs to understand the details of energy and carbon, they must also know how to work as a team.

As mentioned in the introduction to **Chap. 4: Energy Literacy**, nearly every energy issue is actually an organization problem. Many directors of sustainability will acknowledge that their role is one of change management, realigning the functions of an organization to be responsible for environmental and social indicators along with the financial ones.

Organizations are formal or informal groups of individuals, teams, or other organizations. They determine the decision-making process and resource allocations to achieve goals. They can be small (a local coffee shop) or large (a multinational conglomerate). They can be permanent (a board of director) or ad hoc, formed to execute a project and disbanded when it's completed (a development group to build a skyscraper).

Organizational structure contains the institutional wisdom, traditions, and also inertia to change. This can manifest itself in institutional processes of how various levels of the organization interact with each other and rules for how to accomplish certain tasks. These processes, to the impatient, can seem overly bureaucratic, and to the risk-averse, can be a critical vetting step in evaluating new ideas. As a team grows, one needs to shift their management style. Small teams can be managed via individual relationships. Medium-sized organizations need to be managed through committees or groups, and large organizations need to be managed via policies.

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
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Decision-making tools are the thought processes, priorities, and trade-offs that managers need to think through when making a decision. They can help reveal options not previously considered or be instructive in the type of decision to make in order to achieve a particular outcome. Some of the frameworks presented in this chapter are more philosophical in analyzing trade-offs, while others are time-tested methods that one can apply to their situation.

Organizations need a wide variety of leaders, and they may be called to fulfill many different functions. This could range from being a visionary to being the time keeper, from herding cats to leading a fast-sprinting group. They need to be adept at picking the right vision, tools, and frameworks, and be able decide the most appropriate frame of reference to achieve a sustainable future.

Why this chapter is important: Energy strategists will need an intuitive feel for how to serve their communities in overcoming critical challenges and deputize those who show initiative. In today's fast-changing and ambiguous scenarios, strategists will need to guide with certainty into an uncertain future.

Galbraith's Star Model™ of Organizational Design

A design framework for organizations, the Star Model™ depicts the five attributes that need to be aligned for high-performance teams. The model acknowledges that structure is only a component of organizations, and that the interaction between the components influences the successful performance of teams (Galbraith 1978). Each component can have various methods to achieve them, as depicted in Fig. 13.1.

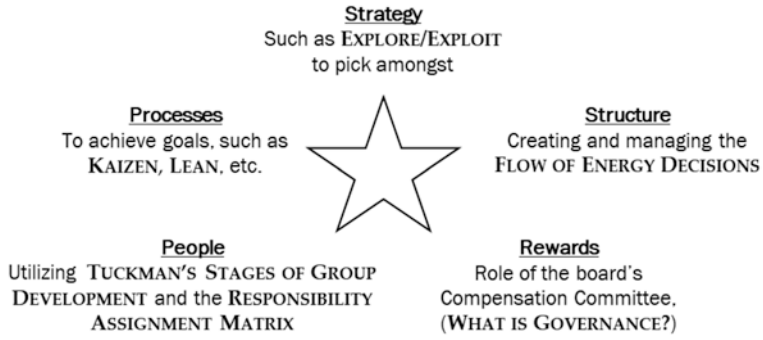

Fig. 13.1 Galbraith's Star Model of organizational design. (Source: Author's creation based on Galbraith, J. R. (1978). *Organization design*. Reading, MA, etc.: Addison-Wesley)

- *Strategy* is the mission, vision, and values of an organization. It sets the direction for the organization, supports the purpose, and is a tacit *license to operate* from society.
- *Structure* determines the relationship of people, number of specialties needed, and movement of power and authority. Hierarchical, matrix, and networked team structures will all respond differently to the same challenge.
- *Processes* dictate the flow of information and decisions. Some processes may need vertical integration, such as long-term strategic planning, while others may need to be lateral across departments that collaborate on projects.
- *People* are the human resources, skills, and expertise necessary to execute the strategy. This includes training, developing, recruiting, and retaining people and skills to meet organizational goals.
- *Rewards* align the actions of the people to the strategy of the organization. This enables individuals to make timely decisions that support the direction of the entire organization.

What it's good for: An effective office of energy management will need each of these five components to function well. This model can be used to understand the maturity of an organization. It helps leaders understand that multiple factors need to be aligned and functioning in harmony for a team to be effective.

Responsibility Assignment Matrix

A responsibility assignment matrix (RAM) can be used to organize complex teams spanning across functions and departments. Unlike an organizational chart that depicts hierarchical relationships, a RAM depicts the functional roles of a team as it tackles problems that the organization is facing.

RAMs are an evolution from the original Management Responsibility Guide which defined seven team roles (Melcher et al. 1969). It has since been simplified to four, now known as RACI charts, an acronym that stands for:

- *Responsible*: The person(s) who is doing the work to complete the task.
- *Accountable*: The individual who has final authority for the outcome. There can be only one person with this role.
- *Consulted*: Subject matter experts whose inputs are valued and sought.
- *Informed*: Those who need to be kept up to date on progress.

A popular alternative is RAPID®, developed by Bain & Company (2011). This one clarifies roles in the decision process, not just the structural responsibilities for the team.

- *Recommend*: Gathers information and proposes a course of action.
- *Agree*: People in the formal approval process. Not always required.
- *Perform*: People who are executing or implementing the decision once a decision is made.
- *Input*: An advisory role that provides information to the Recommender and Decider.
- *Decide*: Only one per team, the one who is held accountable for the final decision.

What it's good for: When decisions can be made by a single person or a few people, a RACI chart is probably not necessary. However, as the team grows and becomes cross-functional and geographically disperse, RACI charts help teams stay clear on roles and responsibilities (Table 13.1).

Tuckman's Stages of Group Development

First proposed by Bruce Tuckman in 1965, the model describes the process of team formation in small groups. It helps describe the maturity of a team as a unit as it progresses from a newly formed entity to a well-established group (Fig. 13.2).

- *Forming*: The stage when team selection and team culture setting is key. There needs to be agreement of vision, goals, agenda, and tasks. The team needs to share a common mental model of the tasks at hand. Because the team is just getting to know each other, it's probably not performing very well yet.

Table 13.1 RACI matrix

Team member	(R)esponsible	(A)ccountable	(C)onsulted	(I)nformed
1. Alice		x		
2. Bob			x	x
3. Charlie	x			
4. Dan	x		x	
5. Eve				x
Etc.				

Source: Author's creation

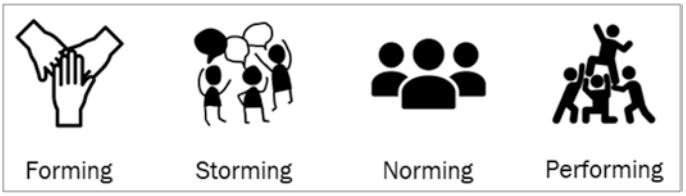

Fig. 13.2 Tuckman's stages of group development. (Source: Author's creation)

- *Storming*: Conflicts can arise due to differences in opinions and personality clashes. During this time, productivity will probably take a hit as the team sorts through internal issues. This is a necessary step, as the team starts gaining each other's trust and as they work through each individual's responsibilities.
- *Norming*: After a while, the team has resolved their conflicts and starts to appreciate each other's strengths. A spirit of cooperation emerges, and a new level of intimacy and teamwork is reached as each member understands the strengths and weaknesses of others. Team productivity starts rising.
- *Performing*: Lastly, the team has now functioned as a unit for a long time, and is motivated and knowledgeable. Members are confident, motivated, and familiar with the tasks at hand. They are more resilient to external pressures and are able to support each other in meaningful ways. Team effectiveness starts rising, resulting in superior performance.

What it's good for: A leader can use this model to diagnose what problems a team may be having or is likely to face. By understanding the stage of group development, a leader applies the right techniques to aid in the team's development and future performance.

Circle Methodology for Meetings

Circle is a method of creating an ethos of appreciation and avoiding a culture of complaints for a team or community. Based on the work of Virginia Satir, this method can manage meetings with as many as 70–100 individuals in a respectful manner, allowing everyone to feel heard, and advances the community goals.

At the former Pinchot University, we used Circle as a way to taking a temperature check of the community. These sessions consist of sharing of joys and worries, and discussions of critical issues, and end with uplifting

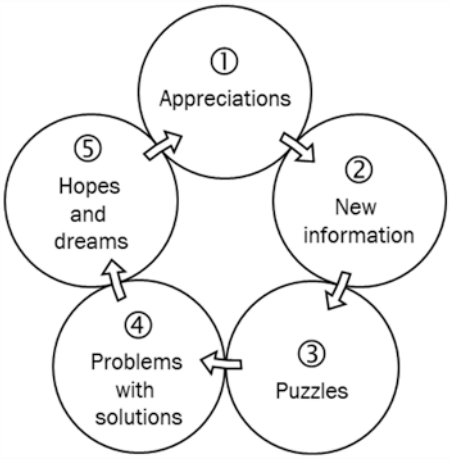

Fig. 13.3 Circle methodology for meetings. (Source: Author's creation)

hopes for the future. Regardless of the seriousness of what was discussed, I always leave Circle feeling energized.

Circle follows this general format (Fig. 13.3):

- *Appreciations*: Sets the tone for a positive meeting by appreciate individuals and groups.
- *New information*: Announcements to the community and other communications of facts.
- *Puzzles*: Observations and quandaries that the speaker may not quite know how to phrase. This is a way to query the community for wisdom.
- *Problems with solutions*: If one observes a problem, one takes responsibility of at least proposing a possible solution. Responses need to restate the problem, as understood, before proposing alternative solutions. If there are no solutions, one really has a *puzzle*. This is a critical step in creating a culture of co-creation.
- *Hopes and dreams*: Synthesizing the content of the meeting with what the future holds.

What it's good for: I use this model when running business meetings. Appreciations become *Introductions*. New Information is a form of *Officer Reports*. Puzzles can be used to generate a list of *Topics for Discussion*, and problems with solutions are the facilitated *Discussions* themselves. Hopes and dreams become *Comments for the Good of the Order*.

Garbage Can Model of Decision-Making

How frequently is a decision pending the return of a critical team member who is on vacation? How many times does a problem exist but no one wants to take responsibility for it? Rather than assume decision-making is a stepwise process in an organization, the Garbage Can Model focuses on the fluidity of different traits as they are mixed in a *garbage can*. These traits are independent of each other, arriving at different moments and staying for varying time periods (Cohen et al. 1972).

- *Problem*: An issue or topic that requires attention, whether inside or outside of an organization.
- *Solution*: Ideas or products. These are frequently developed independently, and the inventors usually search for problems that their idea can solve.
- *Participants*: The people involved. Frequently, the critical people will have many demands on their time, diffusing their attention to the decision at hand.
- *Choice Decision Opportunities*: A critical juncture when a decision needs to be made. This joins the timing of arrival of the other traits inside the garbage can.

Decision inaction occurs in many ways. One of the four traits might be missing from the mix. Solutions might be seeking a problem or a participant might be looking for an opportunity when there are components missing. Frequently, a team will be distracted by the option of the most recent entrant to the garbage can, further diverting attention away from problem solving, even if everything's present.

What it's good for: This model explains the importance of the internal champion in making decisions and implementing change. These champions, through sheer perseverance, personality, and charisma, will convene, cajole, and, if necessary, force the convergence of the four traits until a decision is made (Fig. 13.4).

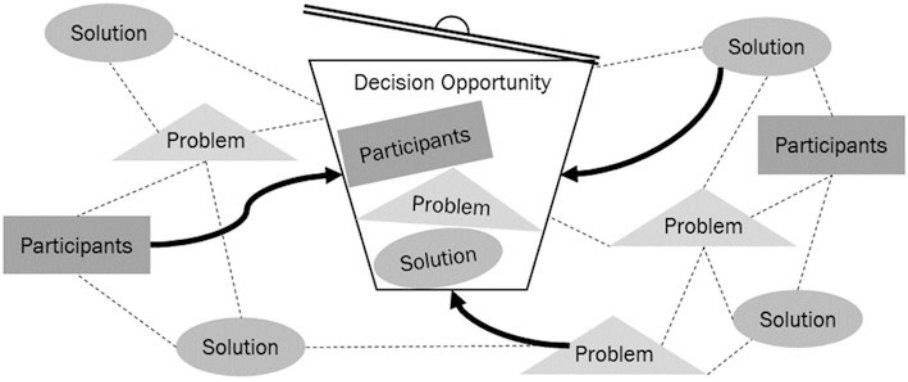

Fig. 13.4 Garbage Can Model of decision-making. (Source: Author's creation)

Muddling Through: Incrementalism

Muddling through is an empirical observation made on how individuals make decisions with very little information (Lindblom 1959). In an ideal world, leaders have a comprehensive set of data with analyses of every possible outcome to determine the best decisions. In reality, it is inefficient and practically impossible to gather complete information on all scenarios and make a timely decision, especially to the satisfaction of **Wicked Problems**.

Muddling through is an approach of making the best choice available based on the available information. When more information arrives or new data is generated, stakeholders can reevaluate whether the organization is still heading in the right direction and see if adjustments need to be made. A *good* choice is one that is a step closer to the goal, while a *bad* one moves further away. These small, incremental changes can accumulate into massive shifts (Fig. 13.5).

Key for this to work is for the organization to agree on the goal or outcome that it cares about. Without that clear goal, the decision-making will get mired in arguments over implementation detail that may not be relevant to the organization as a whole. Keep in mind, a decision of *no action* is still an active choice, which could be good or bad, with its own intended and unintended consequences.

What it's good for: This principle highlights that it's possible to make decisions with limited information. It shifts the burden of responsibility from making the overall *best* choice to one of making the *best decision for right now*. The team can continue to seek out new information and be responsive to future path corrections.

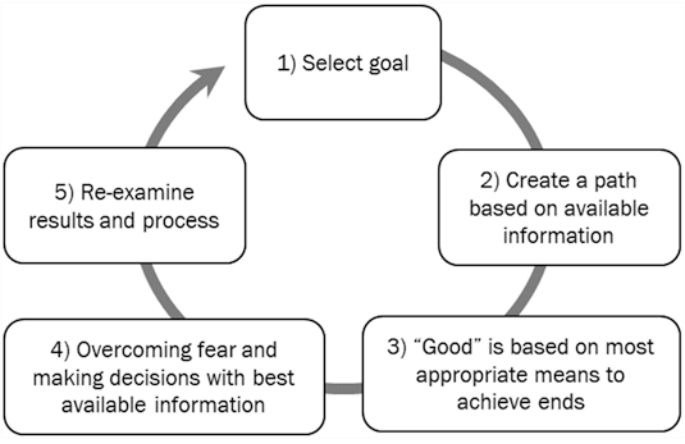

Fig. 13.5 Muddling through: incrementalism. (Source: Author's creation)

Explore/Exploit: The Multiarmed Bandit Problem

Explore/Exploit is a trade-off model that seeks to explain how organizations allocate resources between two competing priorities (March 1991).

- *Exploration* is the attempt to acquire new information and explore new possibilities. Too much, and the organization never develops an idea to fruition.
- *Exploitation* is the optimization of existing choices and known certainties. Too much, and the organization may find themselves stuck when the world changes around them.

According to the boundary conditions of variance in the **Variance Spectrum**, exploration tries to increase variance, while exploitation works to decrease variance.

The multiarmed bandit is a classic thought experiment of this trade-off where a gambler has a limited amount of time to play slot machines at a casino, with each having a slightly different probability of winning. How much time should the gambler spend trying to search for the machine with the best odds versus playing the machine with the best odds so far? In an ideal world, the gambler could play all slot machines before making their choice. But with a scarcity of time, the gambler needs to identify a *good enough* machine to maximize their winnings (Fig 13.6).

This decision-making scenario can be seen in many real-world applications, whether a company fails because it gets stuck in its ways or because it changed its strategic direction every month. The common saying "Perfect is the enemy of the good enough" describes the situation of overexploitation. Likening a leader's attention span as "like that of a squirrel" describes the scenario of overexploration. In a business setting, **Muddling Through** is an *explore* strategy, based on sequential receipt of information. **Kaizen** is an *exploit* strategy to reduce waste and inefficiency of existing processes.

What it's good for: This model describes why teams need to decide between investing resources to gain new information or channel resources to maximize existing processes. These conditions will shift over time, and a leader needs to know when it's time for which strategy.

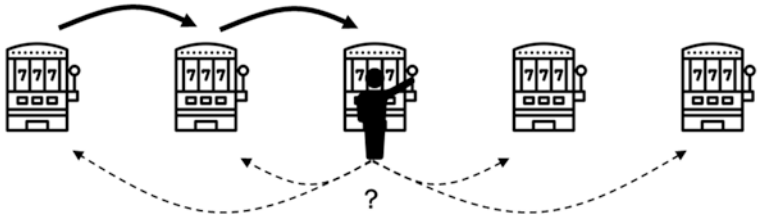

Fig. 13.6 Explore/Exploit: the multiarmed bandit problem. (Source: Author's creation)

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14

Communication: Using Structures to Send Information

Energy concepts are complex enough to begin with that they needn't be handicapped with poor messaging. This chapter will help leaders prepare for dialogue, whether crafting a message, giving a talk, or writing a report. Communicating ideas is just as important as developing them in the first place. Ideas are only as effective as their dissemination and eventual adoption.

Chapters 14 and 15 are related—whereas this chapter is about how to send a message, the next chapter will give tips on how to receive a message. Sending information can be done through writing and speaking, utilizing story structures to get ideas across. Receiving information is about learning and understanding, aided by story structures to synthesize quickly what is being presented. These two chapters create a **Circle of Communication**.

If creativity is the celebration of inventing the new, why restrict the sending of information to well-known structures? A common complaint of Hollywood is that their movies recycle the same plots. Yet as many times as *Romeo and Juliet* reappears in another adaptation, one must keep in mind that even William Shakespeare wasn't the first to tell the tale—he adapted it from a preexisting poem, which was adapted from an Italian novella, and so on.

Structured communication improves getting the message across because it encodes the information into a familiar and logical progression. People are clued in to what to listen for, what to notice, and what to expect. Presentations follow the proverbial structure, *tell them what you're going to say, tell them, tell them what you said*. A startup executive summary is a one-page document following a strict template. Even 30-second elevator pitches follow a common structure helping them be short and sweet, succinct and to the point.

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If the receiver recognizes the structure, it decreases the processing time for them to internalize and synthesize the information, enabling faster comprehension and decision-making. Of course, some senders will complain that the receiver is being lazy, and that they don't put in the time and energy to truly learn and understand the message. Not true! The sender is being lazy in not making the effort to structure the message such that the receiver can easily understand it. Communication is a multiplayer game, and everyone needs to abide by the rules.

Energy strategists need to know how to structure their message simple enough to get the gist across, but not too simple as to become meaningless, vague generalities. A well-crafted message will strike the balance based on audience needs. Good energy and environmental ideas can be aided by good communication, and a well-crafted message can go a long way to making an impactful change.

Why this chapter is important: The energy strategists will learn tips on how to analyze their audience before drafting anything as well as possible narratives to aid in crafting the message. These tips are applicable in communicating a green initiative to staff or in making an investor presentation on corporate environmental impact.

Circle of Communication

Communication is a process of transmitting information. Deceptively simple, it is made more complicated by the multiple components of a message and limitations of various mediums. Frequently, better communication is perceived as just sending more information, regardless of whether it's relevant or not. This is a bad strategy. Simply overwhelming a receiver with data will not persuade them to change their mind.

One model of communication, depicted in Fig. 14.1, is to view it as a complete cycle (Clampitt 2017):

- The *sender* has an idea to be communicated.
- The *message* is the idea encoded by the sender into words, gestures, pictures, or other artifacts of communication.
- The *receiver* decodes the message based on their own understanding.
- A *medium* carries the message, such as a face-to-face conversation, podcast, TV, book, lecture, phone call.
- *Noise* and other distractions permeate the medium. These are unstructured information, irrelevant to the communication at hand.
- *Feedback* confirms the receipt of a message.

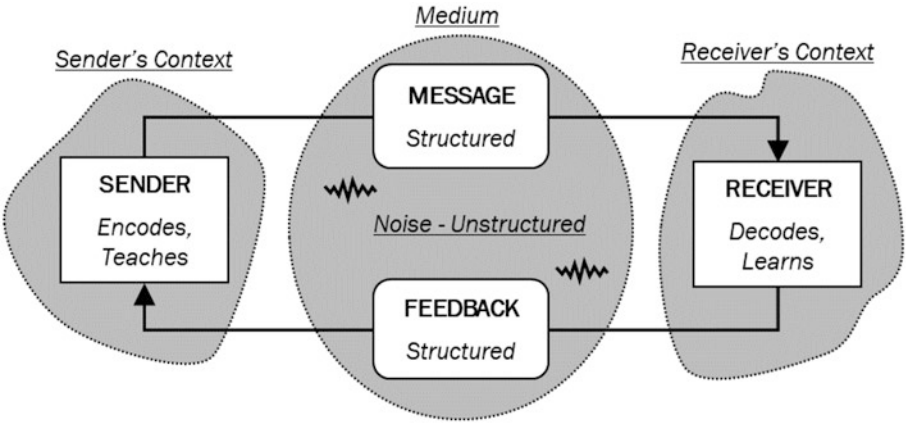


Fig. 14.1 Circle of communication. (Source: Author's creation)

- The *contexts* of the sender and receiver may be different, full of different assumptions, biases, and experiences.

This model indicates that there are many barriers and challenges to successful communications, beyond just crafting a good message. The sender could have crafted a poor message, the message got lost along its path as it was being sent, the receiver wasn't listening, or the sender never received confirmation that the message was understood. More fundamentally, the sender and receiver could have different contexts, interpreting the messages in completely different ways.

There are several best practices that avoid communication pitfalls and reduce misunderstandings.

- *Communicate the context of the message*. The context helps both sender and receiver interpret the message. This is just as important as communicating the message itself.
- *Use well-known structures to encode the message*. This helps cut through the noise. Both sender and receiver are receiving communications using expected conventions.
- *Include a feedback loop to confirm comprehension of the message*. This will catch misunderstandings early, allowing for clarifications.

What it's good for: This model can help a leader pay attention to the communication style of themselves and their team. Since communication is more than just generating a message, developing skills across all these attributes will enhance team performance. Without this compete loop, there is a high chance that the message will be misheard, causing confusion and misunderstanding.

Message House: Anchoring Your Communication

A message house is a well-known public relations (PR) tool used to develop key messages (Carter 2015). It aligns communications across an organization, helping it stay on point when communicating internally and externally. It contains the keywords, concepts, and themes that the organization values. It is an internal document that isn't shared with the outside world but from which is generated all messaging artifacts that face the public. This can include mission/vision statements, elevator pitch, marketing collateral, job descriptions, website content, blog entries, and virtually any other written or oral communication. It is also a living document, getting revisited and updated on an as-needed basis.

Although there are many variants, they generally have the following structure (Fig. 14.2):

- *Umbrella Statement*, an overarching sentence about the organization's themes.
- *Core Messages*, that support and give justification to the umbrella statement.
- *Supportive Statements*, one for each core message, which prove the delivery of each of the core messages.

This limits the message house to at the most 17 statements, a difficult exercise for any organization. The challenge is to decide which values get top bill-

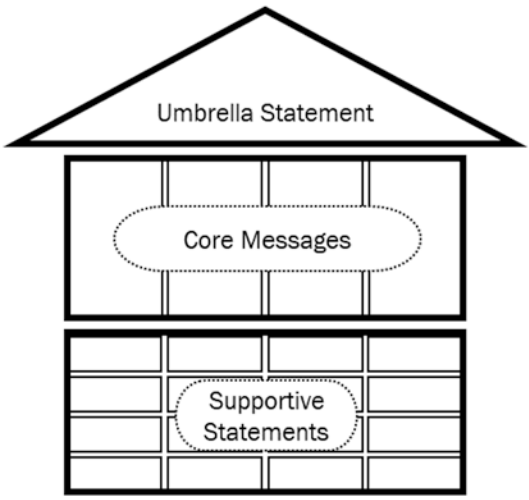


Fig. 14.2 Message house. (Source: Author's creation)

ing and which are the supporting statements. As an example, a core value of maintaining a strong customer service function can result in good client relationships. On the other hand, a core value of maintaining good client relationships can align the sales, product, and customer service teams to that goal. Although the difference is subtle, it will result in different prioritizations of decisions—between the internal customer service teams and customer satisfaction requests.

The message house is also a living document. It is not uncommon for it to take a year or two for the first version to settle down. Even then, the message can get revisited every few months just to make sure it accurately captures the company's position.

What it's good for: Energy projects, by nature, have many interdependencies, sit at various nexuses, and are complex beasts to describe. A message house helps align values and principles up front, aiding in drafting of marketing copy and other communications. It can also be used as a decision-clarification tool to see if a choice is aligned with an organization's goals.

Preparing for a Talk

Whether preparing a ten-minute presentation or a two-day seminar, one needs to have clarity of a message and intended outcome. To do so, one must first understand the purpose of the audience. The narrative used, therefore, is the conveyance of the message for the intended outcome.

Mental Preparation

In any talk, there are three stakeholders—oneself as the speaker, the host, and the audience. Each has an expectation as well as a different contribution, explicit or tacit, to make the event successful. Figure 14.3 shows the mutual expectations among the stakeholders.

- The *Speaker* gives content, expertise, and wise words. The speaker receives publicity, new business, book sales, and so forth.
- The *Host* or *Venue* gives a physical location to convene the speaker and audience. It receives revenues, notoriety, and a following of members.
- The *Audience* gives their time, presence, and money. They may range from novices to experts on the topic, and expectations can range from entertainment to deep learnings.

	...to the Speaker	...to the Host/Venue	...to the Audience
Speaker is giving...	**What do I hope for?** • Promotional • Informative • Persuasive • Story / Narrative	**Why was I chosen to speak?** • Key concepts	**What am I going to say?** • Learning objectives • Questions to address • SIMPLE NARRATIVES • POSSIBLE NARRATIVES
Host/ Venue is giving ...	**What's the location type?** • Theater • Class room • Conference room • Webinar **What's the medium?** • Live audience • Podcast, TV, Radio, etc.	**What's motivation of the venue?** • Book sales • Part of a series • Demonstrate convening power	**How does this host serve their community?** • Business networking • Social function • Community building
Audience is giving...	**What's the audience expecting of me?** • Expert • Practitioner • Entertainer • Peer	**Who are the people coming to this event?** • Age • Fields • Titles and roles • Size of audience	**Why is the audience listening?** • Intro vs. advanced • For entertainment • To learn

Fig. 14.3 Preparing for a talk: mental preparation. (Source: Author's creation)

The style of presentation can inform which possible narrative to pick. Is it a lunchtime talk at a professional conference where one will be entertaining peers, or is it an evening seminar educating nonexperts on key points of one's field? For the former, an anecdote-filled narrative might be appropriate, while for the latter, a logical if/then progression might be more suitable.

Simple Narratives

In a popular Kurt Vonnegut video, he describes the shape of stories, outlining the basic elements that take the listeners on an emotional journey (Kurt Vonnegut on the Shapes of Stories 2010). Recently, a study has found that most stories follow six emotional arcs (Reagan et al. 2016). Movies, novels, and creative writers use them to great effect, capturing the story and conveying the emotion they wish to communicate.

Readers expect that the stories they read will follow such an arc. It makes sense to use a well-established backbone as the basis for any talk—whether informative, persuasive, or educational. The following are some common story arcs, with further suggestions in the Section **POSSIBLE NARRATIVES**.

- *Simple Narratives*: Structures where answering the questions build toward an emotional state. For instance, the progression *Why this? Why us? Why now?* can be used to capture the excitement when pitching a company or

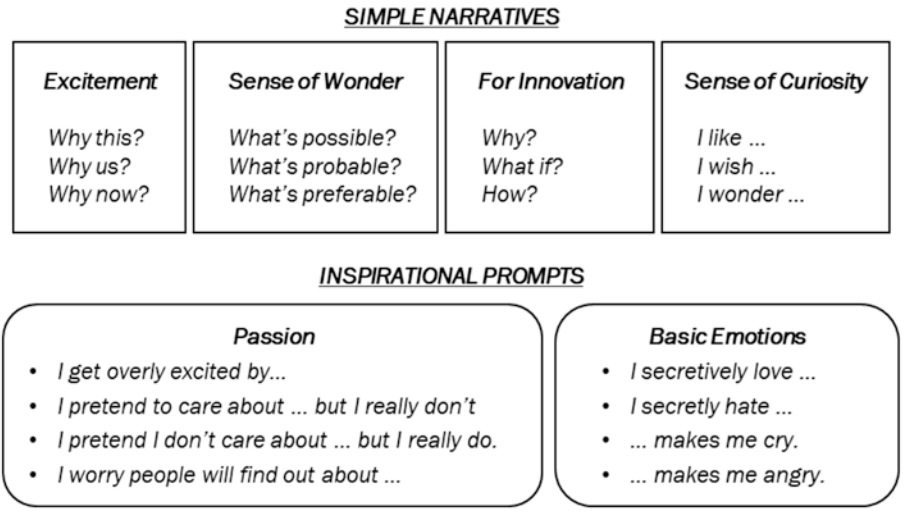


Fig. 14.4 Possible narratives. (Source: Author's creation)

idea. The progression *I like, I wish, I wonder* leaves a sense of curiosity to attack an existing problem from a different lens. **Suggested Question Formulations** develop these techniques in more detail.

- *Inspirational Prompts*: Develop an emotional connection with the topic during the writing phase. Don't shy away from being excited about the work! Audiences are captured by talks that are filled with passion and excitement. Even negative emotions, such as frustration or anger, can anchor the talk and mobilize action (Leitman 2015).

What it's good for: When developing a talk, these brainstorming methodologies help with the outlining, sketches, and composition of the final presentation. Regardless of the length of the final product, these ideas help ground a talk for the audience and convey the message clearly (Fig. 14.4).

Preparing to Moderate a Panel

Unlike a talk, a moderator needs to deflect attention away from oneself and make the others on stage the star of the program. Unfortunately, we have probably all experienced the opposite. This happens when, during question-and-answer, a person poorly disguises a soapbox comment in the form of a question, much to the annoyance of the rest of the attendees.

Much of the success of an interview or a panel program is in the preparation of the moderator. The time a moderator spends in preparation demonstrates to their guests that their time is valued. It also prepares the moderator to be spontaneous. It is easier to connect threads of conversation in real time if one has a deep familiarity of the topics to be discussed. If the conversation stops flowing for whatever reason, prepared questions can be read, giving the interviewer a chance to regroup.

Mental Preparation

Similar to giving a talk, the preparation of moderating a panel starts with understanding the motivation of the stakeholders present. In Fig. 14.5, one can see the style of questioning based on these needs. What is the audience's purpose of quizzing the panelists or the guest? Is it to learn, to be persuaded, or to hear a story? These settings will inform what types of questions to prepare.

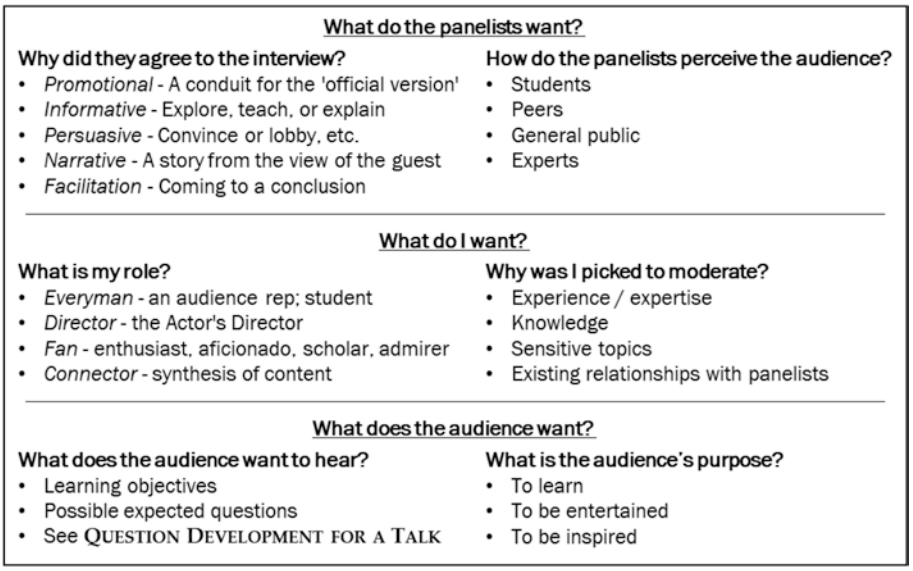


Fig. 14.5 Preparing to moderate a panel: mental preparation. (Source: Author's creation)

Question Development for a Talk

A moderator needs to think of themselves as a representative of the audience who has been appointed to ask questions on their behalf. A good moderator will be genuinely interested in the work of others, clarifying points of confusion and being a vessel of the audience's curiosity. The moderator needs to stitch together the motivations of the panelists, audience, and topics of interest, and be the nexus through which information flows.

The best way to generate questions for an interview comes from satisfying one's own curiosity. Broadcaster and writer Martin Perlich advises to start with, "What in my own life has been like my subject's life? What do we have in common?" We devote Chap. 17 to **How to Ask Questions**. The two tables of Fig. 14.6 are based on Perlich's interview technique and offer suggestions about how to organize question research, generation, and categorization (Perlich 2007). Note that for the live event, one should format their page with enough blank space for notes for spontaneous follow-up questions.

What it's good for: The figures in this section can help a moderator/interviewer organize their thoughts prior to an interview. It can support a spontaneous and dynamic event by providing for areas and topics to explore without seeming rehearsed or scripted.

(A) Question research for moderating a panel

Confirm a point / topic	Cite evidence	Possible question to uncover new information

(B) Organizing questions for the live event

Preamble introduction: *Opening remarks the moderator might make to set the context.*	
Guest introduction: *Who they are. This can be done via the opening question.*	
Opening question: *The boundary between form and emptiness. The questions should be respectful and understated. Prepare at least one.*	
Topic 1: • Question 1: • Question 2: • etc. **Topic 2: (etc.)**	**NOTES** (For follow-up questions from the prepared questions)

Fig. 14.6 Question development. (Source: Author's creation)

Possible Narratives

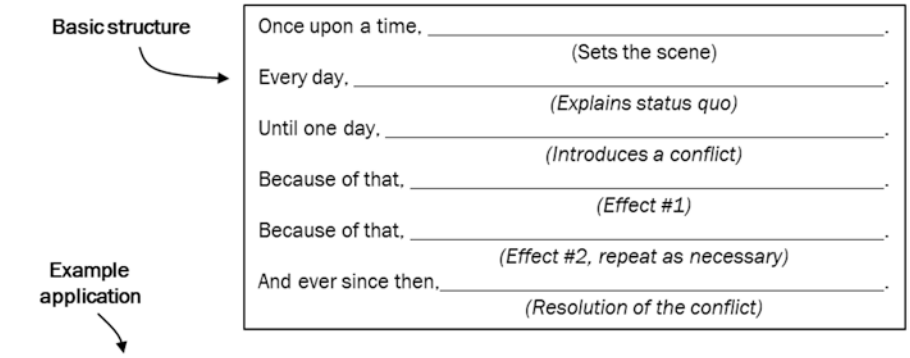
This section gives additional suggestions for narrative forms that can be adopted for messaging.

The Six-Sentence Story

One of my favorite story structures is a six-sentence outline that was first written about by Emma Coats, formerly of Pixar (Coats 2012). I've used this as the basis for lectures, essays, videos, blogs, and many other writings. It organizes the information being presented into a story arc that builds up to a conclusion, helping to engage the reader or listener.

Deceptively simple, the structure is highly flexible, grounding both short stories and major epics. Each of the blanks could be a sentence, a paragraph, or an entire chapter. The entire structure can also be nested as mini-stories inside a larger story arc, such as a flashback in fiction, or a case study to relay a client story.

What it's good for: This framework can be used to develop outlines for an article or presentation. This way, the talk will cover all the information, organized in a logical manner, and help pace the story evenly so one spends the right amount of time on each topic (Fig. 14.7).



Prompt ...	... Response, that became the outline for a lecture on Carbon Tax Policies
Once upon a time,	Societies wanted to control the long-term negative risk of releasing CO_2.
Every day,	Business were concerned that a new tax would hurt the economy.
Until one day,	Long-term climate risks began affecting short-term profits.
Because of that,	Companies started implementing internal carbon taxes as a risk mitigation strategy.
Because of that,	Policy designers borrowed best-practices of other public benefit and Pigouvian tax policies.
And ever since then,	Government and businesses found common ground on how an effective tax could achieve policy goals while growing the economy.

Fig. 14.7 The six-sentence story. (Source: Author's creation)

Statement of Purpose/Chasm Statement

The chasm statement is a possible narrative that encapsulates *what*, *for whom*, and *why* in a single sentence. It was developed to bridge the messaging difference between *innovators* and the *early majority* in the **Diffusion of Innovation** model. While innovators are comfortable taking technical risks on a new product, the early majority usually wants the product to work off-the-shelf with minimal effort. The chasm statement helps innovators frame their disruption into known market comparable (Moore 2014).

Frequently, the general public can feel confused by a new innovation because they don't know how to relate to it yet. Henry Ford's automobile was marketed as a horseless carriage that neither needed to be fed oats nor left behind manure to be cleaned up. Thomas Edison's light bulb was positioned in the market as a candle that didn't cause fires. Putting these innovations into the context of existing world views helped the public recognize how to use the new invention, enabling their adoption (see **Concept—Knowledge (C-K) Theory** in Chap. 11).

What it's good for: This messaging framework can be used as a first-pass elevator pitch when trying to test the value proposition of an innovation. It helps to focus the product or service squarely on the customers being served, the problems they face with existing solutions, and how your alternative is an improvement over the status quo (Fig. 14.8).

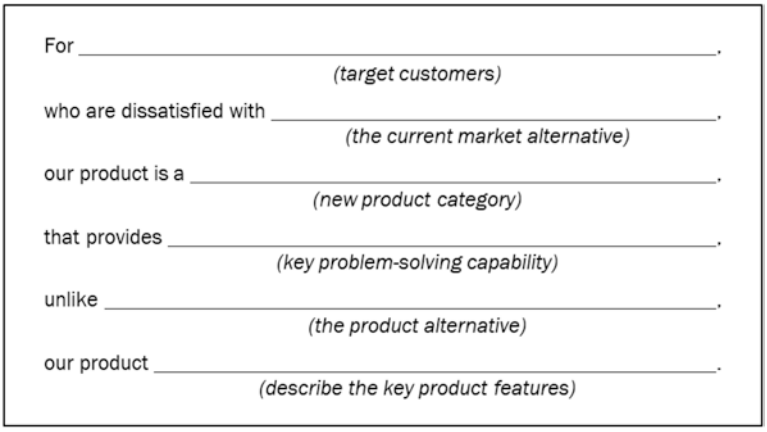


Fig. 14.8 The chasm statement. (Source: Author's creation)

Executive Summary/Pitch Deck/Business Plan Outline

A business' executive summary and pitch deck are succinct introductions to a business, while its business plan is a more comprehensive document with execution detail and market analysis. They all follow similar general structure, differing in their purpose, format, and length. A pitch deck is usually presented to investors, about a dozen slides or so, and the talk lasts anywhere from 5 to 10 minutes. An executive summary is a one-page document used to kick off a conversation exploring future business. A business plan can vary from 10 to 25 pages or longer and is used as a deep-dive into a company during due diligence (Fig. 14.9).

A quick search online will reveal many variations of this template, in terms of both the section titles and the order. Different audiences will have their preferential order, so any outline should be confirmed with them beforehand. Regardless of the template, the **Business Model Canvas** is a useful framework for generating the content. Both methodologies show that the leader has given thought to the key components of their business.

What it's good for: It helps a leader succinctly communicate their company when pitching the *company-as-the-product* to an investor. Conversely, it helps an investor reveal possible unknowns in a business being pitched. By following this or a similar structure, one can diagnose a company and understand their strengths and weaknesses.

Fig. 14.9 Business plan outline. (Source: Author's creation)

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15

Communication: Perceiving Structures When Receiving Information

The quantity of information being generated on energy and climate threatens to overwhelm any energy strategist. This chapter looks at how one internalizes information being received. It is the counterpart to **Chap.** 14, where we explored the sending of information, completing the **Circle of Communication**.

Self-learning is a skill of recognizing the structure of information and synthesizing it for future application. Learning can be enhanced with repetition (practice) and synthesis (pattern recognition). For instance, through constant repetition, a veteran venture capitalist will become adept at scanning business plans, while an HR professional will become very familiar with reading resumes. Likewise, an energy strategist will need to read countless corporate social responsibility (CSR) reports to get an understanding of industry dynamics.

Receivers are confronted with several challenges. First, different types of information are comprehended in different ways, and it is up to both parties to be clear in the communication process. Second, there is a flood of new information available on energy and climate. There are case studies, research articles, policy statements, podcasts, lectures, reports, and other content being generated daily. This creates a third problem: the noise being generated in the field means it's hard to know what to pay attention to.

Message structure can help with all three issues. If the sender and receiver use the same structure, then there is high likelihood the two will share similar contexts as well, reducing the probability of misunderstandings. Organizing the new information in a way that is digestible to the receiver will help increase uptake and comprehension. Conversely, the receiver can quickly look for structure when they are reading an unfamiliar document to increase

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_15

the comprehension of it. All these help cut through the noise of unstructured or poorly structured information.

Misunderstandings arise when the information received doesn't match what is sent. This can be because the sender sends the wrong message, the receiver gets distracted, or the sender/receiver has different contextual interpretations of the information being sent. Feedback from the receiver to the sender is critical in clearing up misunderstandings. When in person, body language helps convey this feedback. For nonvisual mediums, such as the phone or a voice-only webinar, one needs to resort to verbal cues. A receiver can repeat the message to check if the message was received. If there is still misunderstanding, then a deeper conversation about assumptions and context is warranted to clear up the gap in the message.

Why this chapter is important: Rapid comprehension of information can be aided by recognizing the structure of communication being used. This helps professionals process ideas faster and be more effective at decision-making.

Four Stages of Competence: The Journey of Learning

The four stages of competence describe how a novice learns a new task and turns it into an experienced skill. The model separates the competency of skills from the awareness of the task. People who seem naturally good at a task may not know why they are so good at it. They become poor at teaching their skills because they can't explain the components that enable their success. On the other hand, those who take years to learn and master a skill may have a strong grasp of the subtasks and are able to continuously improve as they refine their approaches.

The earliest known description of this model of learning was in 1969 (Broadwell 1969), and it progresses through the following four stages, as depicted in Fig. 15.1:

- *Unconscious Incompetence*: The person is unaware of what they are doing or why. Frequently, good results are attributed to *natural talent* or *beginner's luck*.
- *Conscious Incompetence*: In learning about the task, one becomes aware of the skills required. They can become clumsy in executing the task as they struggle to learn the skill.
- *Conscious Competence*: After much practicing, the skills slowly become routine, but the person still needs to focus and concentrate to execute the task at hand.
- *Unconscious Competence*: After gaining experience, the task becomes second nature, automatic, and requires very little thought.

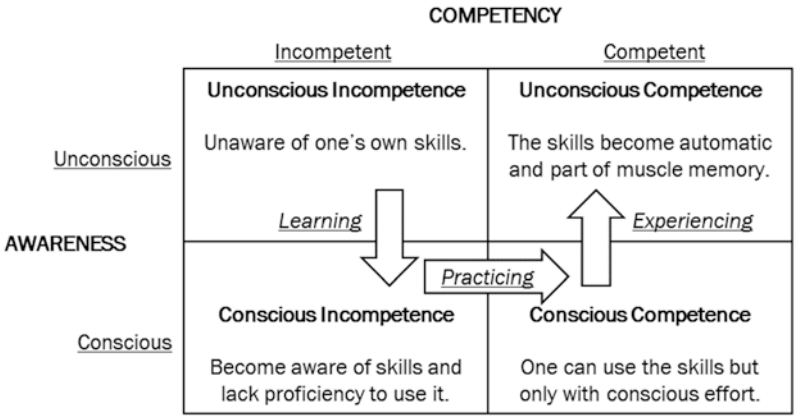

Fig. 15.1 Four stages of competence: the journey of learning. (Source: Author's creation)

What it's good for: This model can be used as a self-diagnosis of where one is in learning a task or a skill. Recognizing the stage one is in can help inform the type of activities to achieve the next level of learning. The journey through the model is not unlike the various levels of synthesis needed to progress through the **DIKW Pyramid**.

DIKW Pyramid: Hierarchy of Knowledge

The data-information-knowledge-wisdom (DIKW) pyramid is broadly used to describe the different categories on the continuum of information and knowledge (Ackoff 1989). It gives a structural and functional relationship between several levels:

- *Data*: Considered discrete facts and observations, it is unorganized, and lacks context and interpretation (e.g., a spreadsheet with numbers). Data is limited in that one cannot make a decision off of it alone.
- *Information*: A synthesis of data that contains descriptions and trends. This gives a context that can be used to make a decision and answer basic questions of who, what, how, and so forth.
- *Knowledge*: Structured information becomes experiences, intuition, and insight. These can also include values, rules, and societal norms.
- *Wisdom*: Synthesized knowledge informs values and ethics. It's exercising judgment of which policies are best for the situation. Wisdom is highly personalized.

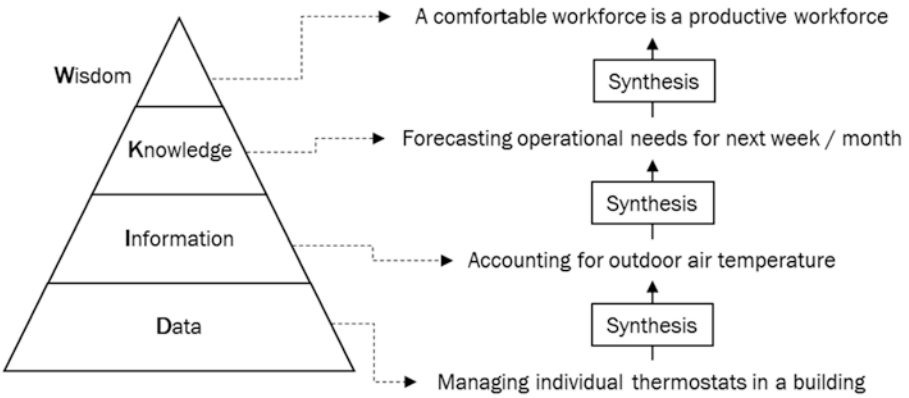

Fig. 15.2 Hierarchy of knowledge: the **DIKW Pyramid**. (Source: Author's creation)

From a communications point of view, each category has different ways of structuring a message. This affects both the sending of messages and how it's received. From a learning perspective, the act of synthesis also moves one from a lower category to a higher category. This implies two ways to gain knowledge: learn from an external source or synthesize from personal experiences.

What it's good for: Knowing what level one's communicating will help a leader pick the right artifact, craft the right message, and make sure the message is understood. Most techniques focus on *data* and *information*. It takes a conscious effort to communicate *knowledge* and *wisdom*. Fig. 15.2 applies the **DIKW Pyramid** to an energy example.

Suggestions for Sending and Receiving Messages

Sending and Receiving DATA

What it is: Raw data is generated by sensors and stored in spreadsheets. It is the headlines on Twitter and the raw senses of sight, sounds, and smells. Raw data is valuable as the original data source, should there be a dispute in any of the analysis or the conclusions.

Example artifact: A spreadsheet of numbers, a collection of field interview notes, or a scrap book.

How to improve its generation: One generally considers more data to be preferable to less data. Thus, installing more sensors, writing longer documents, and speaking for a longer time are all common methods for generating more data.

Limitations of data: Data is noisy, quickly overwhelming a person's ability to discern what's important. Data lacks a prioritization of what is critical to pay attention to. It suffers from the limitation of *in one ear and out the other*. Data can also suffer from a quality problem, where errors may creep into the data set, bringing into question the fidelity and validity of the data. Thus, generating data without a purpose may be counterproductive (see **Data Quality**).

Techniques to send it: Sending data is incredibly transactional. A professor can simply send more information by assigning a longer reading list. An analyst can send more data by mailing a larger spreadsheet.

Techniques to receive it: Receiving data is also very transactional. Seeing and sensing are the two skills used to receive data. Speed-reading a document and listening to a podcast at a faster playback speed are two ways to receive more data. However, this does not mean the data is comprehended or processed faster.

How to synthesize it: Structured data, which becomes *information*, is much more valuable than raw, unstructured data. To make data useful, look for trends, patterns, or categories in the data. For numbers, use graphs. For words and concepts, try organizing them into similar groups.

Additional tips: When undertaking an analysis, always start with the raw data. By the time data is synthesized into information, someone has already made a value judgment of what data is important or not. Even simple analyses such as an average or sum may hide trends and skew answers toward a biased result (see **Gaussian vs. Pareto World Views**). To make one's own decision, it is important to always start with the original data and draw one's own conclusions.

Sending and Receiving INFORMATION

What it is: Information is synthesized data, making it relevant toward a decision. A **Metrics System** is an example of how data is given a purpose. A metric can interpret a data set, judge it against a target, and inform decision-makers how far off they are from their goals.

Example artifact: Graphs from a spreadsheet, an analytical essay about current events, or an outline of a report.

How to improve its generation: Quantitative information generation can be improved by learning analytical techniques and gaining a deeper familiarity of statistics. Qualitative information generation can be improved by being diligent in structuring the prose into logical sections. Using well-established story frameworks, such as those in **Possible Narratives** or **Simple Narratives**, makes it easier for the reader to internalize a message.

Limitations of information: Just because a trend is present doesn't mean that it is relevant. Correlation does not imply causation. One has to be careful to ensure that they have the right context for interpreting the information in front of them.

Techniques to send it: Providing features of a trend and pointing out the context behind the data are ways of sending information. The clearer the assumptions of the data set, the more informed the information.

Techniques to receive it: When receiving information, one should look for the raw data to examine the underlying structure of what is being sent. For instance, the comprehension of a book can increase by observing the structure of the paragraphs, sections, and chapters (Adler and Doren 1972). How are the sections grouped? Is there logic to the flow of the presentation? Similarly, numerical data can be graphed to reveal underlying trends. Is a data set confirming a trend, or is it being presented in a misleading fashion?

How to synthesize it: Look for patterns among information to reveal the structure of the context. Sometimes, this context is tacit or assumed, making the information synthesis all the more valuable to identifying hidden truths or fallacies. One strategy is to categorize information based on attributes to help elucidate these structures.

Additional tips: Frequently, arguments over data are actually debates over the context of information, not over the data itself. As discussed in **Absolute vs. Relative Metrics** in Chap. 10, the same fact, when viewed from two different contexts, can produce wildly varying conclusions. Be conscious and aware of whether one is debating the data or the context of the data.

Sending and Receiving KNOWLEDGE

What it is: Knowledge can be considered as experience, insight, and intuition gained from frequent interpretation of information. With enough exposure to information, one consciously or unconsciously creates shortcuts based on what has worked in the past. A specialist is one who has well-established mental models and frames of reference to aid in their decision-making.

Example artifacts: Frameworks based on years of experience are a shortcut to support decision-making. Making recommendations based on a set of graphs and creating a metrics system to decide what to do are other example artifacts.

How to improve its generation: Experiences can be codified into knowledge by **How to Create Your Own Framework** or by creating new **Metrics Systems** to evaluate progress toward a goal.

Limitations of knowledge: As information gets synthesized into intuition, it can also include baked-in biases, assumptions, and bad habits. Specialization results in knowledge silos that limit ideas to within the realm of one's experience. This results in a new problem, proverbially, *when one's tool is a hammer, every problem looks like a nail*. Thus, to think out-of-the-box, one needs to break down the knowledge silo created by one's experience and view a problem from someone else's context or frame of reference.

Techniques to send it: The art of teaching and mentoring is a way to send knowledge. The best pedagogical styles impart practical experience and are tailored to the learning style of the individual. Mentoring requires patience, a keen eye for quality, and the confidence to give critical, yet gentle feedback.

Techniques to receive it: A strategy to absorb experiences is to expose oneself to high-quality craftsmanship of the skill. For instance, a budding artist working in an artist commune will advance faster than working on their own. An early career professional working on a top team of a leading company will gain valuable experiences faster than most of their peers.

How to synthesize it: Practice to such a point that the response is part of muscle memory. This is where the 10,000 hours of practice comes in to master a skill. There is no shortcut or hack to gain expertise and intuition. The theory of hitting a home run in baseball is easy, and one can read about it in a book. The practice of timing the swing of a bat to strike a fist-sized object traveling 100 miles per hour takes years to perfect.

Additional tips: It was observed in the 1950s that scientific knowledge doubles about 10–15 years (Price 1965). A corollary to this observation is the half-life of knowledge, or that as we gain scientific and engineering understanding, half of what we know will become obsolete within ten years. This might be because an old fact was disproven or because a new discovery supersedes existing knowledge (Arbesman 2013). To any individual, this presents a challenge of staying relevant. Thus, to stay up to date on current practices, it is necessary to adopt a philosophy of lifelong learning.

Sending and Receiving WISDOM

What it is: Wisdom is synthesized knowledge that informs judgment and ethics of why something needs to get done. It's knowing the right policies to adhere to for a benefit beyond the task at hand. It can be an action that is committed to muscle memory and becomes second nature. As a former music professor, Rochelle Walton once said to me, "An amateur practices till they get it right. A professional practices until they can't get it wrong again."

Example artifact: The judgment of whether to execute a recommendation or not, providing clarity in an *it depends* situation, and *unconscious competence* (from the FOUR STAGES OF COMPETENCE) in the performance of a task are all wisdom-based actions. *Institutional knowledge* can be considered organizational wisdom that has been codified in the decision-making process.

How to improve its generation: One can generate wisdom through continuous questioning and inquiry. A curious mind can constantly seek what is new, what is unknown, and be delighted at the surprise of learning something unexpected.

Limitations of wisdom: Wisdom is very hard to define! Perhaps its inability to be described is a quality, as wisdom transcends words to incorporate ethics, relationships, judgment, and other values of humanity.

Techniques to send it: Model the behavior by living it. Demonstrate what's right and wrong rather than telling people what to do. Give others permission to explore, and guide by telling stories of previous attempts, both successful and not.

Techniques to receive it: Apprentice yourself to a master and attempt to learn every minutia of the work. Be open to new insights from even the most mundane of tasks. Question everything, and welcome mentorship from others. Take ownership of your own work, including the blame for mistakes. Openly seek to improve and be intensely curious about the world around you. Have patience.

Additional tips: In the fast-paced world of today, wisdom can seem slow. Yet it creates certainty of values for others that follow. The person who has wisdom is giving implicit or tacit permission to others to take action. Think of a celebrated individual, Gandhi, Lincoln, Nelson Mandela, a grandparent, influential teacher, or a childhood hero. They have attributes of wisdom, and their lives are models for us to pursue today even if the individual is no longer with us. Wisdom can live for a long time. See Fig. 15.3 for an expanded image of the **DIKW PYRAMID**.

Five Rs of a Debrief

Good feedback should be *timely*—relatively recent to an event so that people can remember what happened, and after the adrenaline rush excitement of finishing the project. Waiting 24 hours afterward is generally a good idea. It should be *relevant*—taking into account the context of the situation. It should be *specific*—targeted toward a specific improvement in mind. Just revealing the gap between actual level and reference level of performance is not enough. Feedback needs to spur actions that close the gap (Ramaprasad 1983).

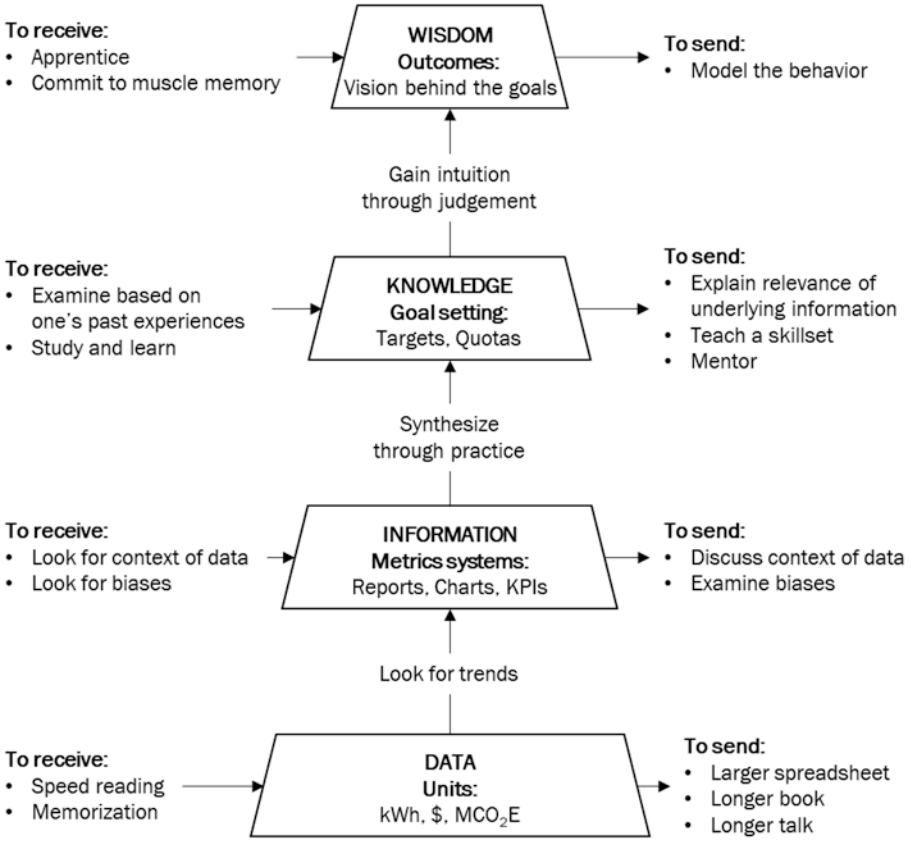

Fig. 15.3 Summary of DIKW sending, receiving, and synthesizing. (Source: Author's creation)

Frequently, criticisms and complaints are dressed and presented as feedback. This usually has the opposite effect of turning people off and seeds distrust amongst team members. A mental frame that avoids this destructive habit: the giver is giving guidance while the receiver is receiving feedback. For problems where one has a suggested answer, use a *problem with solution* format. Every stated problem needs to have an accompanied suggestion. For problems with no known answer yet, state the problem as *puzzle*—something to query the collective intelligence of the group to try and address. See **Circle Methodology for Meetings** for more information.

Air force jet fighters use the following formal debriefing structure to solicit feedback after a mission with the following elements (Bourke 2014):

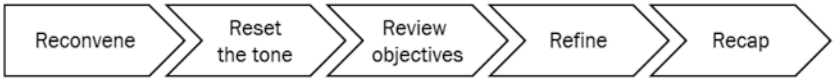

Fig. 15.4 Five Rs of a debrief. (Source: Author's creation)

- *Reconvene*: Plan the debriefs and feedback sessions in advance, otherwise they may never happen. This sets the expectation that observations made during the event are valuable.
- *Reset the tone*: All who participate are peers. Titles, rank, age, and level of experience do not matter when creating an environment for openness.
- *Review the objectives*: Recall all of the objectives set out at the beginning of the project. If they were met, could they have been accomplished better? If they were missed, how can they be met next time?
- *Refine*: What happened? What was off and what worked?
- *Recap*: Summarize the learnings.

What it's good for: Structured feedback is critical at the end of a major project to reflect on the lessons learned. It is an essential component of continuous improvement techniques, such as **Kaizen**. It also reinforces formative learning and closes the loop in the **Circle of Communication** (Fig. 15.4).

Immediate Feedback Suggestions

In some situations, a leader needs immediate feedback. A formal debrief may be too much effort or too unwieldy for small course corrections. The following are some forms of rapid feedback that take no more than a few minutes each (Fig. 15.5).

- *Plus-Delta*: This is a popular two-question technique where the group is asked what went well (*plus*) and what could be changed for next time (*delta*) (Helminski and Koberna 1995).
- *Shapes*: This is adopted from a three-question formative assessment technique to assess where learners are in their learning cycle (William and Thompson 2008). The questions evaluate what they will remember (*square*), what is still unclear (*circle*), and what they can immediately adopt (*triangle*).
- *Fast Feedback*: This is a four-question survey I use after every class. It separates out the roles of the learner and the teacher, reminding the students that education is a team effort. The teaching team gets rapid responses, relevant to the lecture at hand, and informs the teaching team on what can be improved for the next class.

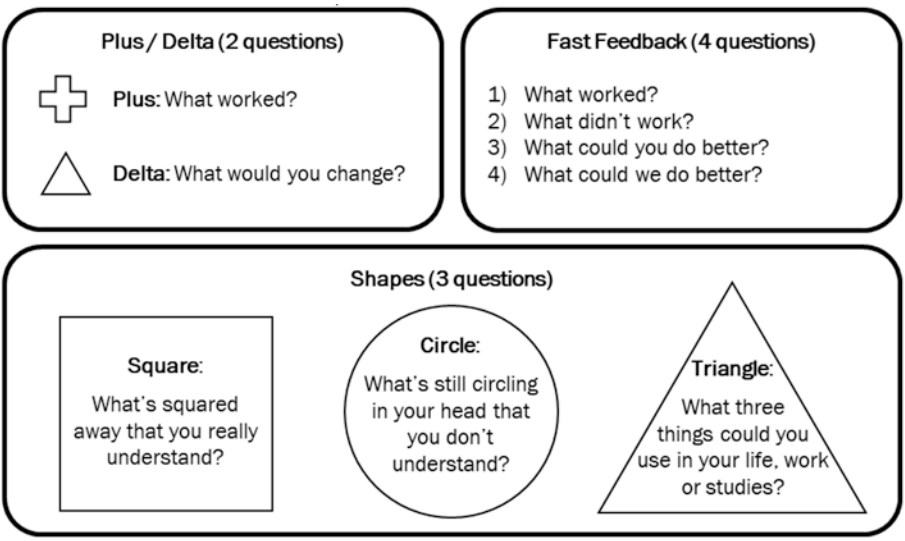

Fig. 15.5 Immediate feedback techniques. (Source: Author's creation)

What it's good for: These mechanisms give quick and rapid-fire feedback to help one make small course corrections in real time. They help leaders understand what concepts learners or team members may be stuck on or were unclear about the first time around.

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Part IV

On Innovation

16

Introduction to Part IV: What Is Innovation?

The energy sector is experiencing a rapid growth in innovations, both directly and indirectly. Some, such as electric vehicles, have the potential to shift society's consumption from petroleum to renewable electricity. Others, such as Bitcoin and other cryptocurrencies, increase consumption of electricity, threatening to wipe out any progress made in energy efficiency. To address climate change, we will need new ideas, products, and services, to do more with less, to do more good than harm, and to improve lives while managing and restoring our natural surroundings.

Why do some innovations not look very innovative? Some ideas may seem fictional, too large to be serious suggestions. Other ideas may seem small and perceived as unimaginative, trivial, or inconsequential. In fact, this seems to suggest that whether an idea is judged to be innovative depends on one's perspective, experiences, and risk tolerance.

Innovation can be divided into micro-, meso-, and macro-regimes (Kastelle et al. 2014):

- *Micro-innovations*: Process improvement innovations that squeeze out efficiencies from existing methods. They are rules based and function as routines.
- *Meso-innovations*: Emergent innovations that combine the rules of different methods to redefine the system boundaries and create new frames of reference. Revolutionary ideas usually begin as the innocent merging of two seemingly disparate ideas.

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
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- *Macro-innovations*: Scale adoption of the new frame of reference to society at large, creating new relationships between suppliers and buyers. This process includes creating new boundaries, or barriers to market entry.

Each innovation method is appropriate under different circumstances. To an engineer who specializes in Kaizen and process improvements, the messiness of emergent innovations might look like chaos. To a futurist who thrives in unbounded ideation, the focused discipline of managing a sales funnel to scale a product might seem unduly constraining. And to a business development executive, who expounds futurisms in front of large audiences, the micro-innovator's tinkering with technical minutiae might come across as small-minded (Fig. 16.1).

The lineage of technology has all three innovation approaches. As seen in Fig. 16.2, wooden wagonways increased the efficiency of horse-drawn carriages in Germany as early as the 1300s. *Macro-innovations* occurred to scale the deployment of wooden tramways across Europe. Continuous improvements to the system resulted in iron railways by the 1700s. Meanwhile, James Watt's steam pump miniaturized the existing mechanical pumps to improve the removal of water from coal mines. The steam locomotive emerged from the combination (*meso-innovation*) of Watt's steam pump with the existing iron railways. This *meso-innovation* occurred again when Edison took Watt's steam engine and combined it with his need to generate electricity for his light bulbs. After many years of incremental improvements, *macro-innovation* took over and the new electric energy utilities scaled to create the grid as we know today.

In Part IV, we explore multiple facets of innovation and how they can be used:

- Chapter 17 grounds innovation in the art of *asking the right question*.
- Chapter 18 delves into the incremental improvements of *micro-innovations*.

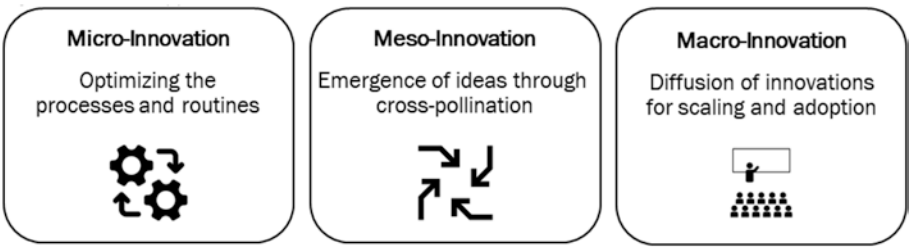

Fig. 16.1 Three approaches to innovation. (Source: Author's creation)

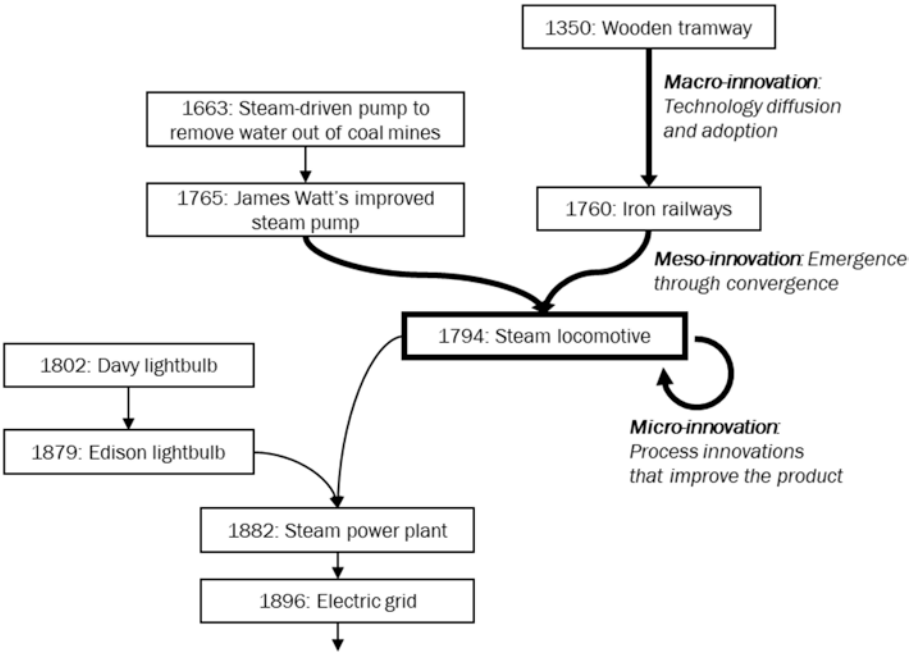

Fig. 16.2 Technology convergence throughout history. (Source: Author's creation)

- Chapter 19 expands ideas into the emergent ideas of *meso-innovations*.
- Chapter 20 scales the adoption of ideas through the discipline of *macro-innovations*.

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17

How to Ask Questions

This chapter gives suggestions for question formations to focus creative sparks onto a problem. The right question lies at the heart of innovations. Indeed, to achieve out-of-the-box *thinking*, one needs to perform out-of-the-box *questioning*.

Questions are a powerful leadership tool, convening a group of people to focus their efforts in an aligned direction. They can communicate to the team the interconnected nature of energy systems and guide the conversation. When a leader nurtures a culture of inquiry, it can help open the team's minds to ideas beyond each individual's experiences.

Closed questions have constricted answers, whether yes/no, true/false, or multiple choice. They are suitable for rapid-fire feedback and confirmation of ideas. They can be used to test the location of boundaries by determining what's in and what's out. They can be scaled to large sets of individuals, and the results can be quickly analyzed with statistical methods. However, they are weak at garnering additional context beyond what is phrased in the question. Respondents may feel constricted to conveying nuanced thoughts in a stark, black-or-white manner.

Open questions have long-form answers. They invite respondents to elaborate on their ideas, possibly providing new insight, information, or analysis in their answer. They are good at conveying the contextual nuance of a situation. The answers should be recorded verbatim so that the researcher can return to their notes for further understandings. However, if unmoderated, the answer may meander into nonsense, obscuring the gems of insight.

Cleverly crafted questions contain within them a frame of reference that guides the respondent's analysis and answer. They can communicate context

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and intention and can be used as a powerful leadership tool. Donald Sadoway, a popular professor at MIT, used the following example to instruct his teaching assistant on classroom management:

- "Do you have any questions?" The answer is *Yes* or *No*.
- "May I have your questions?" The answer is the question on a listener's mind.

The latter unlocks inquiry in a group of people, whereas the former unwittingly blocks it.

Asking the right question can be difficult, and it is a technique that can be learned. Like any skill, it takes practice. Ask many questions, write them down, review, and evaluate them. Ask questions of the question. Don't be afraid of any question. Good inquiries awaken curiosity and spur actions to satisfy it. Be around communities of people who ask a lot of questions. The best, most dynamic individuals ask more questions than they can answer. Top scientists know that every answer they find only spawns at least two more questions.

Why this chapter is important: Energy strategists need to constantly probe for gaps in knowledge, opportunities to chase, and unknowns to learn. Energy systems affect nearly every corporate decision, and there is always another stakeholder group to satisfy, a new department to engage, a new technology to learn, a new policy to propose, and so on.

Why Are Questions a Boundary of Knowledge?

"That's impossible!", "Here's a challenge…," and "A problem with that idea is…" These phrases all imply a boundary that someone needs to cross or doesn't know how to cross.

Questions are a way to explore these boundaries and query why they exist. Is it a hard boundary (the laws of physics), soft (need to rewrite a regulation), personal (outside of one's experiences), or universal (beyond a community's collective knowledge)? There are many ways to probe this boundary, and this chapter discusses some techniques.

Two assumptions about questions to be aware of that are untrue: (1) that the first answer is correct and (2) that the first answer is the only possible answer. Different people will have different answers to the same question. Rather, a systematic collection of questions begins to reveal the attributes, giving shape to something that is previously undefined. Conceptually, these boundaries will rarely intersect at a single point. Although everything *outside* of the boundary is impossible, an opportunity or insight lies at the center of these boundaries (Fig. 17.1).

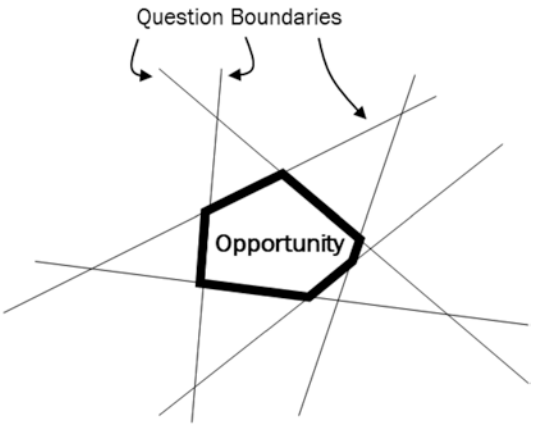


Fig. 17.1 Why are questions a boundary of knowledge? (Source: Author's creation)

To use questions as boundaries:

- *Collect*: Ask and collect as many questions as you can.
- *Inverse*: For every boundary, ask *what conditions need to exist for the opposite to be true.*
- *Observe*: Categorize the inverses to see if there are similarities or patterns. These become the definitions or boundaries to a possible solution.
- *Search*: Look for solutions that fit into the boundary you've defined. Therein lies the opportunity.

What it's good for: Using this method of discovery can tackle a seemingly intractable problem. By reducing the problem to discrete boundaries, one can reveal the structure of the problem and address the core issues, rather than the superficial symptoms of it.

The Five Whys: Root Cause Analysis

Root cause analysis is a method for identifying issues at fault, informing the appropriate remedies to apply. It is commonly used in engineering disciplines for failure analysis. The five whys is one methodology that picks apart the process that arrived at the failure. Instead of trying to externalize the problem by blaming lack of money, resources, or expertise for the failure, it focuses on what's within the team's and organization's control. The method was developed in the 1930s by Sakichi Toyoda and adopted into the Toyota Production System (Tno 1988).

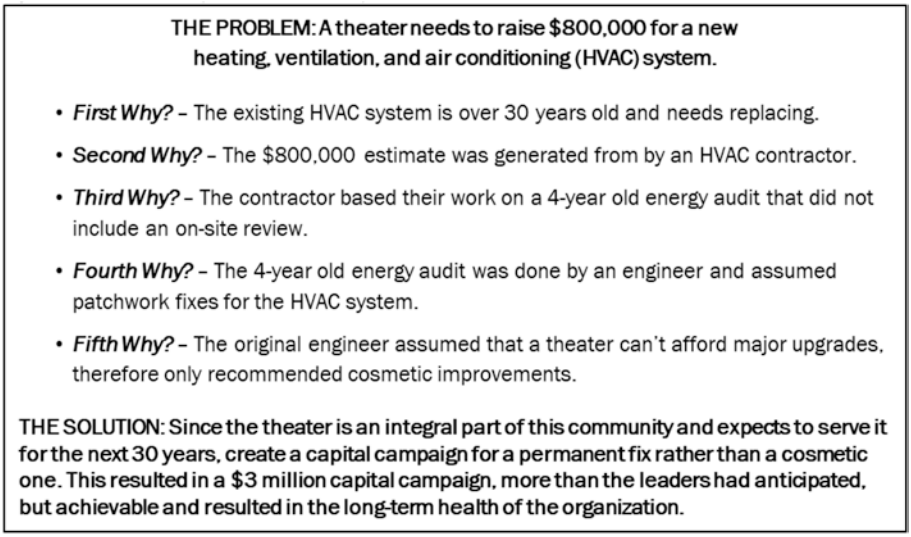


Fig. 17.2 The five whys: root cause analysis. (Source: Author's creation)

It is important to create an environment of different viewpoints and perspectives to diagnose a problem and implement lasting changes. In asking *why* in multiple succession, one remains unsatisfied until the arrival of the *right* answer that prevents the problem from happening again. Thus, each *why* question is really *why did the process fail*? This helps avoid stopping at a satisfactory answer that only treats the symptom of the problem. Figure 17.2 depicts a mechanical system example.

What it's good for: This method is a good postmortem mechanism when something doesn't go as planned. Anecdotal evidence suggests that five whys are enough to reach a root cause, although one can find themselves extending to six, seven, and beyond. It is a form of feedback and complements the **Five Rs of a Debrief** and **Immediate Feedback Suggestions**.

Null Hypothesis: Setting Boundaries

Sometimes it's easier to prove a statement is false than it is to prove that it's true. A null hypothesis is a narrow and specific question that is crafted as the opposite of its hypothesis. It is to be proved false or unlikely to occur based on chance alone. By disproving the null hypothesis, one can infer that the original hypothesis must be true. In doing so, it creates a boundary and determines which side of the boundary the statement falls into. Implicit in the formula-

tion of the null hypothesis is that there's a set of rigorous metrics and measurements that can be used to define and measure it.

1. *The hypothesis*: The hypothesis is creating or probing an assumed boundary between something that is true and false. It is typically something one wishes to be true.
2. *Propose a null hypothesis*: It assumes the hypothesis is wrong and that there is no relationship or boundary. The null hypothesis is worded as the reverse of the hypothesis.
3. *The experiment*: Design, run, and gather data in order to disprove the null hypothesis.
4. *The result*: A false null hypothesis implies that the hypothesis in Step 1 is true.

What it's good for: Much of the scientific method, social science, and business studies use qualitative and quantitative methods derived from using the null hypothesis. For example, in marketing, A/B testing is a common way of experimenting with data to see how small differences can scale adoption (Fig. 17.3).

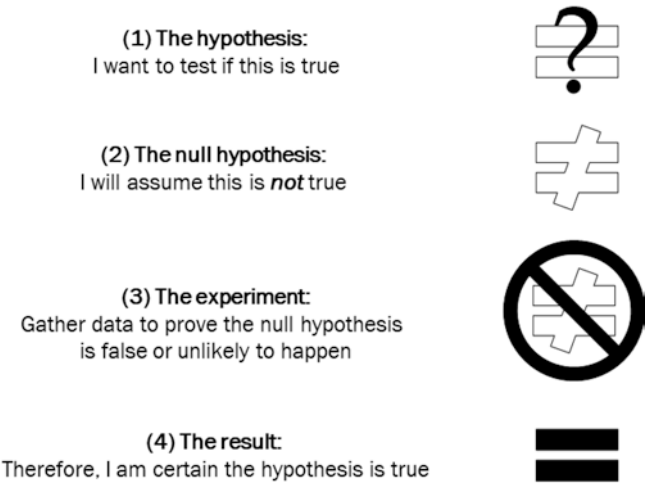


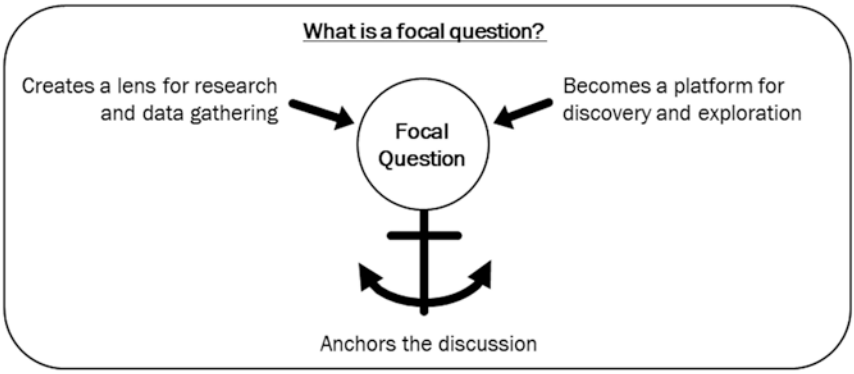
Fig. 17.3 Null hypothesis. (Source: Author's creation)

Focal Question: Explore Beyond Boundaries

A focal question is a way to travel beyond hidden boundaries that are created by assumptions. It is short and open-ended, and is used to convene many people from disparate backgrounds to contribute their expertise and ideas. It explores the context for solution space to exist and is phrased to explore long-range consequences. A good focal question invites more questions just as easily as it invites answers.

Unlike the **Null Hypothesis** or **The Five Whys** where one is searching for a definitive answer, the focal question helps with **Wicked Problems** and **Ambiguous Uncertainties** by querying a community to solicit possible new definitions and boundaries. The outcomes to focal questions can be further topics to research, possible directions for brainstorming, or future choices to be evaluated.

What it's good for: Because a focal question looks at what's beyond existing knowledge, it is a great way to anchor strategic conversations that explore the unknown unknowns in **Johari's Window**. A good focal question will inspire creative thought and make team members think (Fig. 17.4).



Bad Examples *Assumes a boundary within the question*		Good Examples *Invites definition of the boundary*
How can I market my podcast? (*too narrow*)	⇨	How does my intended audience stay relevant with new information?
What is the market size for my new and improved water sensor? (*too discrete*)	⇨	What is the optimal exit strategy for my sensor in 3-5 years?
Should I manufacture and sell a new chocolate bar? (*Yes/no answer*)	⇨	What can the market bear with a new entrant product and player in it?

Fig. 17.4 Focal question. (Source: Author's creation)

Suggested Question Formulations

Questions are a powerful and versatile tool that shape the direction of a conversation. This section suggests several question formulations that can help drive toward goals of innovation, curiosity, and generating excitement. As a **Simple Narrative**, these questions can help a leader frame an essay or a presentation when **Preparing for a Talk**. As a **Focal Question**, they anchor strategy sessions and **Brainstorms**. As thought experiments for decision-making, they help with **Boundary Condition Analysis** and creating **Perceptual Anchors**. The reader is encouraged to come up with their own question formulations as well as adapt these for other applications. The following suggested formulations are also depicted in Fig. 17.5.

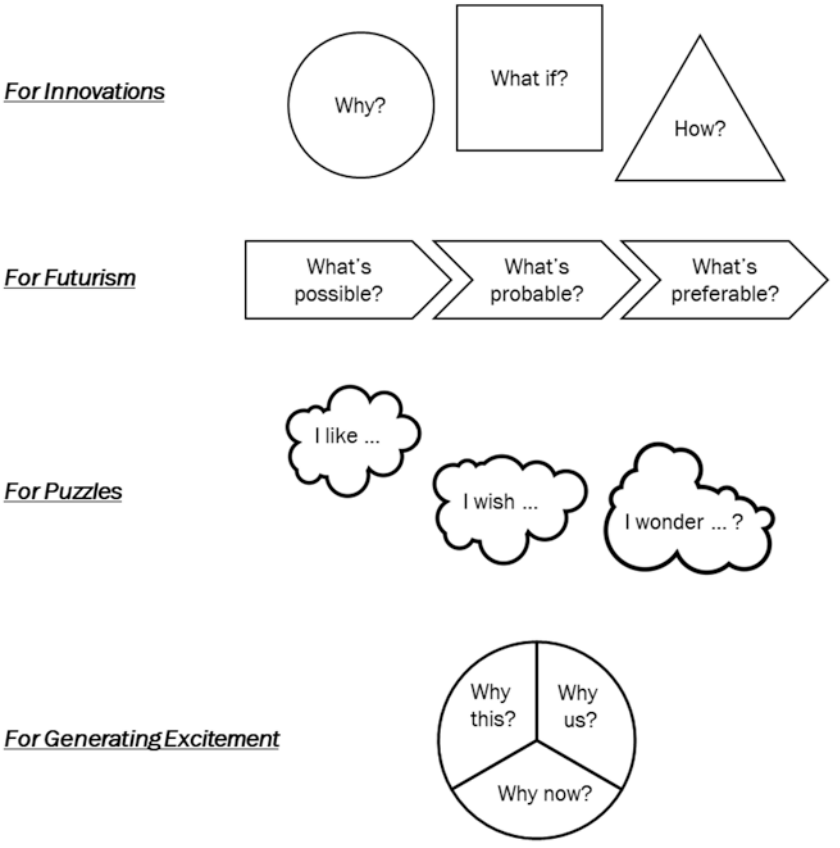


Fig. 17.5 Suggestions for question formulations. (Source: Author's creation)

For Innovations

Developed by Warren Berger, these three deceptively simple questions are fundamental to how innovators discover transformative solutions (Berger 2016).

- *Why*: Becomes aware of a problem. It penetrates deeply into possible issues.
- *What if*: Generates possible solutions. It has an expansive effect to unlock creativity.
- *How*: Enacts solutions. *How* questions roll up their sleeves and get back to work after the daydreaming of the *why* and *what if* questions.

These three questions describe the innovator's journey. Solutions address problems, and problems are bounded by questions. A good innovator asks many good questions along their way and doesn't give up until their curiosity is satisfied. Why don't forks come with instructions (unlike chopsticks)? Why isn't water free? Seemingly naïve questions have value too, for they force the answerer to tackle fundamental assumptions.

This formulation helps bridge the tricky transition all innovations take from being pie-in-the-sky imagination to a feet-on-the-ground execution. When used as a narrative style, it walks the listener through a logical progression of the innovation journey, even though the actual one is messy and recursive.

For Futurism

Futures study is a discipline that tries to holistically discover, invent, examine, evaluate, and propose possible futures. It commonly uses the following questions:

- *What's possible?*: What could be. This is the broadest of questions, exploring possible futures, regardless of their chance of happening.
- *What's probable?*: What is likely to be. Of all of the possible options, which scenarios are likely to occur, given realistic constraints and conditions.
- *What's preferable?*: What ought to be. Just because we can do something doesn't mean we should. Which futures should be the ones that we pursue?

These questions probe the future for what's likely to continue and what's possible to change. Although the future is very hard to predict, one can examine

implied boundaries in the hidden assumptions of our systems and project them forward. Frequently, science fiction authors will use these boundaries of possible futures to create myths, whether utopian or dystopian.

This formulation helps examine what future possibilities exist, allowing teams to start their planning process today. **Enterprise Risk Management** functions may use variants of this structure or the **Scenario Planning** process to create these possible futures.

For Puzzles and to Express Curiosity

Puzzles are concepts that are too fuzzy to be verbalized into a problem. Yet a well-crafted puzzle invites participation and contributions toward formulating the idea. This creates a challenge: how to articulate a puzzle when, by definition, it is hard to put into words? One method to guide puzzle creation is the *I like, I wish, I wonder* process.

- *I like*___: Roots the puzzle in something that's been observed or has already happened. It offers a starting point for exploration.
- *I wish*___: Creates the space of where an improvement might be.
- *I wonder*___*?*: This is the phrasing of the puzzle itself. It frames a pathway forward based on the previous two statements.

The power of this formulation is that it can convene a group of stakeholders to develop and explore a more formal problem statement. An example: *I like* the central location of my desk. *I wish* there wasn't a draft. *I wonder* if I can be engaged without feeling cold? Perhaps the problem is that the heating system is broken, that the desk is placed under a vent, or that there is a broken thermostat.

This formulation creates a story that pulls the audience along by their sense of curiosity. In a decision-making context, it's can generate consensus on the problem statements while avoiding attacks on a person or a process. This is one way to develop a **Focal Question**.

For Generating Excitement

What does an investor pitch, implementing an organizational change management initiative, and introducing a new idea all have in common? They all require a sales effort to convince someone to say *yes*. To create the need to make a purchase or a decision, one needs to generate buzz and excitement for

the product or idea. To do that, one needs to be clear on the positioning of the idea such that it's relevant to the purchaser or adopter.

The following three questions were developed for business-to-business (B2B) sales and are relevant to driving the adoption of any new idea.

- *Why this?*: There are many possible solutions to the problem. Why is this solution the one to be considered?
- *Why us?*: The team or product's capabilities to deliver the solution. Why is this team to be picked over the solution from a different team?
- *Why now?*: A commitment to take action for adoption of the solution. Why is a decision required right now instead of at some later point?

These questions create a sense of urgency for a decision to be made right now. It can help an entrepreneur prepare for an investor pitch. It can help an employee ask for a larger budget for a project. It can be used to inspire a neighborhood to commit to a community solar project.

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18

Micro-innovations: Incremental Process Improvements

This chapter explores micro-innovations, or ideas that squeeze out efficiencies from existing processes. The approach philosophy is to reduce variability of a process so as to produce the same results every time. The outcome is a procedure or process that minimizes waste and defects while maximizes output. These methods are highly applicable in reducing **Identified Risks (Known Unknowns)**.

From a boundary conditions point of view, micro-innovations look at processes within. Components of the system become tightly integrated, working in lock step, and dependent on each other to function properly. One small change anywhere in the system will percolate throughout and affect a large number of other processes. In turning inward, the boundaries are hardened to protect the internal processes from external forces and shocks. This can be a benefit if one is trying to protect a system from change, or a barrier if one is trying to change a system.

Continuous improvement is another way of describing micro-innovations. It is a bottom-up, incremental approach to making change. Every idea, no matter how small and from every individual, is considered valuable and important. Because this relies on crowdsourcing ideas from individuals, the benefits and rewards of the outcomes must also be tangible to the crowd as well. Employees need to have permission to own their portion of the process and share in the rewards of a well-optimized system. There are two important features: first, there needs to be a feedback mechanism to evaluate what worked. This feedback needs to be timely, relevant, and specific. Second, all actions need to be measurable. It is no wonder why many continuous improvement processes deploy deep statistical analysis to achieve their outcomes.

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Micro-innovations require deep knowledge and expertise of a particular field. Whereas generalists need to know how things connect, a subject matter expert needs to be intimately familiar with how the details work and can be improved. An assembly line is a classic example of this concept, where a worker who does one thing well will make fewer mistakes than a generalist who has responsibility for many aspects. Professionals who are technical masters—electricians, carpenters, certified project managers, and Six Sigma Blackbelts—are great micro-innovators.

As mentioned in **Innovations vs. Risk**, decreasing variance, a micro-innovation concern, is in opposition with increasing variance, an essential component of meso-innovations. We will explore those properties in **Chap.** 19.

Why this chapter is important: Energy strategists can use micro-innovations to identify, reduce, and eliminate energy and carbon waste across an organization. The tools selected for this chapter reduce variance or waste in one form or another. Some tools help with reducing internal process variations, while others help a team be responsive to external changes in customer requirements.

Lean Manufacturing: Reducing Waste

Lean manufacturing is a set of principles and methods that identifies and removes waste without sacrificing productivity (Womack et al. 1991). Put simply, anything that does not add value to the product is considered waste and should be eliminated. Lean evolved out of the Toyota Production System and represents a family of tools, including **Kaizen**, **Kanban**, and the **Five Whys**, that are discussed in this book. Toyota identified three types of waste: *muda* (non-value-adding work), *muri* (overburden), and *mura* (unevenness).

Muda is the form of waste to be eliminated. The common list of *mudas* includes:

- Products moving more than necessary
- People moving more than necessary
- Waiting for next production step
- Overprocessing resulting from poor tool design
- Unused inventory
- Production ahead of schedule
- Effort to inspect for defects
- Unused human talent due to underutilization of skills or inadequate training

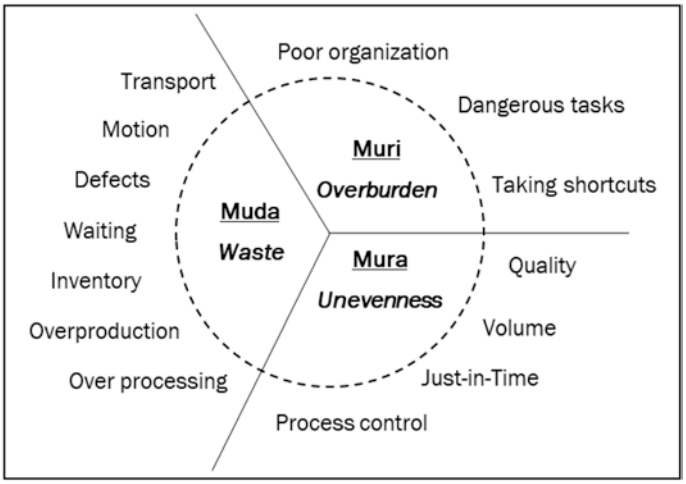

Fig. 18.1 Lean manufacturing: reducing waste. (Source: Author's creation)

Muri is the unreasonable work that management imposes. This can be as simple as moving things around unnecessarily or demanding tasks that are beyond what's possible. These burdens can result in workers taking shortcuts or performing tasks dangerously to meet demands. *Muri* focuses on planning and process design to eliminate these.

Mura is the fluctuations and variability in the work product. These variations can cause defects and quality issues in the final project. In eliminating these errors, fewer components need to be scrapped. This can be resolved with data, metrics, monitoring, controls, and scheduling.

What it's good for: For mature processes, lean manufacturing incorporates physical, management, and process waste into a single methodology. The three components should be adopted simultaneously, and learnings from one area should influence the activities in the others (Fig. 18.1).

Six Sigma: Eliminating Defects

Six Sigma is a set of manufacturing techniques and tools that seeks to eliminate defects through reducing process variations. Six Sigma was created by Motorola in the USA as a direct response to **Lean Manufacturing** that was spearheaded in Japan. Philosophically, Six Sigma is a culture focused on customer satisfaction, far beyond the tools and methodologies within it (Tennant 2001).

The name comes from math—a *six-sigma event* is a statistical term for an event that occurs only 3.4 times every one million iterations. Practically, the

fewer the variations in input variables, the fewer the variations in the output product. Thus, the method heavily depends on statistical process control, control charts, and other techniques to identify and improve the process.

DMAIC, outlined in what follows, is the overall framework for improving existing processes. DMADV is used to design new processes, where the final two letters stand for *Design* and *Verify*.

1. *Define*: Sets the business goal, problem, and scope. Who is the customer and what pain points are they trying to solve?
2. *Measure*: Establish the baseline, the metrics, and the **Metrics Systems** to evaluate performance. What should be measured and how should it be measured?
3. *Analyze*: Identify root causes for elimination. This can be through **Root Cause Analysis**, or process mapping and process diagramming.
4. *Improve*: Identify solutions and test them. Solutions can come from **Brainstorming**, and implementation can be done on any number of project management methodologies.
5. *Control*: Examine the data and quantify the improvement with **Metrics Systems**. Success is achieved if it resolved the customer problem that was defined in Step 1.

Over time, Lean Six Sigma emerged as a combination of the two practices. It combines the waste identification method of Lean with the variance reduction methodology of Six Sigma (Wheat et al. 2001).

What it's good for: Six Sigma is good for taking existing processes and reducing the variance of production. It is customer-centric (*Define* step) and is heavily data driven (*Measure* and *Control* steps). This can be very effective for large, complex processes but bureaucratic and burdensome for smaller procedures (Fig. 18.2).

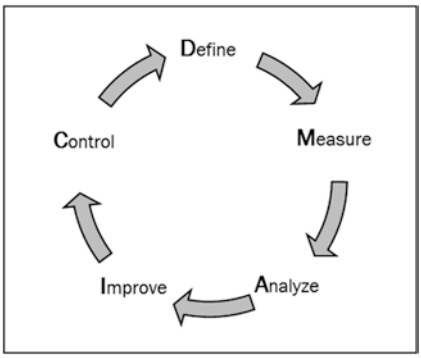

Fig. 18.2 Six Sigma: eliminating defects. (Source: Author's creation)

Waterfall Project Management: Linear Processes

The waterfall project management methodology is well suited for projects where each step needs to be performed to completion before moving onto the next step. First described in the 1970 as a flawed model for software development (Royce 1970), it can be an appropriate for situations where subsequent tasks depend on the previous tasks. For instance, to build a house, one needs to lay a foundation before building a frame for the walls, before attaching the roof, before putting up the drywall, and so forth.

The advantage of this system is that the entire project is planned from the outset, giving all stakeholders a clear understanding of roles, responsibilities, and timing. A disadvantage is that it's hard to change the requirements during the project. For instance, one could use this method to estimate the cost of building a new bridge for a city. However, the costs will skyrocket if, after half the bridge is built, the city decides to add a new exit ramp.

The following are common components to a waterfall process (Fig. 18.3):

- *Plan*: Much effort should be invested up front to gather requirements of the projects.
- *Design*: Once the plans are set, create a design that optimizes for the needs of the project.
- *Build*: With the design, build the product.
- *Test*: Once the product is built, run it through tests to check its performance.
- *Production*: Once it's tested, hand it over to the clients or to a production department to scale manufacturing of it.
- *Support*: Once it's available on the market, support the users of the product.

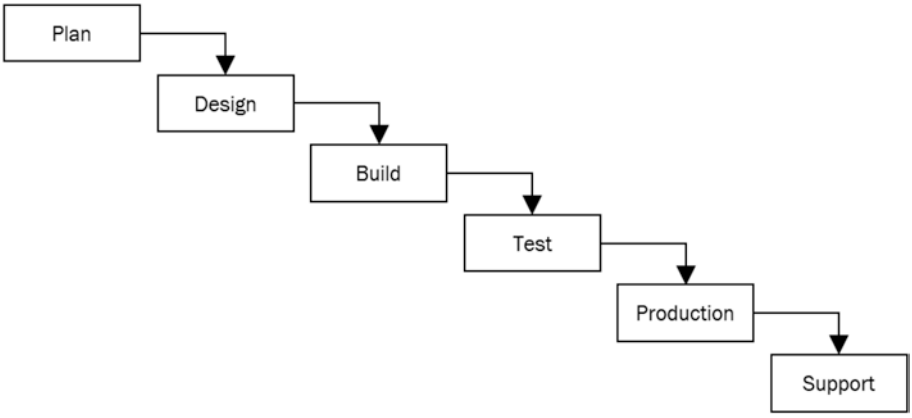

Fig. 18.3 Waterfall project management. (Source: Author's creation)

What it's good for: Waterfall is good for projects that have high dependencies and where the clients know their requirements up front. It is more straightforward to manage and easier to give estimated project cost at the onset. It is harder to change once a project is started.

Agile Project Management and Scrum: Iterative Processes

Agile is a project management philosophy, values, and principles for rapid iterations to meet customer fit. It features frequent product delivery at the end of each iteration and self-organizing teams, and stresses communication with stakeholders/customers. Agile project methodologies are a successful alternative to the linear start-to-finish **Waterfall Project Management**.

There are several Agile methodologies, the most popular being Scrum. This method takes a large project goal (the epic) and breaks it down into manageable tasks. The tasks are then prioritized and executed in an iterative development cycle called sprints (Schwaber and Sutherland 2017, November).

1. *Epic*: Major goals or arcs (i.e., acquire 100 new clients).
2. *Story*: Goals distilled from the epic (i.e., advertising campaign to reach 1000 prospects).
3. *Prioritized tasks*: Tasks that take no more than 4 hours (i.e., draft the newsletter to send).
4. *Sprint backlog*: Tasks assigned to be completed during a sprint.
5. *2-Week sprint*: The set of tasks to be completed in the next two weeks (see **Kanban**).
6. *Daily sprint*: Daily standup meetings, typically no more than 15 minutes each, where each team member is asked: What did you do? What are you going to do next? What roadblocks are preventing you to get work done?
7. *New functionality*: Meeting the goals of a story or epic.
8. *Sprint reviews and retrospectives*: Start the process over again, refilling the backlog, reprioritizing tasks, creating tasks from stories, and so forth.

What it's good for: This technique allows for the input of new ideas and feedback rapidly as a product is being built. It creates outcomes that are a much better fit for client needs, especially if those needs are expected to shift, become clearer, or change due to external circumstances (Fig. 18.4).

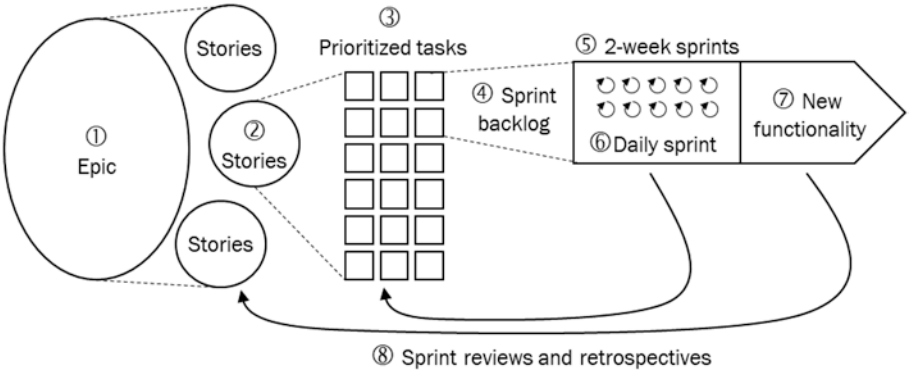

Fig. 18.4 Agile project management and Scrum. (Source: Author's creation adapted from www.scrum.org. All rights reserved)

Kanban: A Pull Process for New Tasks

Kanban is a communication methodology whereby tasks are pulled by workers with availability rather than pushed into the system regardless of capacity to do work. In a *push* strategy, where managers assign tasks, a worker may receive too much work (overburdened) or too little work (underutilized). Instead, workers *pull* or request tasks when they are free and they work on the task until it is done. This fills a system with the right amount of work for its capacity. It has since been adopted in Agile software development as a way to pull work into the Scrum process (Anderson 2010).

It comprises of a workflow visualization method that shows what tasks are in the queue, what's being worked on right now, and what's been completed. An example of implementation:

- *To Do List*: The list is populated during the weekly or biweekly team meetings when the group decides what tasks they are able to accomplish during the current sprint. No new tasks are added to the To Do list during a sprint.
- *Doing List*: Cards are moved to the Doing list when they are being worked on.
- *Done List*: Cards are moved to the Done list when they are completed. The person can then assist on a task in the Doing list or start a new task in the To Do list.

The visualization method shows where the tasks are located in the process. As tasks get completed, cards are physically moved through the process. Each task should already be broken down and accomplishable within a few hours.

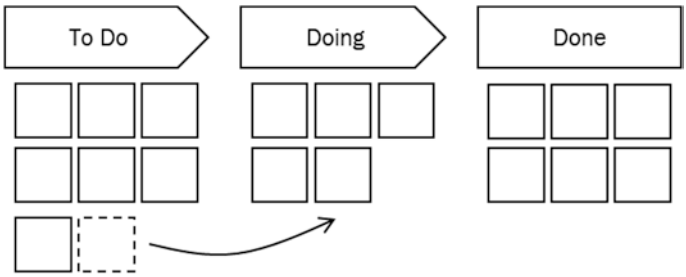

Fig. 18.5 Kanban process for Agile project management. (Source: Author's creation)

In limiting the work in process, managers can encourage finishing of projects at hand instead of starting more tasks. Visualizing a *Done List* also gives a sense of accomplishment to the team at the end of a sprint.

What it's good for: Kanban keeps a team's deliverables clear, transparent, and accountable to each other. This can be used to manage a personal workflow over the course of a week as well as to manage a team that is working to deliver on a goal (Fig. 18.5).

Kaizen and PDCA

Kaizen, a philosophy for continuous process improvements, is a way for all functions and processes to reduce waste. It is an approach to recognize problems and solve them such that quality is improved for everybody around. It is a daily process, enabling every person to look for small ideas that improve a process and encourage them to implement them immediately, often within the same day. Although individual improvement can be perceived as incremental, in aggregate, they can accumulate to large reductions in waste, saving time and money (Imai 1992).

Kaizen grew out of the work of W. Edwards Deming where, in the 1950s, he proposed a design-production-sales-research process to get those departments to collaborate with each other as a way to improve quality and satisfy customers. Quality improvement, Deming reasoned, wasn't just a processing concern, it was also a managerial tool. Japanese manufacturers adopted his method and modified it to the Plan-Do-Check-Act (PDCA) cycle that we know today (Fig. 18.6).

- *Design/Plan*: Plan an improvement by using statistical tools.
- *Production/Do*: Apply the plan into the production cycle.

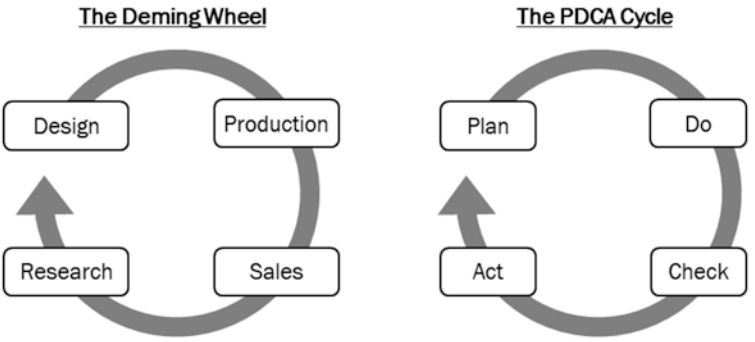

Fig. 18.6 Kaizen and PDCA: small wins. (Source: Author's creation)

- *Sales/Check*: Confirm whether customer is satisfied or if the desired improvement was achieved.
- *Research/Act*: Take corrective actions if the improvement was not achieved and/or seek data for the next round of improvements to be made.

What it's good for: Kaizen is good for mature processes that need to seek innovations on how to optimize it. The product or service outcome needs to be well known and well scoped. It is an example of an exploit strategy in the **Explore/Exploit** framework when a leader has settled on a process and needs to maximize its efficiency.

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19

Meso-innovations: Creating Serendipity for Emergent Ideas

Meso-innovations are the stereotypical "innovation" most people think of—the smartphone, the self-driving automobile, a possible HIV vaccine, and so forth. By the time these technologies are presented to the public, they seem like giant leaps forward. Yet they start their lives as new links created between concepts, people, or fields, and take years of arduous incremental improvements. This combinatorial process is also known as the *adjacent possible*, a deterministic model of the delivery of insight (Johnson 2010).

As mentioned in **Untapped Innovations (Unknown Knowns)**, some ideas are right in front of us but no one has noticed them before. When one mixes contextual backgrounds and perspectives, these gaps in knowledge might flash before us, creating insights. Yet a *new* idea to one community might be a standard practice to another. In fact, one way to look for out-of-the-box solutions is to find a different system with similar properties. By examining those solutions, one may be able to find lessons to the current concerns.

To increase the occurrence of insightful moments, one can create situations that maximize serendipity. Intentionally convening the components of the **Garbage Can Model** can create the *opportunity* to self-organize unlikely connections. The *participants* need to have diverse contextual backgrounds, experiences, and memetic diversity. There needs to be a set of puzzles and *problems* being faced, as well as *solutions* already tried or being used. One should maximize the variance of the system through the widest possible

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_19

inclusion of all elements. Although the appearance of emergent innovations cannot be scripted or predicted, whatever does appear will usually delight the participants.

To the outsider, meso-innovations look like playing, because it is. The properties of having fun overlap a great deal with the process of innovating. Both require engagement with others in the process of exploring beyond one's context. Both generate a sense of delight from groups of people experimenting together, trying variations of the same game, satisfying their curiosity, and sharing the moment of discovery with others. Subtly, both playing and innovating require the permission of others to participate in. A well-behaved kid knows that playing in the sandbox is permitted but playing at the dinner table may not be allowed. Likewise, playing is not a typical workplace expectation, therefore requiring an intentional environment to promote it. Artists, designers, and other meso-innovators know this, and their workspace looks like a giant playground.

Why this chapter is important: Energy strategists will need new solutions to tackle our critical problems. The technologies, methodologies, and practices that got us here won't get us out again. Whether inventing new frameworks, new products, or adapting existing ones to contemporary priorities, energy strategists will need to fill gaps and opportunities with emergent innovations.

Weak Ties: Strengths of Relationships

Interpersonal relationships govern the **DIFFUSION OF INFORMATION** as it spreads within and among communities. These relationships can be among groups of friends in a clique, an association of professionals, or a loose group of hobbyists. It turns out that the strengths of these relationships can limit or spawn ideas, collaborations, and innovations.

- *Strong ties*: Those relationships that have a combination of amount of time, emotional energy, mutual confiding, and reciprocity invested in it. They are tight networks that have shared assumptions, experiences, and worldviews.
- *Weak ties*: Acquaintances, perhaps through a mutual friend, similar hobbies, or common careers, that have a shared reason to cross paths.
- *Absent ties*: Those that are negligible, such as between a vendor to a client, or truly missing because no interactions exist.

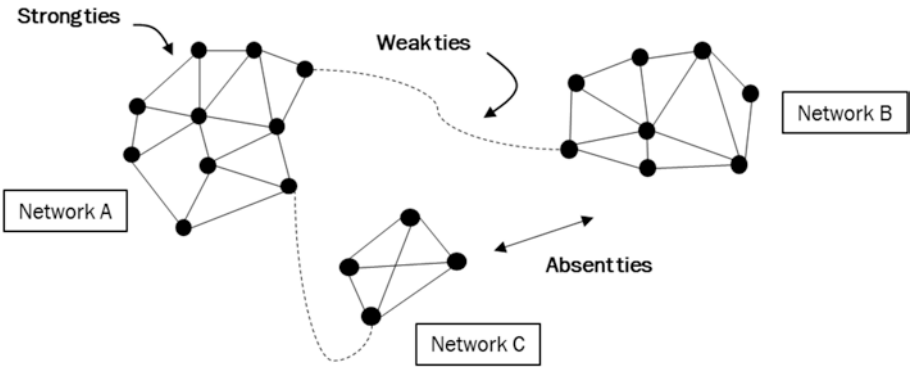

Fig. 19.1 Weak ties: strengths of relationships. (Source: Adapted and reprinted with permission of Granovetter, M. (1973). The Strength of Weak Ties. *American Journal of Sociology*, *78*(6), 1360–1380. Retrieved from http://www.jstor.org/stable/2776392; permission conveyed through Copyright Clearance Center, Inc.)

First proposed by Mark Granovetter, weak ties are incredibly powerful at creating opportunities. Weak ties can disseminate information faster and to a broader audience, whereas strong ties usually limit the message to a small clique. As a result, weak ties increase the pace of innovation by bridging access to novel information and resources. Job seekers have a higher success rate finding employment through weak ties (a friend of a friend), as compared to strong ties (a close friend), or absent ties (online resume submission). An ecosystem with many weak ties is more resilient than one with mostly strong ties.

What it's good for: This theory highlights the importance of inclusion and diversity in the field of emergent innovations. One needs to maximize weak ties for serendipity to emerge. To create future energy products, try convening different communities, contexts, and cultures such that new ideas can combine and form (Fig. 19.1).

Brainstorming: Generating Ideas

Brainstorming is a way of conducting a creativity exercise that unlocks ideas to solve a specific problem. Popularized by Alex Osborn, it is best used as a way to help people be spontaneous in free-wheeling generation of ideas and removing inhibitions that might hold them back (Osborn 1953).

There are many brainstorming processes and methodologies. Most of them consist of three broad phases, (1) idea generation, (2) idea synthesis, and (3) idea selection. Osborn made several recommendations for how to improve the outcome of a session, focusing on the idea generation step. His philosophy was that more ideas generated will increase the likelihood that a good idea is contained within the group.

The *purpose* of a brainstorm should be well-grounded before it begins. Use a **Focal Question** to center and align the creative efforts of the stakeholders involved.

The principles of a brainstorm are:

- *Defer judgment*: During idea generation, there is to be no evaluation of the ideas being proposed.
- *Reach for quantity*: Since the process optimizes for idea generation, the quantity of ideas is a key metric for success.

The rules of a brainstorm are:

- *Go for quantity*: Increase the likelihood of good ideas and solutions.
- *Welcome wild ideas*: All ideas are welcomed, regardless of how crazy they may seem.
- *Withhold criticism*: No criticism should be made to encourage free generation of ideas.
- *Combine and improve*: Merge ideas generated for further ideas and insights.

Once the idea generation phase is done, the ideas can be synthesized, discussed, and evaluated. During this phase, it is still likely for new ideas to emerge from the outcomes of what's already been presented.

Finally, the ideas need to be filtered as to whether they solve the original problem. The ideas can be judged and prioritized, leaving the best one or best few for further analysis and consideration.

What it's good for: The methodology helps an individual or a group synthesize their collective knowledge and experience to craft possible solutions to a specific problem. Energy spans across many stakeholders, and innovative solutions need to consider the needs of many people. **Techniques to Add or Limit Information** discusses further ideas on how to encourage idea generation (Fig. 19.2).

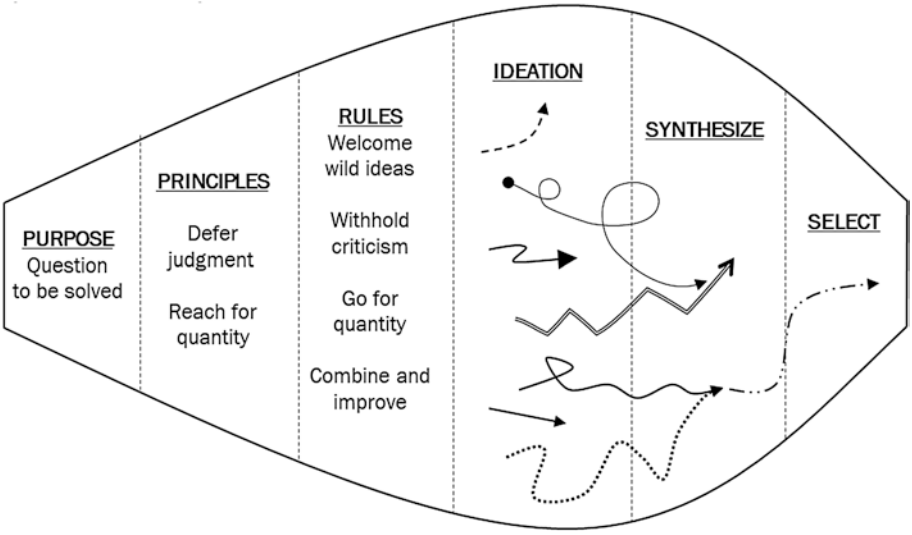

Fig. 19.2 Brainstorming. (Source: Author's creation)

Questionstorming: Generating Curiosity

Questionstorming seeks to identify the unknowns, define the problem statement, and convene a team to explore the topic. It is aspecific form of **Brainstorming** where questions are being generated rather than ideas. By defining the problem, stakeholders are aligning their assumptions, curiosities, and unknowns so as to be more effective in solution-seeking activities.

The skill of **How to Ask Questions** is rarely formally taught in school. The Right Question Institute developed the Question Formulation Technique™ (QFT) to help educators unlock curiosity in their students by teaching them a process of how to ask one's own questions. In this manner, students retain the lessons stronger because they are seeking their own answers (What Is the QFT? n.d.).

Figure 19.3 is a modified version of the QFT that can be used for a questionstorming workshop. The process is grounded in a **Focal Question**. Similar to a **Brainstorm**, focus on quantity of question over quality and withhold judgment. Save the filtering of questions for quality and relevance for the end of the process. Lastly, end a questionstorm with a review and feedback.

What it's good for: In a business setting, this aligns a team on the problem statement, the most urgent priorities to address, and a possible pathway forward of actions.

Step 1: Review the rules for producing questions
- Ask as many questions as you can.
- Do not stop to discuss, judge or answer any questions.
- Write down every question exactly as stated.
- Change any statement into a question.

Step 2: Produce questions
a) Create a FOCAL QUESTION to explore.
b) Ask questions about the question focus.
[*Target 50 per person! Quantity over quality at this point!*]
c) Modify questions by changing closed-ended to open-ended and vice versa.

Step 3: Categorize your questions
a) Group or categorize questions by what seems logical.

Step 4: Prioritize your questions
a) Choose the three most important questions from the list.
b) What was the reason for selecting those three?

Step 5: Establish next steps. How will you use the questions?

Step 6: What did you learn?

Fig. 19.3 The questionstorming process. (Source: Author's creation)

Techniques to Add or Limit Information

"*Yes, and* ___," perhaps the fundamental rule of improvisational acting and has gained popularity as a **BRAINSTORMING** tool. It is part of a broader family of techniques that improv actors use to generate ideas and tame the chaotic nature of creativity into cohesive, while spontaneous, scenes.

Improv is incredibly creative because it optimizes for the momentum of information discovery. Not all ideas are good, and even the good ideas can be made better. Improv treats all ideas as a stopping point on the way to yet undiscovered, new, and better ideas. In long-form improv, which uses a single word as a prompt to create a 45-minute performance, a team collaborates their creativity in real time. The fun and humor of this style comes from the genuine surprise and spontaneity that arises from making unexpected connections as multiple scenes develop. Improv games are designed to encourage the adding of new information. Here are a few additional prompts:

- *Yes, and* ___: The phrase that follows naturally adds new information to the conversation. Even when one disagrees with the previous statement, this prompt can encourage co-creation of newer and more powerful ideas.
- *I love [X] because of [Y]*: is a variant of *yes, and*___. The [X] is something known and [Y] is the related new information. For example, the sentence

"I love dogs because I'm allergic to cats" adds new information about one's health.
- *If this is true, what else is true?*: A thought experiment to springboard into tangential ideas. For instance, if there is a tree, might there be a treehouse? If a treehouse, might there be kids? If kids, might there be a school bus? Thus, the idea of a tree could lead us to *bus*.

Similarly, some phrases are to be avoided because they stop the momentum of discovery:

- *No.*: The opposite of *Yes, and* ___, as it rejects the new information being presented.
- *Reiterating information*: Because improv optimizes for the momentum of new discovery, repeating what has already been stated stops the addition of new information.
- *Asking a question*: Answering a question requires the respondent to stop and refine or reiterate old information. This is why it is best to save clarification questions for the categorization/prioritization phase rather than the ideation phase during a brainstorm.

The idea generation portions of a **Brainstorm**, **Questionstorm**, or innovation session can be based on these Improv techniques. As tools to rapidly iterate on ideas, they create environments of combinatorial processes and technology convergences from which the adjacent possible can emerge. If an elevator is true, why not an elevator to space? If a subway is true, why not a tunnel between New York and Los Angeles? Thus, from this point of view, meso-innovation processes can be considered *Innovation-as-a-Game*.

What it's good for: These are the basic techniques to create a dynamic idea generation session. They can be used anytime when thinking creatively and out-of-the-box (Fig. 19.4).

Affinity Diagrams (the KJ Method): Sorting Ideas

Affinity diagram, or the KJ method, is a process that helps capture the dynamic information of ideation and conversations to make some sense out of it all. Named after Japanese ethnologist Jiro Kawakita, it was created to help analyze ethnographic data, which is complex, non-repetitive, and idiosyncratic. It has since been applied to business and management as a way to organize nonlinear thinking generated from a **Brainstorm** or **Questionstorm** into a set of priorities and tasks (Scupin 1997).

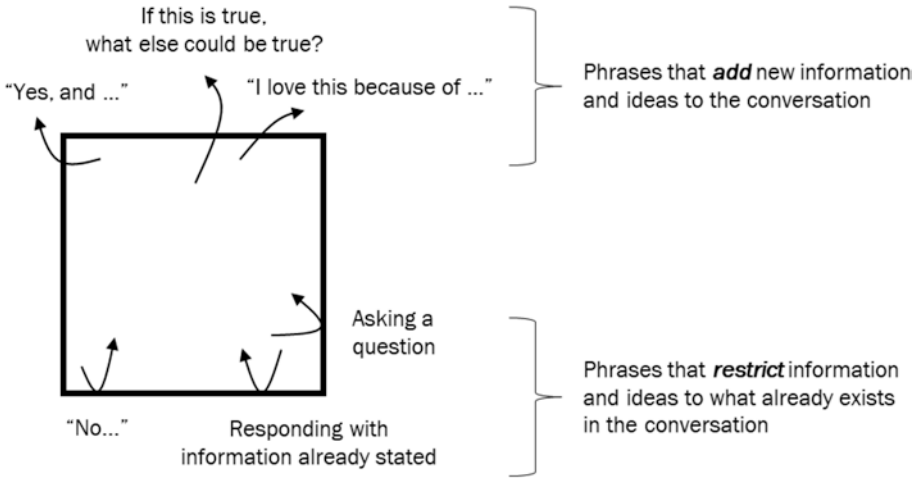

Fig. 19.4 Techniques to add or limit information. (Source: Author's creation)

The method walks a team through a process to generate ideas, categorize them, and prioritize the tasks. The process uses copious sticky notes or notepads and follows the following steps (Fig. 19.5):

1. *Capture ideas*: Produce as many ideas as possible. Only one idea per card. Put all of the sticky notes from everyone onto a wall or something where the entire group can walk around and read.
2. *Group together*: In silence, the teams reads the cards and group similar cards and like-ideas. The organic nature of this step means some groups might be moved to form clusters, while other groups might be broken up and absorbed. Do this step in silence, so that the emphasis is on reading the cards and interpreting them as written.
3. *Label the clusters*: Once the groupings have settled, name each group and discuss why the groups formed as they did. In this step, the disagreements in Step 2 can be discussed and the assumptions shared. The team can then make a final decision as to how the groups should be formed.
4. *Analyze and prioritize*: Prioritize the tasks that are generated by the ideas. What are possible follow-up actions to fill missing gaps or to advance the initiative?

What it's good for: This process combines elements of individual and group exercises, periods of silence and discussion, and includes both mental and physical activities. It helps the group bring structure to a brainstorm and results in a strong conclusion with an action plan.

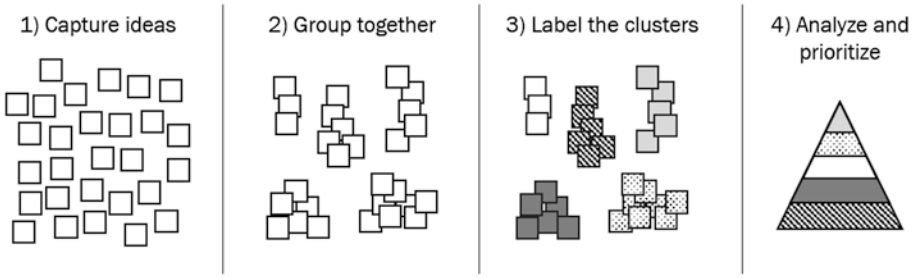

Fig. 19.5 Affinity diagrams (or the KJ Method). (Source: Author's creation)

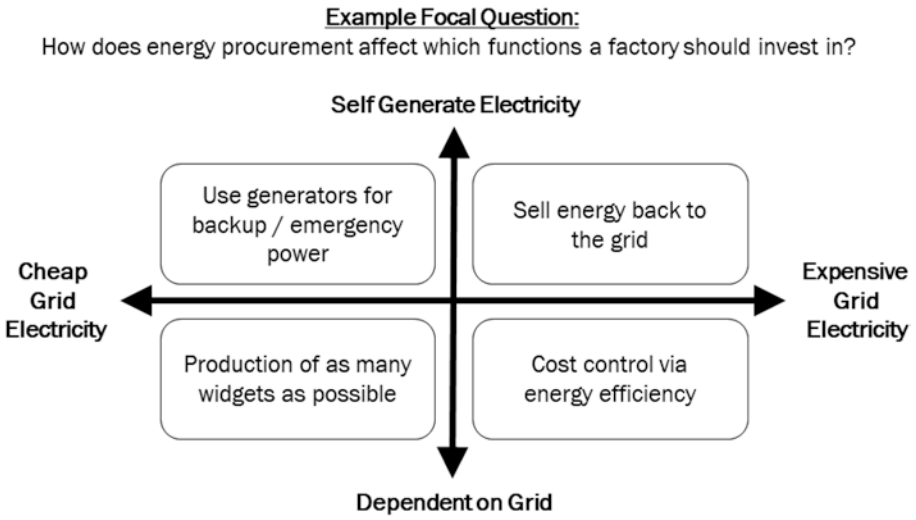

Fig. 19.6 Scenario planning: designer of worlds. (Source: Author's creation)

Scenario Planning: Designer of Worlds

Scenario planning was developed as a way to identify existential and hidden risks a company may be exposed to. It is a way of looking at extreme possibilities to prepare for probable and preferable alternatives. A good outcome of scenario planning will test and stretch the boundaries, including even unlikely scenarios. Although predicting the future is as old as human history, the modern-day method is usually attributed to Herman Kahn, who was tasked for forecasting military needs during the uncertainties of the Cold War (Bradfield et al. 2005).

Simplistically, scenario planning is a **Boundary Condition Analysis** of two factors and creates four possible scenarios from their intersection to answer a **Focal Question**.

1. Start with a focal question to align the team on the outcome being examined.
2. List as many factors as possible that affect the decisions.
3. Pick two independent factors to create the matrix. Look at their extremes, regardless of how unlikely they are. For instance, electricity cost is independent of whether it is provided by one's own generators or by the electric grid.
4. Give each quadrant a title. What would that world look like?
5. Describe the attributes of each world.
6. Spin stories and use cases, risks, and contingency plans for each world that is described.

What it's good for: Scenario planning is a thought experiment used by futurists to identify possible outcomes. It is best used when data from the past is insufficient to project the future. This can help decision-makers examine probable risk exposures, opportunity gaps, and other variables during the planning process (Fig. 19.6).

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20

Macro-innovations: The Discipline of Scaling Adoption

This chapter examines macro-innovations where technologies and ideas diffuse into general usage. Much is written about great strategies and groundbreaking inventions. Yet successful entrepreneurs are those who are disciplined in the execution of tactics. A well-executed operation can overcome the shortfalls of a mediocre strategy. This notion is the principle in Bill Aulet's book, *Disciplined Entrepreneurship*, where the rigor of following process is perhaps the best indicator of success for an early-stage company (Aulet 2015).

The two most difficult questions an entrepreneur can answer when trying to sell their new product are *So what?* and *Who cares?* Most customers don't care how new or exciting an invention is; they make purchasing decisions that improve their quality of life. Many innovative products don't reach their full potential because the features and benefits were never perceived by the buyer to be essential.

The roles of an entrepreneur and intrapreneur are very similar. An entrepreneur tries to make a change to an external system, while an intrapreneur does that for the internal system. An intrapreneur needs to manage internal resources to drive the development of a product or a methodology or create a new corporate function. The features and benefits of these ideas need to be explained, executed, and delivered. The intrapreneur needs to find the money via a budget allocation to create a self-sustaining system (Pinchot 1986).

Most new ideas compete against four types of decisions a person can make, and successful businesses need to be strategic in how they overcome all four of these competitors:

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_20

1. *Inaction*: The least risky option is always to maintain status quo, especially if making a change is not critical to survival. After all, why fix something that's not broken?
2. *A different priority*: There are many $10,000 purchases a person can buy, including residential solar panels, a new entertainment system, or a family vacation.
3. *Internal solution*: A person or company can always try to do it themselves with internal resources instead of making an external purchase.
4. *External competitors*: The traditional view of competition—the buyer can purchase from others in the market who are offering a similar benefit.

Why this chapter is important: Energy strategists need to know how to scale ideas, whether internally for organizational change or externally for market transformations. They need to interact with employees to adopt best practices, explain the benefits of *Energy as Strategy* to the C-suite, and communicate their activities to a broad range of customers, investors, and stakeholders.

Diffusion of Innovation

The diffusion of innovation describes how ideas and practices diffuse through society. First used to describe how farmers adopted new agricultural practices (Rogers and Beal 1958), it has since been applied to describe the adoption of new technologies, products, and ideas. The model categorizes customers based on their buying habits and preferences (Fig. 20.1). These are:

- *Innovators*: Tinkerers who want to have the latest solution, even if the product isn't working perfectly. They are great at troubleshooting issues and providing debugging.
- *Early adopters*: Visionaries who can identify an emerging trend and get ahead of it. They are demanding customers because they need the solution to fit their vision for it.
- *Early majority*: Pragmatists who care about the quality of the product and the reputation of the vendor and that the product ecosystem (i.e., third-party vendors) is well established.
- *Late majority*: Conservatives who are perfectly happy with their existing technology. When they make a new purchase, the solution needs to be completely plug-and-play.

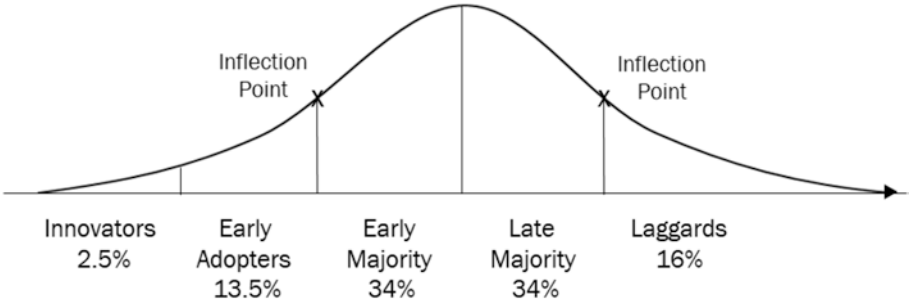

Fig. 20.1 Diffusion of innovation. (Source: Author's creation based on Rogers, E. M., & Beal, G. M. (1958). *Reference group influences in the adoption of agricultural technology*. Ames, Iowa: Dept. of Economics and Sociology, Iowa State College)

- *Laggards*: Skeptics who believe that new ideas never achieve their promises. They point out failures and discrepancies between sales claims and delivered product.

Geoffrey Moore identified a chasm at the left-side inflection point were many technology companies fail to cross. This is because the visionaries of the early adopters are not good reference customers for the pragmatists who buy for present-day needs. As a result, the strategies that worked in the early stages of a product deployment won't work in reaching the mass market. Companies that make it across this chasm know that their early wins don't translate to later success and are able to pivot to meet the needs of the buyers they're trying to attract (Moore 2014).

What it's good for: Energy innovations also follow this same pattern of adoption. The position on the innovation curve informs what strategy to pursue for adoption in that customer segment. Thus, marketing an energy innovation to *early adopters* is very different than marketing it to *laggards* (Fig. 20.1).

Business Model Canvas

The Business Model Canvas is a template that can be used to analyze the strategy and value proposition of a company, division, or product line. Its format helps with the visualization of the knowns and unknowns in a company (Osterwalder and Pigneur 2013).

The canvas consists of four main components:

- *Value proposition*: The core reason why a customer should buy the product.
- *Key partners, key activities*, and *key resources*: The company infrastructure and where resources will be coming from.
- *Customer relationships, customer segments*, and *channels*: The customers and the markets to where the products are going.
- *Cost structure* and *revenue stream*: The financing mechanisms that support the business.

What it's good for: The model can be used to understanding a whole business or a product line. Investors essentially buy companies. This framework treats the *company-as-the-product*. It helps cover the bases when analyzing a new execution strategy or writing an **Executive Summary/Pitch Deck/Business Plan Outline**. When applying this framework to a business, it frequently becomes apparent that some boxes tend to be more fleshed out than others. This helps reveal biases of known information and identifies areas that need more work (Fig. 20.2).

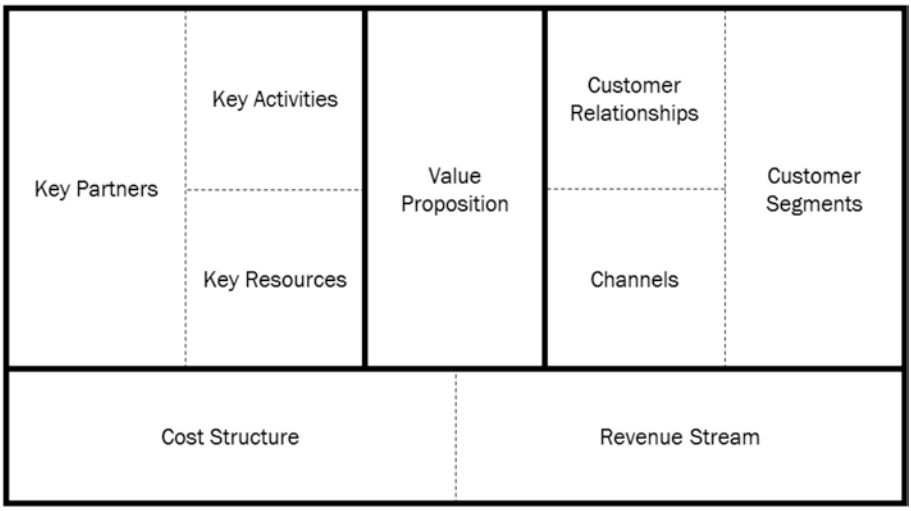

Fig. 20.2 Business Model Canvas. (Source: Author's creation based on www.strategyzer.com under a creative commons Attribution-ShareAlike 3.0 Unported (CC BY-SA 3.0))

Marketing Mix

The marketing mix is based on the portrayal of a marketing manager's role in mixing a set of ingredients to communicate the value proposition of their product or service. It has since evolved into describing a set of tools that a company can use to meet their marketing goals for a product or service. Since its inception in 1964 by Neil Borden (1964), it has been developed, updated, and expanded into both product- and consumer-facing versions. In what follows are examples of subtle, yet important, differences between the models and how they analyze an energy efficiency incentive product offered by a utility.

Four Ps of the Product Marketing Mix

The Four Ps model, first developed by Jerome McCarthy, has been a mainstay in the marketing mix (McCarthy 1964). The model has been updated numerous times, expanding the original four Ps to seven (Fig. 20.3).

- *Product*: How well does the product satisfy the customer's needs and wants?
- *Price*: Does the price reflect the *perceived* value and support the larger business model?
- *Place*: Where does the customer gain access to the product? Is it in a shop or online?

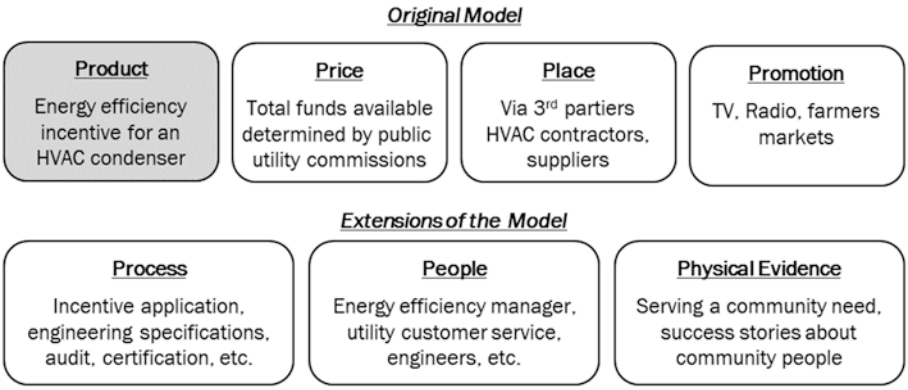

Fig. 20.3 Marketing mix: four Ps of product marketing. (Source: Author's creation)

- *Promotion*: How do customers learn about the product?
- *Process*: What are the set of activities that need to be undertaken to deliver benefits to clients?
- *People*: Who represents the company, and do their behaviors align with the value of the product? This includes employees and customer segments.
- *Physical evidence*: What are nonhuman environments, such as the décor of a lobby, that support the marketing message?

Four Cs of the Consumer Marketing Mix

A consumer-centric model of the marketing mix was developed out of a growing need to target the needs of the buyer rather than the needs of the producer. Figure 20.4 depicts Koichi Shimizu's version, which focuses on the consumer and demand-side needs (Shimizu 2014).

- *Commodity*: The goods or services for the consumers.
- *Cost*: The production cost as well as the social, selling, and purchasing costs.
- *Channel*: The flow of goods, and how they reach the consumer.
- *Communication*: The method of publicizing through active means (advertising and public relations) as well as passive means (corporate identity and branding).

Shimizu further expanded his model into the 7Cs Compass Model for a more complete co-marketing approach between company and consumers. It

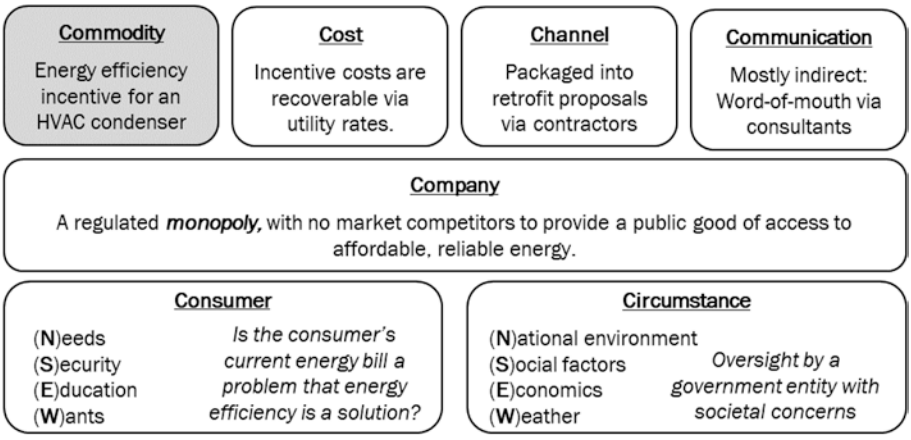

Fig. 20.4 Marketing mix: four Cs of consumer marketing. (Source: Author's creation)

is called a Compass Model because two of the attributes for Consumer and Circumstances, have N-S-E-W components:

- *Consumer*: Seeking to make purchases that satisfy *(N)*eeds, *(S)*ecurity, *(E)*ducation of the product, and *(W)*ants.
- *Circumstance*: Internal and external factors that affect the ability to deliver products. These can be *(N)*ational environment, *(S)*ocial factors, *(E)*conomics, and *(W)*eather.

Finally, at the core of the model is the *Corporation*:

- *Corporation*: The organization that competes with others in its industry for market share.

What it's good for: The marketing mix helps a company cover their bases in their marketing strategy, either during development phase or while diagnosing possible problems. Even with new tools, such as social media, the principles are still valid. This is also an example where a different frame of reference to analyze the same situation might reveal answers otherwise overlooked, helping to double-check one's assumptions (Fig. 20.4).

Five Cs of Marketing: Situational Analysis

This model is a diagnosis of a business to understanding a product's market position. Marketing strategies need to take into consideration both external factors of its market position and internal factors of its ability to deliver. The Five Cs is an overview of the environment in which a business operates, analyzing both macro- and micro-environmental factors of their organization (Doyle 2016).

The five factors are as follows:

- *Company*: The company's ability to deliver on the promise. This includes the financial strength as well as the product's value proposition and performance record.
- *Competitors*: The competitor's ability to deliver on the same or similar promise.
- *Collaborators*: The collaborators are those that enable the company to gain more business opportunities. This could be distributors, suppliers, partners, and so forth.

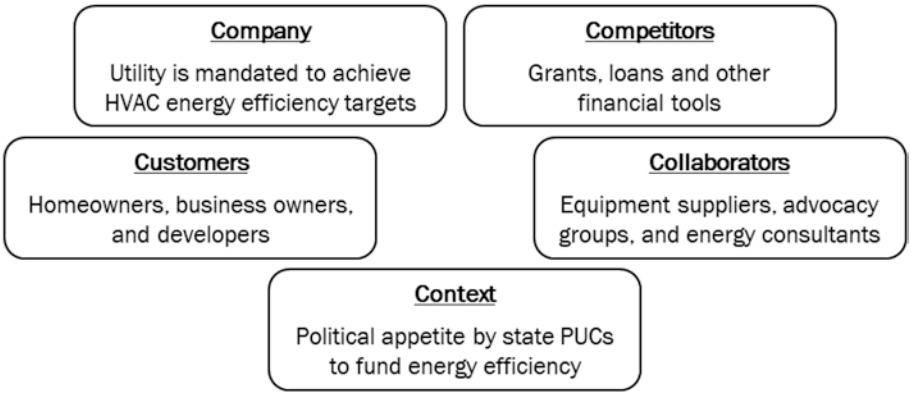

Fig. 20.5 Five Cs of marketing: situational analysis. (Source: Author's creation)

- *Customers*: The customer's shifting needs and requirements. This could be due to changing market size, customer motivation, how you're reaching them, and so forth.
- *Context* (or *climate*): The larger business, political, and social context. Decisions may be affected by political, economic, social, and technology (PEST) factors.

Although seemingly similar to **Porter's Five Forces**, the intention behind them are different. Porter's is an external review of industry-wide factors related to competition to determine the attractiveness of a market segment. This Five Cs analysis is a company-specific approach to determine their status in relations to the key factors of the market.

What it's good for: This analysis informs a possible market positioning of a product or service. It can be used to launch a new product that fills a gap in the market or refine the positioning of an existing product. The example in Figure 20.5 continues to examine an HVAC incentive in the market.

PEST (or PESTEL): Context Analysis

A leader needs to be aware of the macro-environment and major trends that the company is subject to. The PEST analysis can be used as a scan of the market to understand how one's organization fits into the broader ecosystem context. This then supports internal decisions on strategy, operations, and organizational development (Aguilar 1967).

There are many variants of the model, with the original PEST expanded numerous times to PESTEL, STEEPLED, and others. All of these factors can impact positively to strengthen one's marketing position or negatively to challenge one's ability to operate.

- *Political*: How governments are intervening in the economy or the market. This could be regulatory, legal, or political instability.
- *Economical*: Financial information, such as interest rates, inflation, and cost of capital.
- *Sociocultural*: The attitudes of the market, such as lifestyle choices and social trends.
- *Technological*: New technologies, processes, and practices that are changing the market.
- *Environmental*: Ecological, weather, and climate factors that are affecting a company's ability to operate.
- *Legal*: Laws that change the company's ability to operate. These can be anti-discrimination laws, consumer protection laws, health and safety laws, and so forth.

Additional variants might include Demographics (gender, age, income bracket) and Regulatory.

What it's good for: PEST analysis gives the ecosystem context that is external to the organization. This can be used within a **Situational Analysis** or **Marketing Mix** to understand context or circumstance (Fig. 20.6).

Fig. 20.6 PEST (or PESTEL): context analysis. (Source: Author's creation)

Sales Funnel and Pipeline Management

Sales management is an oft overlooked discipline when it comes to scaling adoption. However, no amount of marketing analysis can replace a good deal closer. The purpose of a sales team is to uncover who has the problem that one's product, service, or idea can solve. To do so, one must have a customer journey process that walks a prospective client from the first interaction to closing. The process has several stages, and a sales team will plan specific customer interactions associated with each stage. An example set of stages might be as follows (Fig. 20.7):

- *Universe*: A large list of names on a call list representing the universe of possible buyers. They may exhibit the demographics of people who have the identified problem.
- *Above the funnel*: Those who have expressed interest in the product. The person might be doing active research in the market to understand what's available.
- *In the funnel*: Those who are seriously evaluating the product as their solution. Usually one is drafting proposals at this point, if not having already submitted one for evaluation.
- *Best few*: Those where the buying decision is imminent.
- *Closed won/closed lost*: Customers leave the funnel when a buying decision is made. Regardless of win or lose, the salesperson no longer has to spend their time paying attention to this customer anymore.

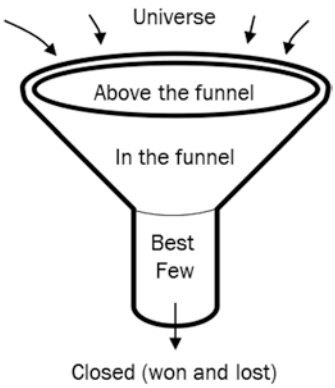

Fig. 20.7 Sales funnel and pipeline management. (Source: Author's creation)

A funnel forms when the prospectives start making the way through the process. At each stage, customers who are not a good fit will start to drop out. This is good—it's not uncommon for over 100 names to be in the funnel at any time, and the salesperson's limited time is best spent focusing on those that can result in a deal.

What it's good for: From the stages of the funnel, one can calculate the customer acquisition cost (CAC) and customer lifetime value (LTV). CAC is a measure of how much a company spends to move a client from the *Universe* to *Closed*. LTV is how much profit the company expects to generate per long-term relationship with the client. These metrics help evaluate sales performance).

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Part V

Non-Financial Indicators for Corporate Governance

21

Introduction to Part V: What Is Governance?

Governance resides in the world of *it depend*s. Board members need to use their best judgment and broad experience to decide what's important to pay attention to. As the ultimate decision-making body, the board of directors has broad responsibilities of advisory and oversight. Boards need to balance demands on their attention, from internal needs to maintain a healthy organization to keeping a pulse on external factors.

Boards need to review, challenge, and concur with management's plans. They need to create strategic goals that are reasonable to achieve by the management team, hire the CEO, and approve budgets and long-term spending plans to achieve the goals. Then the board needs to monitor the leading and lagging indicators, providing oversight to the executive's progress. Unfortunately, boards frequently limit their focus to oversight obligations and compliance concerns on behalf of shareholders. This results in overlooking signs of distress, both internal operational risks in the company and external shifts in the market.

Some investors are using environmental, social, and governance (ESG) indicators to make investment decisions. ESG contains non-financial indicators, or metrics, used to evaluate the health of an organization that isn't monetary in origin. They range from energy consumption and carbon emissions to gender pay gap, human rights, and many other sustainability factors. Attention to non-financial indicators emerged in the 1970s when investors opposed to apartheid started divesting in companies that did business in South Africa. Today, investor activism has expanded their concerns to other social ills, such as conflict diamonds and human trafficking (Fig. 21.1).

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_21

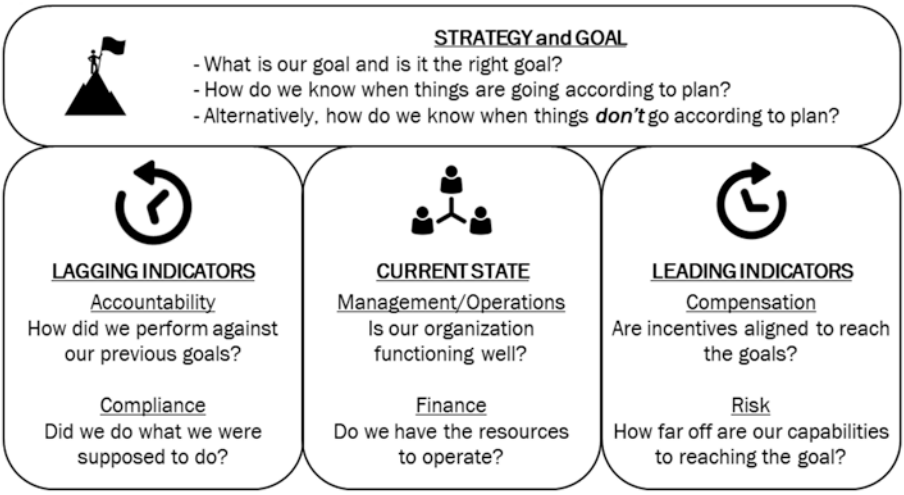

Fig. 21.1 Example board questions and concerns. (Source: Author's creation)

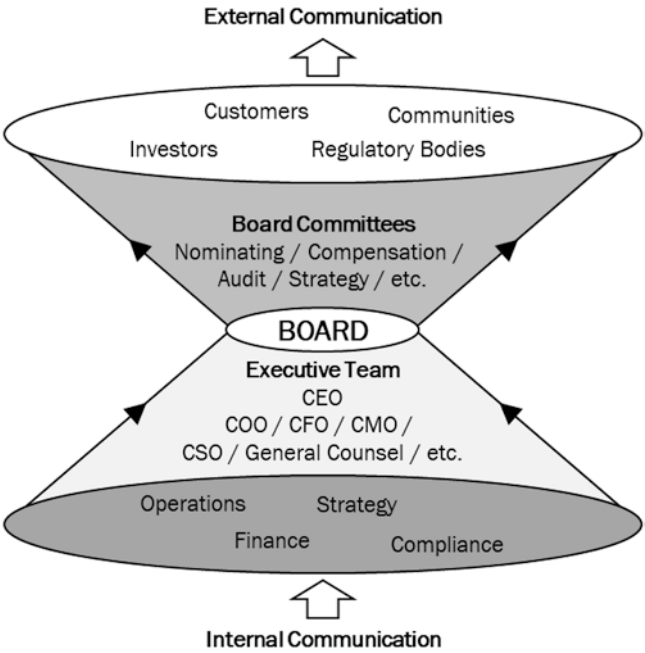

Fig. 21.2 Boards as a center of communication. (Source: Author's creation)

Internally, boards need to synthesize climate reports being presented by the executive team. Energy data is analyzed through various lenses based on the functions of the operational department. Executives are grappling with the challenge of reconciling these multiple viewpoints of energy and climate into a cohesive strategy.

Externally, boards need to be responsive to investors and global concerns. Investors are demanding climate action plans, and some institutions are divesting from oil and gas and other heavy industries due to their contributions to climate change. Many reporting frameworks have sprung up, demanding information on energy, climate, and other resource footprints.

Energy strategists need to supervise these interrelated communication flows, helping to make sense out of it all. They need to support top-down strategy creation and oversight by understanding how energy factors affect strategy and ESG reporting. They need to support bottom-up aggregation of analyses provided by different department. They need to provide cohesive recommendations to executives and boards that support long-term corporate strategies.

Part V has two chapters that examine energy indicators through the dual role of a board (Fig. 21.2).

- **Chapter** 22 looks at energy, environmental, and climate data within the organization and how it's *analyzed for executives and the board*.
- **Chapter** 23 reviews reporting frameworks and how data is *presented to investors, customers, and the general public*.

22

Influence of Energy on Internal Reporting

This chapter examines how the treatment of energy analyses differs by department within an organization. Energy consumption, carbon emissions, and climate impact are key components of the family of non-financial indicators. Energy metrics are requested by many departments that need to consider climate impacts within their own function. Unfortunately, each department analyzes a different subset of energy data and uses the results to support different purposes. This can skew the results toward the preferred risks and opportunities to that one department and overlook enterprise-wide issues.

Departments that wish to reduce their operational expenditures may wish to invest in monitoring systems that optimize resource consumption efficiency. Meanwhile, energy management systems are frequently value engineered out by those who wish to minimize capital expenditures. Still others, who value workforce safety, may wish for equipment with low maintenance requirements, reducing probabilities for worker accidents.

The **Flow of Energy Decisions** shows that issues can originate from any level of a corporate hierarchy and affect the entire organization. Issues may arise from the top down, such as a corporate policy to only lease green office space, or from the bottom up, such as recycling and paper reduction initiatives. Pressures can emerge from internal forces, such as self-organized green teams, or come from external factors, such as new clean energy laws and regulations. These different starting points result in the random acts of greenness that the **Energy Strategy Maturity Cycle**™ tries to synthesize into a metrics-driven strategy.

These data sets, analyses, issues, and initiatives need to converge in support of the corporate strategy. Boards can drive strategy only based on how their

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_22

information is presented. A more unified treatment of these competing interpretations of the same energy data will result in increased alignment of energy outcomes toward corporate goals.

Furthermore, good management of non-financial indicators can have a meaningful impact on a company's financial performance. Investors reward companies with strong sustainability mechanisms with higher stock price (Eccles et al. 2014). If executives are paying close attention to non-financial risks, it is a good indicator that they have a strong awareness of their financial risk as well.

Why this chapter is important: To act as the translator, the energy strategist needs to understand the question that an energy-related report was created to answer. The person needs to relate to the different goals of each department, the problems they were created to manage, and the functional tools they have at their disposal. By doing so, the energy strategist becomes a nexus of information, helping the board manage the intersections energy and the corporate strategy.

Resiliency and Sustainability: Two Different Strategies

Resiliency and sustainability are both used frequently to describe a company's relationship with environmental impact. Their purpose is different, resulting in slightly different prioritizations of decisions (Fig. 22.1).

- *Resiliency* is generally concerned with withstanding shocks from external sources. It is how a company acts to *respond* to external shocks. Climate risk management and adaptation strategies are two approaches of how a company can protect itself against future changes.
- *Sustainability* is generally about impact and footprint. It deals with how a company's activities *affect* the world. Lessening a company's emissions and reducing waste are sustainability issues.

Although there are large overlaps in strategies, not every solution will satisfy both resiliency and sustainability outcomes. For instance, solar panels support both efforts. They are more sustainable because they divert usage away from fossil fuel consumption and they are more resilient as they can provide power when the grid goes down. On the other hand, a

Fig. 22.1 Resiliency and sustainability: two different strategies. (Source: Author's creation)

diesel backup generator provides resiliency during a power outage without a sustainability component. Likewise, planting trees to offset carbon emissions promotes sustainability without contributing toward a company's resiliency.

What it's good for: Although resiliency and sustainability are related, they are different enough that unifying the team around one of these objective functions can help clarify the direction and strategy of an organization. This model points out that, sometimes, a solution is better suited for one goal than the other.

Four Views of Energy Data

What's a tank of gas? To an airline, Jet A fuel is 80% of their operating expenses and represents a critical component to their operations. Let us use jet fuel as a way to examine the context of analysis based on different departmental functions:

- *Financial Risk Management*: Concerned with financial viability of an organization. This includes the response to cost, price volatility, managing funds to ensure long-term viability, and being a responsible steward for shareholder's investments.

- *Enterprise Risk Management (ERM)*: Concerned with large, long-term global trends that can disrupt a company's position in the market. This could be geopolitical, customer demographic shifts, or trends in the global economy.
- *Sustainability Management*: Concerned with the corporation's impact on the world and communicating it to stakeholders. They examine where raw materials are purchased from and explain the footprint of buying their product.
- *Environmental, Health, Safety, and Sustainability (EHS&S)*: Concerned with internal quality controls and environmental compliance. They ensure employee safety of equipment operations, customer safety using the product, and environmental regulatory compliance.

A sustainability outcome has different meanings to each department. Financially, it means less cost. ERM-wise, it means resiliency and adaptation. For a sustainability professional, it's about their contribution to global emissions. To EHS&S, it means minimizing harm in the operations and fewer accidents while operating fuel-consuming equipment. Although *use less fuel* is a universal long-term answer, it may not address the immediate needs facing each department.

What it's good for: The frame of reference of an energy analysis affects the outcome and recommendations. Understanding the different viewpoints informs the synthesis of needs and constraints into a corporate energy strategy (Fig. 22.2).

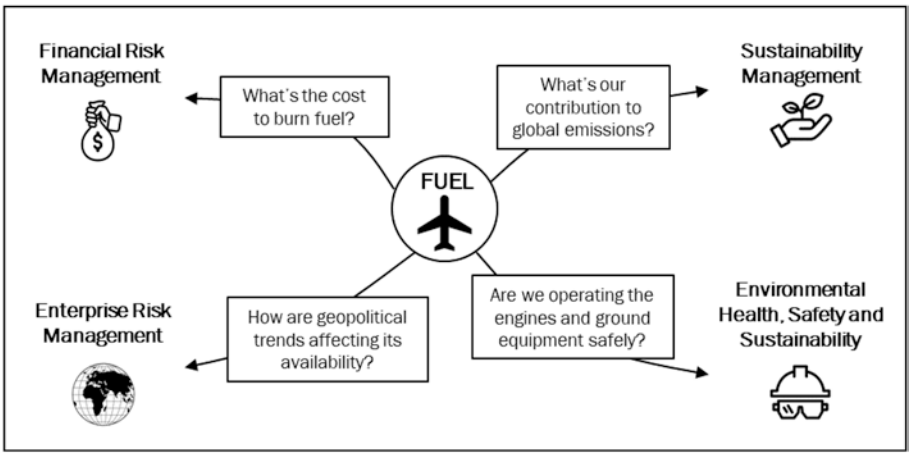

Fig. 22.2 Four views of energy data. (Source: Author's creation)

Financial Risk Management

Are We Being Responsible with Our Money?

The goal of financial management is to ensure the viability of an organization. The department plans, organizes, directs, and controls the financial activities within the organization to be able to achieve its goals. For public companies, one responsibility is to file Form 10-K with the US Securities and Exchange Commission (SEC). Within it, the businesses are obligated to disclose financially material information, or known trends, events, and uncertainties that may affect an investor's decision. Some, such as the **Sustainability Accounting Standards Board** (SASB), make the case that sustainability reporting should reside within financial reporting.

Financial concern for energy includes the management of the cost volatility and price increases in the cost of the resource. Unfortunately, energy and fuel costs are relatively small, usually around 1–5% of a company's operating budget. For large organizations though, that can still be tens of millions of dollars, a meaningful amount. Energy is traditionally considered an uncontrollable resource, subject to external, global factors that are far beyond a company's internal decision-making. However, the volatility and uncertainty of the costs, coupled with its critical nature for smooth operations, are forcing companies to develop innovative strategies and tools to take control over the resource management.

Some financial tools are well suited for energy decisions. End-of-life planning for an equipment, upgrades, and retrofits that have paybacks and returns can be analyzed using **Discounted Cash Flow**, **Net Present Value**, and other methodologies discussed in the **Financial Statements** chapter. Capital investments made in years prior can be depreciated over their useful life. Five-year strategic plans will peer into the future, using financial pro formas to rank possible scenarios. In the near-term, there are internal processes and controls to make sure there's enough cash in the bank to cover short-term obligations, like bills and payroll.

However, these tools break down when the situation is beyond the time horizons of financial concerns. For instance, a freezer case at a grocery store may have an operational and financial life of 10–15 years, but the refrigerant used may have a large 100-year impact on global warming. On the flip side, a good infrastructure decision will benefit the organization far beyond a financial forecast. Well-insulated buildings constructed a century ago are still well-insulated today and need less energy because of it. Unfortunately, most

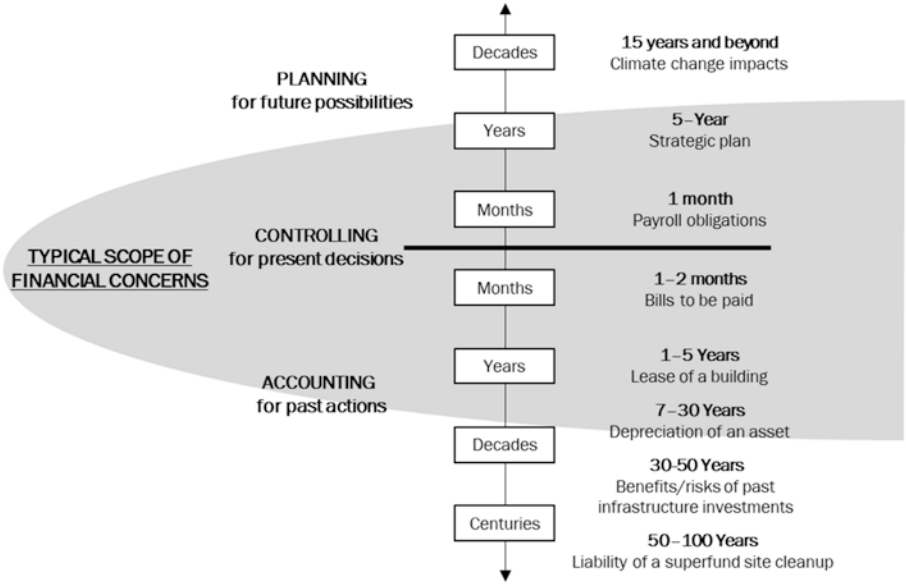

Fig. 22.3 Financial risk management. (Source: Author's creation)

decisions that have large impacts on climate have time horizons far beyond the scope of financial tools.

What it's good for: Financial risk management is great in that it encompasses a suite of well-known and mature tools. However, it does not fulfill the reality of environmental management. This is because environmental risks are usually beyond the timescales that financial decision-making tools were developed for (Fig. 22.3).

Enterprise Risk Management

What Is the Next Global Shock, and Can We Survive It?

Enterprise risk management (ERM) involves planning, organizing, and leading the activities to minimize risk on an organization's capital and earnings. It seeks to identify trends that can knock the company off of its path and prevent it from reaching its goal. Thus, ERM can be viewed as reactive to future ecosystem disruptions, adaptive to future trends, and building resiliency into the corporate infrastructure. CEOs and other executives are responsible for reporting company-related risks in the annual financial filings that investors receive.

Historically, ERM was viewed as a value protection function, emphasizing auditing and compliance. This results in tools such as the risk map, a matrix that compares the likelihood of risks to the severity of the risks. Although useful in the visualization of risks, risk maps are still derived from **Known Knowns** or **Known Unknowns**, limiting the data set to what is within the realm of experiences of the people building the map.

The contemporary view uses ERM as a strategy and value creation function, where one needs to holistically evaluate the likelihood and significance of adverse events and create resiliency plans to manage them. Good ERM processes are highly quantitative and incorporate data and viewpoints from across the entire organization. As a best practice, from the bottom up, it uses quantitative techniques to measure how risks are changing and the effectiveness of the risk controls implemented. This needs to match the top-down risk appetite of the organization's overall strategy.

COSO, an organization established in the 1980s by the then five major accounting associations and institutes in the USA, represents the ERM framework as a helix with five components, as depicted in Fig. 22.4. When working together, they create a culture of continuous improvement of the risk profile that supports value creation of the organization (The Committee of Sponsoring Organizations of the Treadway Commission (COSO) 2017).

- *Governance and Culture*: Where board oversight, compliance, and audits reside
- *Strategy and Objective Setting*: To analyze the context and the appetite for risk
- *Performance*: The identification and prioritization of risks and how to operate against them

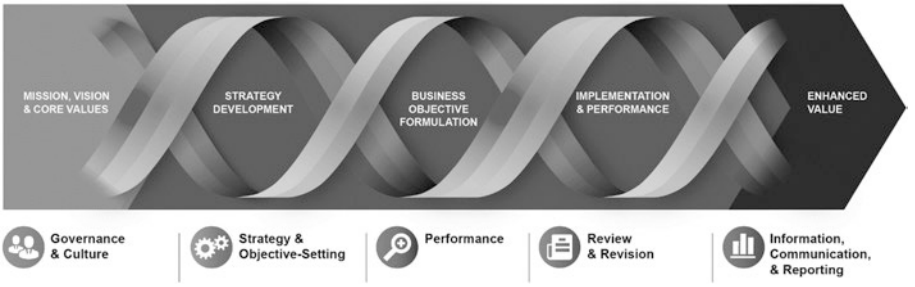

Fig. 22.4 Enterprise risk management. (Source: © 2017 COSO Enterprise Risk Management Framework. All rights reserved. Used by permission)

- *Review and Revision*: To review the risks and improve the ERM process
- *Information, Communication, and Reporting*: Where the risks and activities are communicated

Energy-related ERM concerns include the long-term availability of resources and the global impact of its emissions. The changing climate is already affecting the supply chain. It's well known that changes in rainfall and temperatures are shifting the agricultural source of chocolate and coffee. How should Starbucks, Nestlé, and other food and beverage companies adapt to these changes that will happen in the next 20 years? The number of billion-dollar climate-related natural disasters is on the rise. How do corporations protect their physical assets and production line from being a casualty of the next hurricane, superstorm, or heat wave?

A major challenge is that climate change is a grand macro-statement that can be devoid of local ecosystems. Yes, it's well known that a 2 °C rise in average global temperatures will cause trillions of dollars of losses, but *which* company site is in danger and *what* financial investments should be made today? Of the hundreds of capital projects being evaluated, and the thousands that were implemented in the past 30 years, *which* decisions are the ones that we should pay attention to? When decision feedback loops are decades long, it is hard to know what was the actual culprit.

What it's good for: ERM looks at large, unbounded problems, well suited to analyze global trends in climate and energy. However, connecting these trends to daily operations is still a challenge.

Sustainability Risk Management

What Is Our Impact on the World?

The sustainability profession began within marketing and communications functions with the responsibility for drafting corporate social responsibility (CSR) reports. These voluntary documents are used to disclose company ESG metrics and activities to the public. Usually following **Global Reporting Initiative** (GRI) standards, sustainability professionals gather and compile data from across the organization.

Energy is one of many environmental indicators to be reported. The GRI also asks for the **Carbon Inventory: Scope 1, 2, and** 3, materials flow, water, emissions, biodiversity, and environmental compliance. Sustainability needs to interact with many divisions, operations, real estate, legal, facilities, product line managers, and so on.

This broad interaction across an organization creates a few challenges and opportunities. Organizationally, the sustainability function can be housed anywhere. The responsibility for drafting the reports can now be found in operations, finance, and even legal departments. In some organizations, the broad-reaching nature of sustainability has given it a unique position to use non-financial indicators for strategy and risks, culminating in the chief sustainability officer in joining the C-suite.

Materiality is an accounting concept relating to the quality of being relevant. Generically speaking, information is material if its omission or misstatement may influence a decision. Within sustainability, material indicators are those that may influence stakeholder decisions based on economic, environmental, and social impacts. One decision-making tool is the materiality matrix, included in many CSR reports. This visualization depicts the factors that impact a stakeholder's decision in the company against the actual impact the decision has on the environment. They are customized per company, so a financial services organization may prioritize ethical behavior and data privacy, while a power-plant operations company may focus on safety of facility and emissions of fuel supply (Fig. 22.5).

As one can see, stakeholders may be basing their decision on different non-financial indicators, making defining materiality a challenge. For instance, financial materiality may focus on the business model or risks associated with raising capital, while environmental materiality may claim any and all climate-related exposures to be relevant information. Still others may let the corporation define relevant issues to disclose based on their own context.

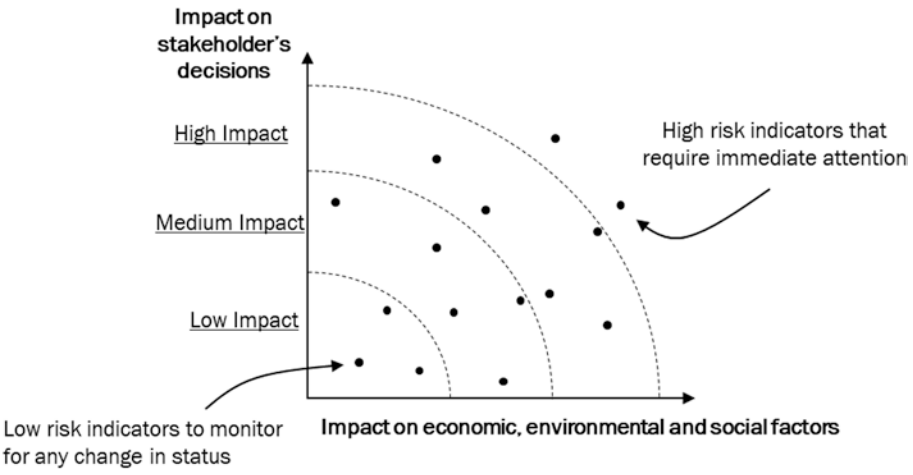

Fig. 22.5 Sustainability risk management. (Source: Author's creation)

Because of the different viewpoints on materiality, one recent best practice is to create multiple materiality matrixes for different stakeholder. Investors protecting their long-term financial returns may want to know a corporation's resiliency plan to climate change. Customers may care about the carbon footprint of the product and want to see emissions data. Employees may want to know about educational opportunities and ethics of the management team as factors of deciding to stay for a long-term career.

What it's good for: Sustainability management can provide contextual and interpretive reports on non-financial indicators that can deepen knowledge of organizational health. However, if used poorly, they can come across as confusing and distracting. When used well, they can enhance ERM and create lasting systems change.

Environmental Health Safety and Sustainability

Are We Operating Well and Safely?

Environmental, health, and safety (EHS) professionals are involved with internal processes to meet environmental regulations and reduce employee injury. They seek to identify possible hazards and violations, aiming to reduce and eliminate them. Various regulatory bodies, such as the US Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA) within the Department of Labor, are responsible for setting compliance rules. This is traditionally an operations responsibility and resides under the COO.

Environmental performance improvement contemplates much more than simply surpassing regulatory compliance criteria. It further aims to reduce operational risks (e.g., avoiding major incidents such as the Exxon Valdez oil spill), improve the corporate culture for environmental protection and performance, and increase employee awareness and competence for applying environmental controls. These roles focused on improving the company's energy and environmental impact on the world.

Meanwhile, the sustainability functions were reporting to customers the carbon footprint of the products they purchase, a downstream concern. To do so appropriately, a company needs to know the carbon footprint of their upstream materials suppliers. This made a natural collaboration opportunity creating EHS and Sustainability (EHS&S). This gave better insights into the whole supply chain, addressing issues that contribute to the cumulative environmental footprint of the organization (Fig. 22.6).

One tool for achieving EHS&S goals is the ISO 14000 set of international standards for environmental management. The ISO 14001 in particular lays

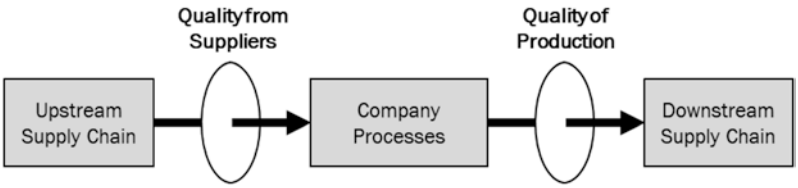

Fig. 22.6 Environmental health safety and sustainability. (Source: Author's creation)

out the requirements for an enterprise construct that systematically identifies, characterizes, controls, checks, and evaluates the ongoing environmental consequences of processes. Through the recursive application of the resulting systemic discipline, the enterprise can achieve continual improvement of the system in order to effect environmental improvements.

A company implementing the management system may opt for third-party system certification from an accredited certification body that signifies its conformity to the requirements of the ISO 14001 standard. The certification represents a credible affirmation that the system has been diligently structured and implemented; it is not a declaration that all regulatory requirements have been met. Regulatory compliance is usually checked through a separate exercise employing appropriately skilled auditors for carrying it out.

EHS&S is a natural home for total life-cycle cost analysis, as it captures the upstream costs and corporate value-add into a product. Companies quickly realized that they could influence the upstream supply by changing their procurement policies and practices. Large organizations are leveraging their buying power by requiring suppliers conform to ISO 14000 or other environmental specifications if they wish to continue being suppliers. To downstream customers, products with a lower environmental footprint are market differentiators. Marketing and communications can then utilize the same data set to advertise for responsible production as a competitive advantage.

Although EHS&S and operations are where the sustainability implementation is done, from a corporate point of view, each individual measure taken may seem insignificant. Yet under the philosophy of **Incrementalism**, the accumulation of many small changes makes a difference. Unfortunately, during corporate strategy and decision-making, these small changes run the risk of being value-engineered out as individually inessential. One needs to keep in mind that when viewed in aggregate, they improve the entire system.

What it's good for: EHS&S is where the implementation of sustainability within operational processes takes place. It is the execution arm that results in sustainability outcomes.

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23

External ESG Reporting Frameworks

This chapter is a summary and review of several common reporting frameworks for environmental, social, and governance (ESG) factors. These frameworks can be used as structures for corporate social responsibility (CSR) reports, financial filings of the annual 10-K report to the SEC, or other supplementary reporting to customers and investors.

Financial accounting history is several thousands of years old, developed by the Babylonians, along with writing and counting, as a way of tracking, recording, and auditing transactions for taxation purposes. Decision-making tools that utilize financial data are only several hundreds of years old. In comparison, ESG indicators are merely a few decades old, and although there is a consolidation of methodologies, there is yet to be a universally standard format for data presentment. Decision-making tools based on ESG data are still in their infancy.

The common intention of ESG reporting is to disclose information to investors that is material to their investment decisions. Yet materiality is defined differently by various standards-setting organizations. Therefore, to understand the purpose of a reporting framework, one needs to understand the decision it is designed to support, the question it is trying to answer, and the problem it is trying to solve. For a corporation, in picking which reporting framework to use, it needs to ask itself, *Who do you report to and why?*

To summarize the reporting methodologies discussed in this chapter,

- **Triple Bottom Line** evolved from total-cost and lifecycle cost accounting.
- **UN SDGs** align initiatives to the 17 goals set by the UN to be achieved by 2030.

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- **Environmental** P&L helps identify operations and supply-chain risks.
- GRI grew out of a need to standardize disparate environmental reporting practices.
- SASB integrates sustainability metrics into existing financial compliance filings.
- TCFD helps the financial sector account for climate-related risks in their portfolios.
- **Integrated Reporting** is a philosophy of how to holistically disclose a company's societal impact and footprint.

Regardless of their origin, ESG frameworks are voluntary and encourage good behavior. All of them are customizable to a certain extent. Some are highly adaptable to emphasize contextual information, while others are more standardized to encourage comparability. Yet there are enough differences that it spawns a new challenge: When most everything is customized and unique, how does one compare across companies or industries? Depending on how a company defines its risks, even multi-year reports might not be comparable for trend analysis.

Why this chapter is important: Energy strategists need to know how their investors are demanding energy and climate data. This will help in the selection of a reporting framework, inform the metrics systems needed, and support the drafting of the report itself. Furthermore, energy strategists may be called upon to read, analyze, and give their interpretations of ESG reports of others organizations for insights and best practices.

Triple Bottom Line

The triple bottom line (TBL) of *people, profit, planet* is a popular shorthand for sustainable development. In 1987, the Brundtland Commission of the United Nations defined sustainable development as those that meet the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development and Brundtland 1987).

Sustainability expert John Elkington applied accounting principles to the definition. Following income statement principles, he stacked social, economic, and environmental bottom lines in that order. As Elkington states, "Society depends on the economy, the economy depends on the global eco-

system, whose health represents the ultimate bottom line." Thus was born the triple bottom line metaphor (1999).

TBL is a form of full-cost accounting as it traces direct costs and allocates indirect costs. Each capital is subsequently broken down into further categories with metrics that can be tracked:

- *Social Capital (People)*: Such as society's public health, education, and skills. TBL seeks to benefit many stakeholders and not exploit any groups.
- *Economic Capital (Profit)*: Financial metrics, such as value of assets, profits, and revenues. Financial performance is an important factor for sustaining corporate viability.
- *Natural Capital (Planet)*: Environmental and ecosystem health, for reducing ecological footprint, such as waste, and also destructive practices, such as overfishing.

Companies that follow TBL usually supplement their financial reporting (a compliance requirement) with CSR reports that describe metrics and impact on social and natural capitals.

What it's good for: The triple bottom line has become the shorthand for businesses to talk about sustainability. It is a simple and easy-to-understand concept. A proper TBL analysis can become very detailed and include many metrics (Fig. 23.1).

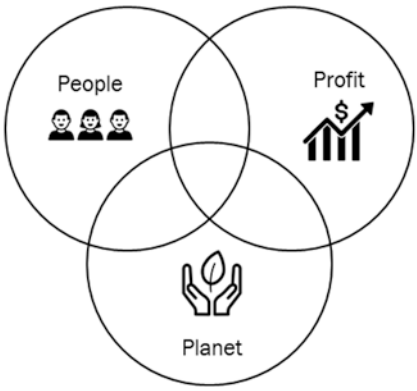

Fig. 23.1 Triple bottom line. (Source: Author's creation)

UN Sustainability Development Goals

The United Nations Sustainable Development Goals (SDGs) are 17 goals,[1] adopted in 2015 by the UN General Assembly to be achieved by 2030. They are the successors to the eight Millennium Development Goals (MDGs), established in 2000 for the year 2015.

The SDGs were developed in conjunction with hundreds of global stakeholders and are interdependent by design. They acknowledge that many of these global social outcomes cannot be achieved by focusing on a single category; rather, progress needs to be made holistically in conjunction and collaboration with others. Indeed, this book intersects at least six of the SDGs: (6) Clean Water, (7) Affordable Clean Energy, (9) Industry, Innovation and Infrastructure, (11) Sustainable Cities and Communities, (12) Responsible Consumption and Production, and (13) Climate Action. However, this strength is also its weakness. The SDGs are criticized for being too broad and difficult to measure.

The UN and think tanks have estimated that it will cost $4 trillion per year to be able to achieve these goals, far beyond the capabilities of government or philanthropic efforts alone. By including the private market as stakeholders, it also enables the $200+ trillion in annual private capital assets to be invested into achieving the goals (Madsbjerg 2017).

What it's used for: Although not specifically a reporting framework, the terminology is used frequently to communicate the purpose or goals of an initiative. Many initiatives, activities, and studies are taken using the SDG goals (Fig. 23.2).

Environmental P&L

The environmental profit and loss (EP&L) was pioneered by Puma in 2010 as a way of putting a monetary value onto the environmental risks in their supply chain. It had two benefits. First, in examining the environmental impacts of their upstream suppliers, Puma was able to identify and reduce costs and risks of those resource needs. Second, Puma gained a competitive advantage in the market with new product innovations. These products were not only price competitive, they also gave environmentally conscious customers transparency into the impact of their purchases.

[1] General Assembly resolution 70/1, Transforming our world: the 2030 Agenda for Sustainable Development A/RES/70/1 (21 October 2015), available from https://undocs.org/en/A/RES/70/1

Fig. 23.2 UN Sustainable Development Goals (SDGs). (Source: Reprint with permission from: https://www.un.org/sustainabledevelopment/)

Kering, the parent company of Puma, has since released its methodology open source (Kering 2016).

1. *Decide what to measure*: Identify the metrics to include key elements of the business and their impact on the supply chain. Kering created five tiers of their supply chain:
   (a) Tier 0: Direct operations in the stores, warehouses, and offices.
   (b) Tier 1: Final assembly of the finished product.
   (c) Tier 2: Manufacturing of the components.
   (d) Tier 3: Processing of raw materials to be used in manufacturing.
   (e) Tier 4: The raw material production.
2. *Map the supply chain*: Identify the suppliers operating within each tier.
3. *Identify priority data*: Identify data that can be collected across the entire supply chain.
4. *Collect primary data*: Collect environmental and non-environmental data from suppliers.
5. *Collect secondary data*: Supplement the data with industry-wide sources.
6. *Determine the monetary value of the data*: Analyze costs, environmental benefits, and impact on human well-being.
7. *Calculate and analyze the results*: Consolidate the results to obtain an overview of the environmental and human impact.

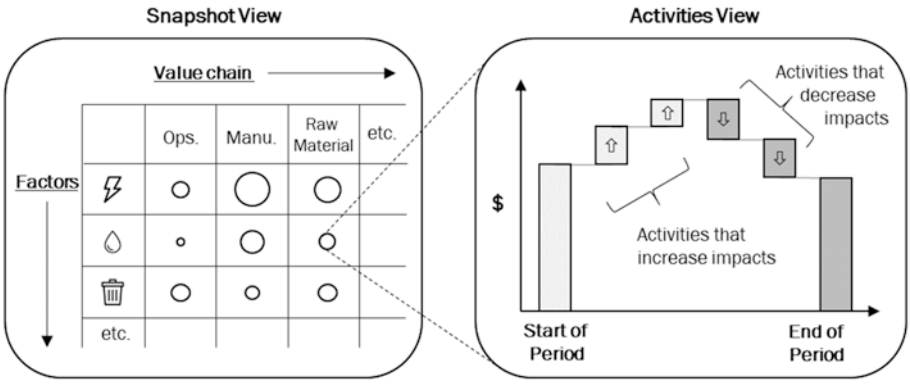

Fig. 23.3 Environmental profit and loss. (Source: Author's creation based on Kering (2016, July 9). Accounting for Environmental Benefits in the Environmental Profit and Loss. Retrieved from https://naturalcapitalcoalition.org/accounting-for-environmental-benefits-in-the-environmental-profit-and-loss/)

Two common visualizations are the matrix for a snapshot of impact and a waterfall chart to depict activities that change the impact. The vertical component of the matrix lists multiple environmental factors, and the horizontal component describes the steps in the value chain. The impact of that intersection is represented by the size of the circle. Each circle can then be expanded to examine its constituent activities in a waterfall diagram (Fig. 23.3).

What it's good for: EP&L is a great way to manage the impact of operations, production, and supply chain. It evaluates environmental indicators within the context of the financials. Investors and customers can see how managerial decision-making is being influenced by non-financial indicators and what the executives are doing to improve the metrics. Executives have a rigorous tool to manage non-financial risks in a transparent manner.

Global Reporting Initiative

The Global Reporting Initiative (GRI) is a worldwide network, formed in 1997, that grew out of a need to standardize sustainability reporting. After the Brundtland Report, many corporates and nonprofits started paying attention to environmental indicators but lacked consensus of what to disclose and to whom. The Coalition for Environmentally Responsible Economics (CERES), jointly with the Tellus Institute and support from the UN Environment Programme, founded the GRI organization in 1997 as a way to standardize environmental reporting. It has since been widely adopted worldwide and is considered the standard for CSR reporting.

It released the first version of the guidelines in 2000 after consultation with global stakeholder groups and has since maintained its multi-stakeholder approach to environmental metrics. A stakeholder council of up to 50 individuals are elected from United Nations–defined regions and represent the core constituencies of the GRI network: business, civil society, investment institutions, labor, and mediating institutions. The standards are set by the Global Sustainability Standards Board that functions separately from GRI's operations and management.

The roots of GRI reporting are grounded in the ten CERES principles of environmental, social, and financial investing (CERES 2001):

1. Protection of the biosphere
2. Sustainable use of natural resources
3. Reduction and disposal of wastes
4. Energy conservation
5. Risk reduction
6. Safe products and services
7. Environmental restoration
8. Informing the public
9. Management commitment
10. Audits and reports

Structurally, the GRI is modular, making it easy to adapt to an organization's context and needs. It is broken down into the following components (Global Reporting Initiative n.d.):

- *Foundation*: The principles of GRI and the reporting framework.
- *General disclosures*: Basic information of business name, locations, markets served, and so forth.
- *Management approaches*: How management determines materiality and what to disclose.
- *Economic*: Such as economic performance, procurement, and anti-corruption practices.
- *Environmental*: Such as energy, water, emissions, and biodiversity.
- *Social*: Such as diversity, nondiscrimination, and labor relations.

What it's good for: The GRI is a common, well-understood, and comprehensive format for ESG reporting. Its structure drives corporate behaviors to improve those metrics. For readers and analysts, it clarifies where to look for what piece of information (Fig. 23.4).

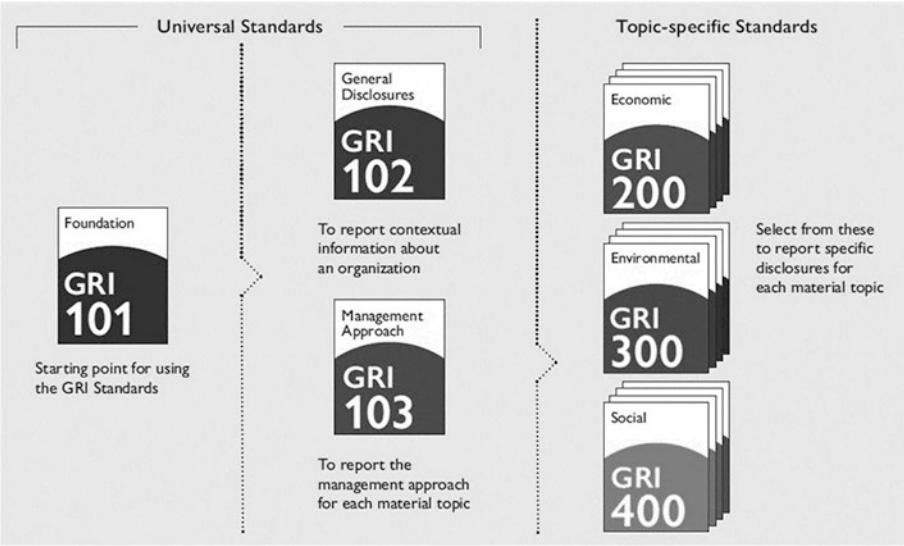

Fig. 23.4 Global Reporting Initiative. (Source: Reprinted with permission from the Global Reporting Initiative (GRI), the independent international organization—headquartered in Amsterdam, with regional offices around the world—that helps businesses, governments, and other organizations understand and communicate their sustainability impacts)

Sustainability Accounting Standards Board

The Sustainability Accounting Standards Board (SASB) was created in 2011, and grew out of the goal to integrate sustainability standards into existing financial systems (Sustainability Accounting Standards Board n.d.). It was driven by investors and analysts' need to compare companies with a sector on their sustainability metrics. Unlike the GRI, which is a stand-alone report, SASB advocates integration of its standards into the Form 10-K annual report. SASB considers sustainability materiality to be a financially material concern, one that **Financial Risk Management** departments can disclose in their annual reports.

First, SASB considers five major categories in the universe of ESG issues that may be material to financial concerns. Within the five categories are the 26 general issues.

1. *Environment*: Including climate change risks, energy, water, carbon, and waste concerns.
2. *Social capital*: Such as customer health, ethical advertising, community development, and access to services.

3. *Human capital*: For example, diversity and equal opportunity, employee health, compensation, and recruitment.
4. *Business model and innovation*: Product life cycle, packaging, pricing, safety, and so forth.
5. *Leadership and governance*: Such as regulatory, policy, board structure, and compensation.

Second, SASB acknowledges that different industry segments will be exposed to different risks. For instance, the mineral processing sector needs to be concerned with their high exposure to GHG emissions, while the financial sector needs to pay close attention to business ethics issues and selling practices. The Sustainable Industry Classification System (SICS®) categorizes all public companies into one of its 79 classifications based on common risk exposures. Unlike traditional industry classifications that are created based on the supply chain, SICS® groups sectors are based on resource intensity and sustainability impacts. Thus, "Infrastructure" companies include electric utilities and real estate, two sectors not commonly grouped together.

The two factors are synthesized in the Materiality Map®, which depicts what indicators are relevant to which sectors. For every indicator, SASB then defines the metrics system, units, and reporting requirements. This creates a heavily metrics-driven, highly traceable, and comparable accounting standard. An excerpt of the Materiality Map(R) is presented in Fig. 23.5.

What it's good for: It delves into a company's internal management of environmental risks to create comparable metrics within an industry segment. In this way, corporations can quantify the financial risks of ESG indicators within their organizations and communicate them to global asset owners and asset managers.

Task Force on Climate-related Financial Disclosures

The Task Force on Climate-related Financial Disclosures (TCFD) was developed in 2015 to understand how the financial sector can take into account climate-related issues. It was developed by the Financial Stability Board at the request of G20 finance ministers and central bank governors.

Institutional investors, such as banks, insurance companies, and pension funds, sit at the top of the investment supply chain, managing trillions of dollars of global assets. They needed to understand their long-term exposure to climate-related risks that were buried deep within their portfolio. Furthermore,

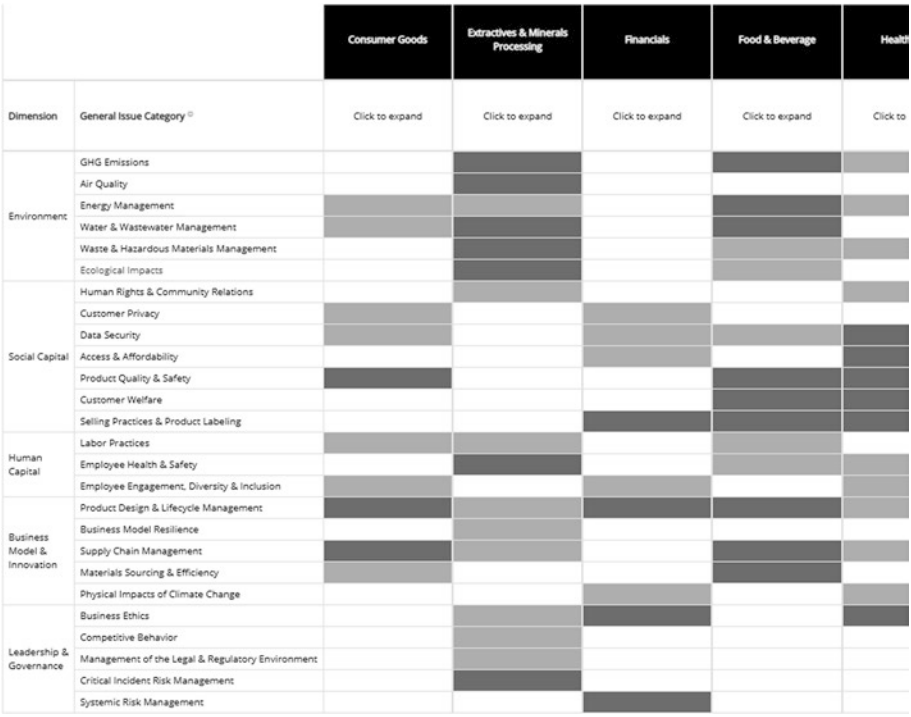

Fig. 23.5 An excerpt of the Materiality Map(R) from the Sustainability Accounting Standards Board (SASB). (Source: Reprint with permission. For a full map, please visit https://materiality.sasb.org/)

knowing the risks informs the development of new and innovative financial products. The intention was to create a reporting framework that discloses relevant information within other filings or reports, not to be a stand-alone document.

TCFD recognizes three broad categories where climate affects financial performance:

- *Transition risks*: The transition to a lower-carbon economy requires systematic changes required in policy, legal, technology, and markets. How is an organization exposed to these risks as the economy transitions its fuel sources?
- *Physical risks*: These can be long-term and chronic, such as the change in global water availability causing a shift in the agricultural supply chain and transportation need. They can also be short-term events, such as disruptions caused by an expected increase in billion-dollar weather-related natural disasters.

- *Opportunities*: New products services, markets, and technologies will be needed to serve the low-carbon and low-emission targets. For instance, new technologies are needed that are more efficient in their usage and management of resources. New financing mechanisms are needed for credit, lending, and insurance underwriting to incentivize the development of climate-resilient products.

TCFD recommends four broad topics for disclosure to investors in reporting climate risks:

- *Governance*: How an organization is governed and organized around climate-related risks and opportunities?
- *Strategy*: What are the impacts, actual and potential, that are material to an organization's business, strategy, and financial planning?
- *Risk management*: How does the organization identify, assess, and manage these risks?
- *Metrics and targets*: What metrics and targets are used to access these factors?

What it's good for: As a financial tool, it seeks to understand how financial assets are exposed to long-term climate risks through the ownership and operation of physical assets. It can also help with new financial services innovations that are climate-resilient (Fig. 23.6).

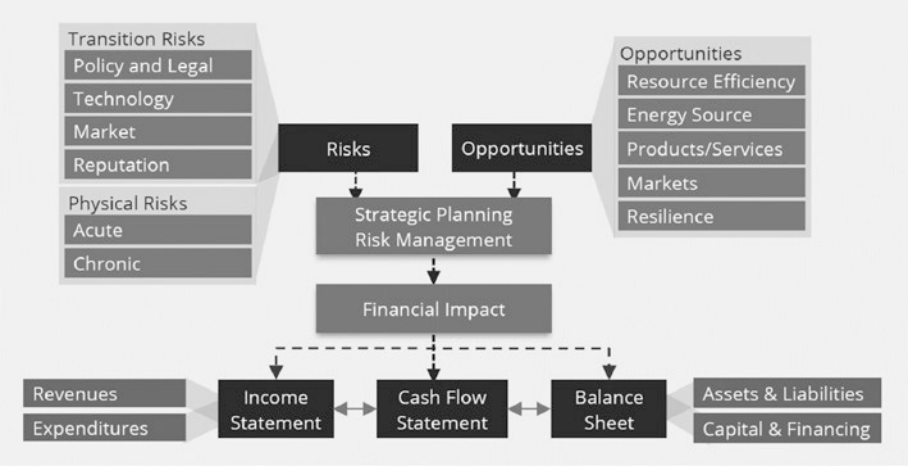

Fig. 23.6 Task Force on Climate-related Financial Disclosures (TFCD). (Source: Task Force on Climate-related Financial Disclosures. (2017). *Recommendations of the Task Force on Climate-related Financial Disclosures*. Reprint with permission)

Integrated Reporting

The notion of integrating sustainability metrics into corporate reporting originated in South Africa where a private citizen's rights to sustainability is enshrined in the Constitution, stating that "Everyone has the right to have the environment protected, for the benefit of present and future generations."[2] The *King Report of Governance for South Africa 2009* (also known as *King III*), authored by Mervyn King, noted that sustainability was integral to a company's performance and value creation, not just as a risk to be mitigated. Corporate citizens, therefore, need to behave in a similarly responsible manner for the benefit of society (King Committee on Corporate Governance and Institute of Directors (South Africa) 2009). The recommendations were adopted by the Johannesburg Stock Exchange, which required companies in its listings to follow the integrated reporting recommendations of *King III*.

The organization International Integrated Reporting Council (IIRC) was created in 2010 after the Prince of Wales convened global coalition to oversee the creation of an integrated reporting framework. The IIRC considers that financial capital alone was no longer sufficient as the only descriptor of corporate productivity and value creation. The integrated report (IR) does not need to be a stand-along document. The framework can be used to draft any compliance-based report as long as it's written based on the principles outlined by the IIRC.

An integrated report identifies six different capitals that can be consumed, stored, built up, or run down over time. They are (International Integrated Reporting Council 2013) as follows:

- *Financial*: The pool of funds available to an organization, including both debt and equity financing. It is the medium of exchange through which the other capitals are transferred.
- *Manufactured*: Human-created equipment and tools that are needed and used for production activity.
- *Intellectual*: Organizational knowledge such as intellectual property for research and development as well as processes, procedures, and "know how" to get a job done.
- *Human*: An individual's capabilities, competencies, and experiences along with their motivations to innovate, develop, and further an organization's strategy.

[2] The Bill of Rights of the Constitution of the Republic of South African, Section 24 (1996).

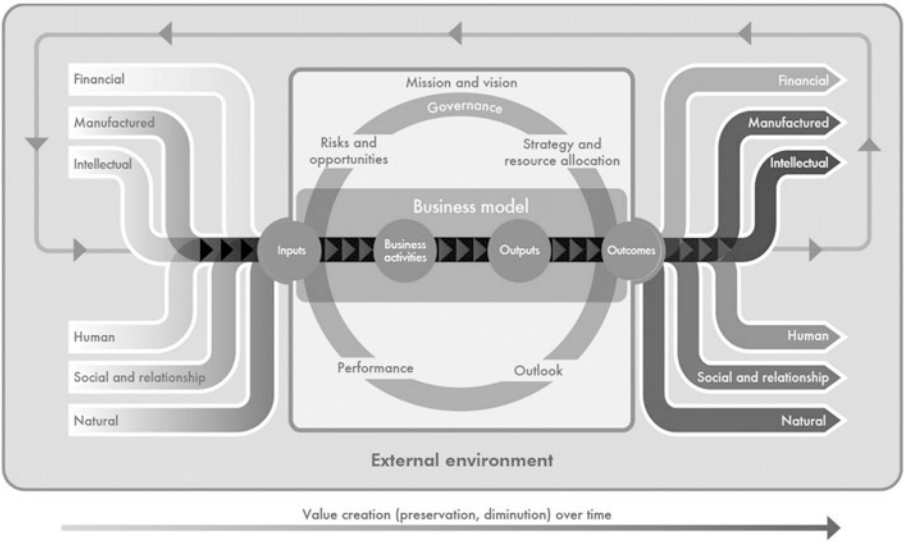

Fig. 23.7 Integrated Reporting. (Source: Reprint with permission from the International Integrated Reporting Council ©)

- *Social and relationships*: The norms, values, and behaviors shared within and among institutions and communities that enhance the individual's ability to share information.
- *Natural*: Renewable and nonrenewable environmental resources and processes that support the past, present, and future prosperity of an organization.

What it's good for: Integrated reporting is a report-writing framework that emphasizes value creation and productivity as opposed to a risk management and mitigation. It can be used to enhance compliance-based financial and/or sustainability reporting (Fig. 23.7).

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Part VI

Epilogue

24

Epilogue: Advice to an Energy Strategist

Strategy is a craft, and frameworks are its tools. Frameworks can be very powerful tools, aligning activities of entire global sectors to achieve an agreed-upon outcome. The **United Nations Sustainable Development Goals** (UN SDGs) have been adopted, referenced, or pursued by countries, businesses, and investors. Schools use them to organize teaching content, and books have been written about how to achieve them. Think tanks have published studies on the trillions of dollars of infrastructure investments needed to achieve them.

Yet frameworks can also be abusive tools, used to hide, ignore, or conveniently overlook critical externalities that threaten the entire system. Many financial players ignore the need for environment improvements simply because they are only compensated to pay attention to the **Financial Statements**. Strategists who are familiar with only a handful of tools may apply those tools to every situation, whether they are the right tool or not. **SWOT** is perhaps the most frequently abused tool, as it's used incorrectly or applied in the wrong circumstances.

When frameworks are used incorrectly, it may be because they are being used to solve the wrong problem. It may be because the problem has changed and the tool is no longer applicable. Or it may also be that the framework was not applied correctly or had disciplined follow-through in its usage. For sure, coming up with the wrong answer is bad enough, but being certain that a wrong answer is the correct one can be dangerous.

Leaders need to use their judgment and wisdom to know which framework to pick, to modify, and, if necessary, when to stop using a framework. It's a constant, dynamic balancing act between many choices. Just because a framework works doesn't mean it's the best tool. Just because a framework has flaws

J. Y. Jia, *The Corporate Energy Strategist's Handbook*,
https://doi.org/10.1007/978-3-030-36838-8_24

doesn't mean it's useless. Don't discount a framework just because it is old. It may contain much wisdom about the system. Don't create something new just because the situation looks different. Perhaps the underlying system has already been described somewhere else. Unfortunately, there is no prescribed way to tell the difference, only the art of knowing what to do based on years of experience. As the statistician George Box once said, "All models are wrong, but some are useful." Similarly, all frameworks in this book are wrong, but many of them may be useful to the leader trying to grapple with unfamiliar, challenging, or critical situations.

Leaders can hone their skills by applying these tools to various situations and becoming familiar with the outcomes. As we stated in the opening of this book, the two hardest parts of problem solving is knowing how to start and knowing when to stop. Start with a problem definition. End when you've reached your predefined metric for success. Military strategists need to know if it's worth capturing a hill. As energy strategists, which problem will be the hill worth taking for you? These three questions may be helpful in the journey:

- Why do you consume energy?
- What if you didn't?
- How could you achieve that goal?

Why Do You Consume Energy?

The Objective of Consuming Energy

We innately understand that our society has benefited from readily available energy. What we seem to have forgotten is whether energy is actually needed to achieve a specific societal benefit. As a result, much of our energy is consumed for no real benefit. Just because something is cheap doesn't mean we should buy a lot of it.

For instance, after Thanksgiving, turkeys are half off at grocery stores. Frequently, there will be a *buy one get one free* sale. Can one save money with lower-cost turkeys? Of course! But buying four turkeys on an impulse just to take advantage of a deal may not save any money. One may have spent more than they've budgeted for food for that week, or one may be eating turkey sandwiches for a long, long time. If the turkey spoils before being eaten, the "saved" money becomes wasted.

Likewise, energy is cheap, frequently only 1–5% of a business's total operating budget. Overspending on energy actualizes itself in several forms. Historically, lighting design tended to overestimate the amount of light

needed in the workplace. Modern lighting systems may use half, if not fewer, light bulbs to provide the same amount of illumination, substantially cutting bills. Likewise, HVAC systems tend to be sized far larger than they are actually needed. This is done because it's cheaper to oversize an original system than it is to upgrade a small system into a larger system. Many HVAC systems are also designed to run only at full capacity regardless of the number of people in the building. Yet one can provide the same level of comfort at half the energy cost. We can afford to be wasteful because energy is so cheap.

In all of these examples, the level of service the end user experiences is the same but the resource used to achieve it is different. With either one or four turkeys, no one went hungry, but the latter may generate a lot more waste. In the building, no worker is going to complain about being too well-lit or being too comfortable, yet with oversized system, energy is wasted. In both examples, one has much room to optimize the resources needed to deliver on that service.

Deciding on the level of service needed is common when making decisions in other parts of one's business. Every business requires energy. The decisions on equipment purchases and retrofits should reflect the utilization of the system. It will have an impact on energy expenditures. To control one's energy spend, start by determining the objective. Then tailor the energy need to that objective. As a result, a business can spend the right amount of energy. For a family that loves turkey sandwiches, coming home with four turkeys may have been part of the plan. For those being opportunistic, it may end with wasted food.

What If You Didn't?

The Business of Planting Trees

A business sustains its own operations by making money. Revenues must be greater than expenses, and a successful business is able to repeat this year over year. To do so, it must manage risks to both sustain and grow revenue while controlling and lowering expenses. Businesses manage revenue-side risks by erecting competitive barriers to entry, investing in marketing, and training a sales force. They manage expense-side risks by creating rules around fiscal discipline, developing risk-management policies, and buying business continuity insurance.

An ecosystem sustains itself with a constant influx of resources. Moss needs moist soil and fallen biomass to grow, herbivores need a steady supply of fauna to forage, and omnivores need a large supply of prey for the hunt. Large ecosystems have also learned to manage the risks of natural disasters, and biology has developed innovative means to ensure resiliency. Wildfires in redwood forests clear out low-level brush, removing resource competition for the more mature trees. Monarch butterflies poison the birds that eat them, protecting themselves from harm. Fish swim in schools to confuse their prey.

A sustainable business is merely one that makes money by giving back to the environment. This might seem strange but the concept is, in fact, many hundreds of years old. The medieval colleges of Oxford and Cambridge built their buildings out of stone and trimmed the inside of the rooms with wood. The architects immediately realized they faced a sustainability problem. The stone walls would last for a millennium, but the wood trims had a lifespan of a mere 150 years. To solve this issue, the colleges bought land and planted forests. By the time the trees matured, the wood within the colleges would be in need of replacing, and new trees would be planted, continuing the cycle.

Some of the challenges we face today exist because the risk cycles faced by the environment do not match the deliverable-driven risk cycles of the business world. After all, the environment works on a generational timescale, while businesses care about hitting next quarter's targets. But if businesses planned for longer cycles, they would be better matched to environmental needs as well. There are several century-old companies that plan many decades into the future, and it is no surprise that each of their plans calls for planting trees today. Perhaps if all businesses operated on a 150-year plan, we'd all be planting trees too.

How Could You Achieve That Goal?

Inventing Old Technologies

Once I was approached by an entrepreneur with a great idea. She was trying to convince a large manufacturer of consumer products to change the way it sold liquid laundry detergent. Rather than selling a new plastic container each time, she wanted them to sell a reusable container that the consumer could refill with the liquid. Her financial model predicted many millions of dollars in savings with reduced consumption of plastics. She was very excited by her new business model, and the large consumer product company was interested in her idea.

I thought this was a great idea too and that, if successful, it could have a large and meaningful impact. What struck me was that it is, in fact, a very old idea. Before the invention of cheap plastic buckets, say 200 years ago, it was very standard to bring one's own containers to a store and buy goods in bulk. Without realizing it, she was excitedly advocating for an old consumer behavior as if it was new.

Here is a good general rule: If a new technology promotes a common behavior from 200 years ago, then it will probably result in reduced energy consumption. Energy consumption rises when a new technology fundamentally depends on readily accessible energy for its basic functionality. Conversely, energy consumption will decrease if the technology reinvents a historical best-practice that can deliver value without consuming any energy at all.

Last Words: Two Challenges

I leave the reader with two challenges—ones that I faced while writing this book. When starting on the project, I accumulated many frameworks for consideration to be included. I immediately had to decide which ones to keep. Not all frameworks made the final cut. There are entire families of frameworks, for product management, life cycle costs, process controls, and many others, that are excluded.

> My first challenge to the reader: ***What else is out there that may not have been described by this book?*** Find, discover, and learn other families of frameworks that are suited for your work.

Next, I had to decide how to present them in a logical order. Through experimentation with different groupings, new connections between frameworks emerged. Some, such as the **Carbon Resource Prioritizations**, revealed themselves as logical combinations of others being described in the book. This became an example of **Meso-Innovations** in-action, that is, combining ideas from two different sectors to bring out new ideas.

> My second challenge to the reader: ***how many other frameworks can you discover by recombining the frameworks described in this book?*** Take the initiative to improve on this book and find even more powerful tools to manage the nexus of finance, energy, and carbon than those described here.

Together, we can make the world a better place.
Happy Frameworking!

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[1] Note: Page numbers followed by 'n' refer to notes.

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