Establishing a Carbon Emissions Reduction Target and Action Plan for Philadelphia Macaroni Company Based on the 1.5 Degree Challenge

By

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EXECUTIVE SUMMARY

Project Background

Global food systems account for over 33% of global anthropogenic greenhouse gas emissions, according to new research from Nature Food [43]. The Intergovernmental Panel on Climate Change (IPCC) Special Report on Climate Change and Land recently attributed 11 to 19 billion tonnes of annual emissions to food systems [1]. Reducing greenhouse gas (GHG) emissions from the global food industry has become a top priority for industry leaders and stakeholders due to the industry's significant environmental impact. Global food industry leaders are setting Science-Based Targets Initiative (SBTi) targets for company emissions. They have published goals to reduce operational waste, address operational water risks, and commit to sustainably sourced ingredients [2]. Many companies hope to achieve these goals through internal and external actions, including engaging suppliers to reduce the overall environmental impact of the products of these companies. Our client, Philadelphia Macaroni Company (PMC), is committed to reducing its negative impact on the planet while simultaneously assisting its customers, large food industry players, in their pursuit of sustainable development. Although PMC is a private company and is therefore not required to publicly disclose sustainability-related performance, PMC recognizes that this effort provides them with a competitive advantage and solidifies their position as a preferred supplier to their customers.

Objective

The primary goal of our Master's Project is to help our client develop climate targets that align with a 1.5 degree Celsius trajectory. Our objective is to propose strategies geared towards achieving these climate targets. The climate targets that we developed revolve around greenhouse gas emissions, renewable energy, packaging, water management, waste reduction, and wheat production, which have been identified by PMC as the pivotal areas of concern.

Report Contents

This report will walk readers through the climate targets we recommend PMC work towards to align with the 1.5 degree Celsius trajectory and strategies to achieve the targets they've identified as priorities. We begin by introducing the need to address carbon footprint within the corporate sustainability world. The paper then details the client, relevant industry background, and the current sustainability initiatives that PMC is undertaking. Next, we delve into the objectives of this Master's Project, followed by examining the materials and methodology utilized to accomplish our project objectives, targets and strategies. We then highlight the targets we recommend to PMC and focus on the strategies we recommend PMC leverage to achieve its priority targets. Lastly, we provide a discussion on the key findings of our market research, exploring the limitations of our project approach, next steps for PMC to assess, and key project takeaways.

Targets Developed
By 2030

- *Carbon emissions:* Report on Scopes 1 & 2 publicly
- *Carbon emissions:* Reduce Scopes 1 & 2 by a minimum of 25% compared to baseline 2016 numbers
- *Packaging*: Use 100% recyclable, reusable or compostable industrial packaging
- *Sustainable Sourcing:* Source 3 million bushels of certified-sustainable or regeneratively grown wheat
- *Renewable energy:* Use 20% renewable electricity
- *Water management:* Reduce water use by a minimum of 20% compared to baseline 2016 numbers
- *Waste management:* Reduce waste sent to landfills by a minimum of 20% compared to baseline 2016 numbers

By 2050

- *Carbon emissions:* Net zero greenhouse gas emissions across Scopes 1 & 2 and the entire global supply chain (Scope 3)

The Client: Philadelphia Macaroni Company
Philadelphia Macaroni Company (PMC) is fifth-generation, family-owned business-to-business (B2B) enterprise specializing in the production of dried, frozen, and specialty pasta for a global clientele. PMC's operations include a vertically integrated grain milling division known as Minot Milling. PMC serves as a crucial supplier in the value chain for leading brands within the food industry.

Acknowledgments
We extend our gratitude to the Philadelphia Macaroni Company for granting us the chance to collaborate with them. Specifically, we would like to thank Nicole Masnicak, who works at PMC and served as our primary contact at PMC, for her insights, guidance, and patience. We would also like to thank Duke Professor Holly Emerson, who served as our Advisor throughout this Master's Project, for taking the time to share her knowledge with us. Lastly, we would like to thank Abbey Sheehy, who served as the Master's Projects Program Coordinator and clearly outlined project expectations and deadlines.

Confidentiality Disclaimer
Our team signed a non-disclosure agreement with Philadelphia Macaroni Company. As a result of this agreement, we have redacted the names of competitors and customers as PMC found appropriate. In addition, we have generalized information related to PMC in line with PMC's expectations.

ACRONYMS

- **CO2** - Carbon Dioxide
- **CCF** - Corporate Carbon Footprint
- **CSR** - Corporate Social Responsibility
- **CH4** - Methane
- **GHG** - Greenhouse Gas
- **N2O** - Nitrous Oxide
- **NGO**- Non-Governmental Organization
- **PMC** – Philadelphia Macaroni Company
- **R&D** – Research and Development
- **SBTi** - Science Based Targets initiative
- **SASB** - Sustainability Accounting Standards Board
- **IPCC** - Intergovernmental Panel on Climate Change
- **HVAC/HW** - Heating, Ventilation, Air Conditioning and Hot-Water Systems
- **ESP** - Energy Savings Percentage
- **ENV** - Envelope
- **RTC** - Renewable Thermal Collaborative
- **RNG** - Renewable Natural Gas
- **KPIs** - Key Performance Indicators
- **mt** - Metric Tonnes
- **kWh** - Kilowatt Hour

GLOSSARY OF PROJECT SPECIFIC DEFINITIONS

In the realm of Corporate Social Responsibility (CSR), it's common for companies to interpret certain terms in their own ways. The explanations provided here reflect our team's understanding and application of frequently encountered CSR concepts.

- **Customer** – Specifically for this project, we identify a customer as a food manufacturer that procures pasta products from the Philadelphia Macaroni Company.

- **Environmental Footprint** – This term denotes the impact of a company's activities on the environment, concentrating on aspects like water usage, waste generation, greenhouse gas emissions, and the procurement of sustainably farmed agricultural products.

- **Greenhouse Gasses (GHG)** - Our evaluation primarily measures emissions of CO2, N2O, and CH4.

- **Stakeholder** – At the Philadelphia Macaroni Company, key stakeholders include suppliers of essential ingredients, employees, the leadership team, and customers. As a privately-owned entity, the company is not influenced by investor concerns or priorities.

- **Sustainable Agriculture** – In our pasta production process, wheat serves as the main agricultural ingredient. Our commitment to sustainability is concentrated on adopting and promoting sustainable farming practices in the cultivation of wheat.

- **Waste** – Our study focuses on the Philadelphia Macaroni Company, a supplier to major food manufacturers, specifically examining organic waste generated during pasta production and potential packaging waste from delivering products to customers.

- **CDP** – The CDP is a global non-profit organization that provides environmental reporting frameworks to help companies and cities evaluate and manage their environmental risks, including those related to climate change, water scarcity, and deforestation.

- **Corporate Social Responsibility (CSR)** – A business strategy where companies voluntarily incorporate ethical standards, social concerns, and environmental stewardship into their operations. It goes beyond compliance to embrace activities such as sustainable practices, fair labor conditions, and community development, aiming to enhance the quality of life for employees and the broader community.

- **Net Zero** – This goal is pursued by individuals, businesses, organizations, and governments with the aim of balancing the amount of greenhouse gases emitted with those removed from the atmosphere, ultimately reducing net emissions to zero.

- **Science Based Targets initiative (SBTi)** – A partnership between CDP, the UN Global Compact, WRI, and WWF, motivates organizations to set science-based emissions reduction targets consistent with the Paris Agreement's aim to keep global warming below 2°C, ideally at 1.5°C. SBTi offers guidance for aligning reduction strategies with current climate science, promoting sustainable practices and mitigating severe climate effects.

- **Scope 1 Emissions** – The direct greenhouse gas emissions from sources that a company or organization owns or controls, such as fuel combustion in company vehicles and boilers.

- **Scope 2 Emissions** – The indirect greenhouse gasses emitted from the generation of purchased electricity, steam, heat, or cooling that a company consumes. These emissions come from sources not owned or directly controlled by the company.

- **Scope 3 Emissions** – Include all indirect greenhouse gasses emitted along a company's value chain, beyond its direct operations and energy acquisitions. These emissions originate from sources the company does not own or control, such as the manufacture of purchased goods, transport in vehicles not owned by the company, and the usage and disposal of its products. Encompassing both upstream and downstream activities, Scope 3 typically accounts for the largest portion of a company's overall emissions.

- **Sustainability Accounting Standards Board (SASB)** – Now under the International Financial Reporting Standards (IFRS) Foundation, SASB provides guidance for publicly reporting critical sustainability metrics in a financially relevant context. These industry-specific standards aim to inform investors and businesses about the financial implications of sustainability issues.

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INTRODUCTION

Corporate Carbon Footprint

The corporate carbon footprint (CCF), also referred to as the company carbon footprint, pertains to all direct and indirect emissions of greenhouse gasses, particularly carbon dioxide, associated with a company's operations throughout its supply chain over a specified reporting period, typically one year. The methodology and approach adhere to globally acknowledged standards such as ISO 14064, GHG Protocol [8].

The CCF is crucial for assessing greenhouse gas indicators in sustainability reports and for ongoing management of carbon emissions. Understanding the CCF value enables companies to move toward climate neutrality, and its calculation helps identify the most carbon-intensive activities within a company, such as energy. With this information, companies can develop carbon reduction strategies as an integral component of a comprehensive sustainability strategy.

Addressing Corporate Carbon Footprint

Fuel manufacturers were aware of the detrimental effects of emissions as early as the 1970s. In an attempt to deflect criticism, BP collaborated with Ogilvy advertising agency to develop a low-emission diet campaign in 2005 [9]. This initiative resulted in the development of a calculator that could determine the carbon footprint of any individual. Naturally, the carbon footprint that the corporation itself produced was ignored. It shifted accountability from the company to the individuals. However, it also marks the first ever effort made to measure carbon footprint. This is, one may argue, the campaign's redeeming quality. As a first step towards change, it was suggesting that one might compute one's carbon footprint. Although the framework for carbon accounting had been set decades before, it wasn't until recently that companies started to focus on calculating their emissions and working towards reducing their footprint. Recently, environmental sustainability has emerged as the fifth pillar of Carroll's framework. Organizations now confront pressure from both internal and external stakeholders to incorporate environmental considerations into their long-term decision-making processes. Businesses increasingly acknowledge that externalities such as greenhouse gas emissions, increased waste generation, and water degradation can no longer be disregarded, as they affect financial performance and challenge the traditional "business-as-usual" approach. Both customers and consumers share apprehensions about the origin and procurement of the food they ingest, with a growing emphasis on considering the broader environmental consequences of their purchases [10][11]. Noteworthy trends in the food industry present opportunities for individual companies and entire supply chains to transition their operations towards more sustainable practices [12]. Companies are urged to respond proactively to sustainable food trends, spanning from the extraction of raw materials to the consumption of end products, thereby encompassing every facet of their supply chains [13].

Philadelphia Macaroni Company

Philadelphia Macaroni Company (PMC) is a premier producer of dry, frozen, and specialty pasta options, serving industrial, private label, retail, and co-pack clients throughout the United States. Established in 1914 and headquartered in Philadelphia, PMC is a fifth-generation family-owned business celebrated for its commitment to innovative strides within the industry. With pasta manufacturing facilities in New Jersey, North Dakota, Pennsylvania, and Washington, PMC supplies a broad array of short and long pasta varieties to customers worldwide [3]. The combined output of PMC's facilities exceeds 700 million pounds of pasta annually [4]. PMC's products and manufacturing sites adhere to industry quality and safety standards, holding certifications from the British Retail Consortium (BRC), Oregon Tilth, and OU Kosher [5].

PMC operates within the dry pasta manufacturing industry, which has a total worth of $3 billion [6]. This sector is primarily characterized by the dominance of white-flour pasta, noodles, and gluten-free products [7]. Barilla and Ebro, key competitors, jointly hold approximately 30 percent of the market share [7]. Projections suggest that the pasta industry is anticipated to witness a revenue increase of approximately three to five percent over the next five years as markets recover from the impacts of COVID [7].

For PMC to thrive in this competitive sector, it is imperative to secure essential inputs, attain economies of scale, and distinguish their products from rivals [7]. In pursuit of these objectives, PMC is dedicated to championing extensive sustainability initiatives within the organization. This commitment aims to secure competitive advantages over rivals, enhance business efficiency through streamlined supply chain management, demonstrate leadership in corporate social responsibility, reduce their carbon footprint to reach net-zero emissions, and strengthen overall efficiency and reliability within the food industry.

PMC’s Ongoing Sustainability Efforts

PMC has been dedicating their efforts to consistently enhance their environmental impact, reduce their carbon footprint, utilize vertical integration at their mills, and foster relationships with farmers to implement sustainability initiatives. PMC has centered their work around tracking and implementing regenerative and sustainable practices across their farmer base. Several soil salinity programs have been set in place. They have established the groundwork for an integrated Corporate Social Responsibility (CSR) reporting framework, leveraging a specialized "Greenhouse Gas Emissions Inventory Data Collection & Emissions Calculation tool," comprehensive competitor analysis, and thorough assessment of the pasta supply chain. This framework was initially developed by three Duke Master of Environmental Management (MEM) students in 2012. Following this, PMC, in collaboration with Duke students in 2021, furthered their efforts, eventually developing a three-year Corporate Social Responsibility (CSR) action plan. Following the action plan, during the 2022–2023 school year, PMC again partnered with Duke MEM students to develop a carbon emissions footprint calculator for calculating their emissions.

PROJECT OBJECTIVE

The objectives of this project have been outlined below:

- Assist our client in developing climate targets that align with a 1.5 degree Celsius trajectory
- Outline carbon emission reduction strategies to achieve priority targets, including a target focused on renewable energy integration in their operations

MATERIALS AND METHODS

We have divided our project into three phases, as outlined below:

Phase 1: Benchmark against competitors and reconcile with PMC's current efforts to identify environmental targets

In this phase, we will:

- Identify competitors and better understand the landscape in which PMC operates
- Understand competitor environmental targets
- Understand PMC's environmental targets and the reasoning behind these targets
- Reconcile PMC's targets and efforts with those of competitors
- Identify Scope 1 and Scope 2 targets that will help PMC reach 1.5 degrees Celsius

Phase 2: Identify priorities based upon customer demand and low-hanging fruit with high rewards

In this phase, we will:

- Understand customer demand when it comes to PMC's climate targets
- Identify 2 priority targets for PMC (based on customer demand and client ability)

Phase 3: Briefly outline strategies to achieve priority efforts identified in Phase 2
In this phase, we will:

- Suggest ways that PMC could approach reaching these priority targets in an efficient and effective manner

Sources of support include the following:

- Competitor and environmental data from Client
- Additional insight from client into company priorities
- SBTi to understand more about science-based targets
- CDP
- Faculty and others within our networks who are familiar with the food and beverage sector

RESULTS

Climate Targets for PMC

By 2030

- *Carbon emissions:* Report on Scopes 1 & 2 publicly
- *Carbon emissions:* Reduce Scopes 1 & 2 by a minimum of 25% compared to the baseline year of 2016
- *Packaging:* Use 100% recyclable, reusable or compostable industrial packaging
- *Sustainable Sourcing:* Source 3M bushels of certified-sustainable or regeneratively grown wheat
- *Renewable energy:* Use 20% renewable electricity
- *Water management:* Reduce water use by a minimum of 20% compared to baseline 2016 numbers
- *Waste management:* Reduce waste sent to landfills by a minimum of 20% compared to baseline 2016 numbers

By 2050

- *Carbon emissions:* Net zero greenhouse gas emissions across Scopes 1 & 2 and entire global supply chain (Scope 3)

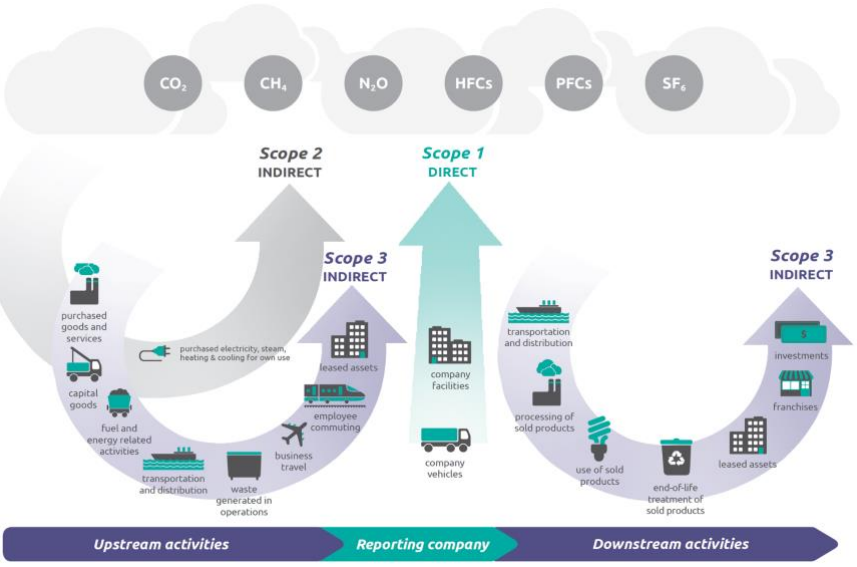

Fig 1: Classifying Scope 1, 2 and 3 emissions [40]

Key Focus Impact Areas Identified
PMC has identified the two targets below as priority targets.

- *Carbon emissions:* Reduce Scopes 1 & 2 by a minimum of 25% compared to baseline 2016 numbers by 2030
- *Renewable energy:* Use 20% renewable electricity by 2030

The reason behind PMC identifying the above targets as key focus areas of impact is that 8 of PMC's competitors have a target of reducing Scopes 1 & 2 by a minimum of 25% compared to baseline numbers by 2030, and these baselines average around the year 2015. In order to remain competitive to customers, PMC sees the importance of reducing their Scopes 1 & 2 emissions accordingly, though 2016 is the earliest year of emissions data that PMC was able to identify. In addition, PMC has been interested in increasing their renewable energy usage and recognizes that both Scopes 1 & 2 and renewable energy are mainstream topics that customers continue to care about deeply and pose questions about.

Strategy Recommendations for the Key Targets

1. ***SCOPE 1: CARBON REDUCTION***

- Replace natural Gas (NG) with Renewable Natural gas (RNG)
- Join RTC - Renewable Thermal Collaborative
- Conduct site-specific ESG assessments for each of PMC's eight facilities to better understand areas of opportunity for each specific site
- Implement metrics to assess the CSR programs in place

2. ***SCOPE 2: ENERGY EFFICIENCY UPDATES***

- Energy-optimize the pasta making process in the Warminster facility, PA
- Post-Extrusion energy savings
- Drying phase energy savings
- Increase demand for short pastas by more heavily marketing
- Apply for Tax Incentives for implementing Energy Efficiency Updates

3. ***SCOPE 3: RENEWABLES INTEGRATION***

- Unbundled PPAs for small offtakers like PMC
- Green Tariffs with Utilities
- Go for a VPPA aggregation - combined offtake projects with PMC's big customers
- On-site Solar

DISCUSSION

Key Observations and Findings with Regard to Project Phase 1

The research reveals a trend among major competitors towards setting ambitious emission reduction targets. These targets encompass both Scopes 1 and 2 emissions, showcasing a growing industry commitment to mitigating environmental impact.

Three of PMC's customers stipulate that their suppliers must report on Scopes 1 and 2 emissions. Additionally, eight of PMC's primary competitors aim to reduce Scopes 1 and 2 emissions by at least 25% compared to a 2016 baseline average. Regarding packaging, six key competitors of PMC aspire to utilize industrial packaging that is 100% recyclable, reusable, or compostable, while one customer mandates the same requirement for its suppliers. Similarly, four key competitors of PMC aim to decrease water usage by a minimum of 20% compared to a 2016 baseline average by 2025, and two competitors intend to reduce landfill waste by at least 20% by the same target year.

All of the above observations have been incorporated into our recommended targets, though some goals that are set to be achieved by 2025 for key competitors have become 2030 goals for PMC, as PMC has been heavily focused on innovation and has a little way to go to catch up with its competitors who have been focused on sustainability these past few years. In addition, PMC data spans back to the year 2016 for emissions, water, and waste, thus we recommend that PMC use a 2016 baseline as opposed to a 2015 baseline.

We also found it extremely valuable to learn what PMC's customers require of its suppliers, which include PMC. By identifying what is required of PMC, we were able to confirm that PMC's priority targets are aligned with what our team felt should be prioritized based upon expectations set for PMC.

We also recognize that PMC is earlier on in its sustainability journey, thus we were not surprised to observe that it will take time before PMC can meet SBTi requirements. When we developed targets for PMC, we wrote out all relevant SBTi targets and shared them with PMC. Unsurprisingly, PMC is not ready to meet many of SBTi's aggressive requirements. However, PMC is eager to increase its reliance on renewable energy and will start by aiming to use 20% renewable electricity by 2030. Notably, competitor benchmarking highlighted a gradual shift towards renewable energy adoption, with key competitors aiming for a substantial percentage of renewable electricity usage. This signals a broader recognition of the role renewable energy plays in achieving sustainability goals within the sector.

Key Observations and Findings with Regard to Project Phase 3
Strategy 1: Carbon Reduction

- Replace Natural Gas (NG) with Renewable Natural gas (RNG)

Renewable natural gas (RNG) also referred to as biomethane stands as a promising solution in PMC's quest for sustainable energy. This innovative resource has undergone enhancement and integration into the traditional natural gas infrastructure. It is produced from various organic waste materials, such as livestock waste, food scraps, and wastewater sludge, into a clean and reliable energy source. By harnessing waste streams that would otherwise harm the environment, RNG plays a pivotal role in the transition towards cleaner energy alternatives [14][15].

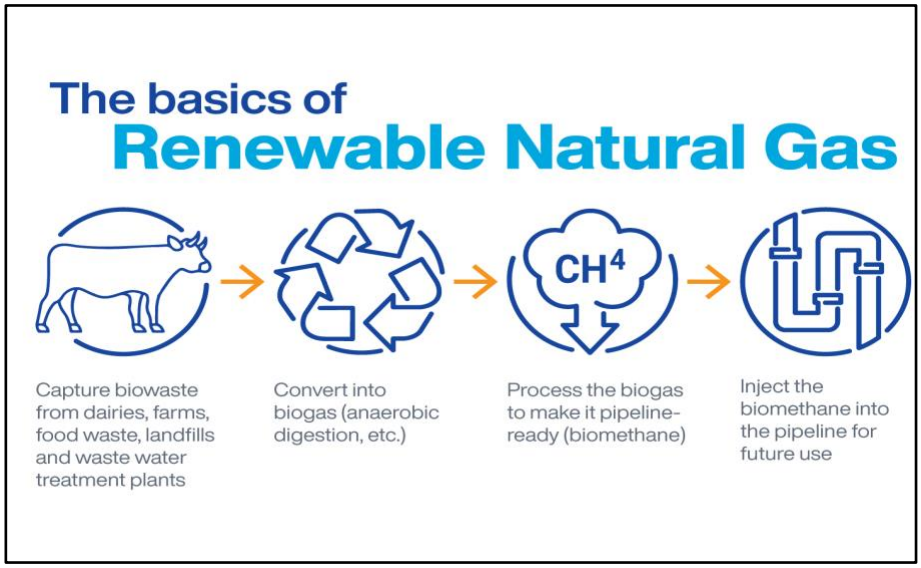

Fig 2: The basics of RNG [43]

RNG is produced through two primary methods: anaerobic digestion and thermochemical conversion of biomass. Anaerobic digestion involves the breakdown of organic matter by microorganisms in an oxygen-deprived environment. This process generates biogas composed mainly of methane and carbon dioxide. Biogas derived from anaerobic digestion can be upgraded to meet existing pipeline-quality standards used by PMC, transforming it into RNG that is chemically identical to conventional natural gas. RNG can be seamlessly transported through existing natural gas pipelines, ensuring efficient distribution and accessibility.

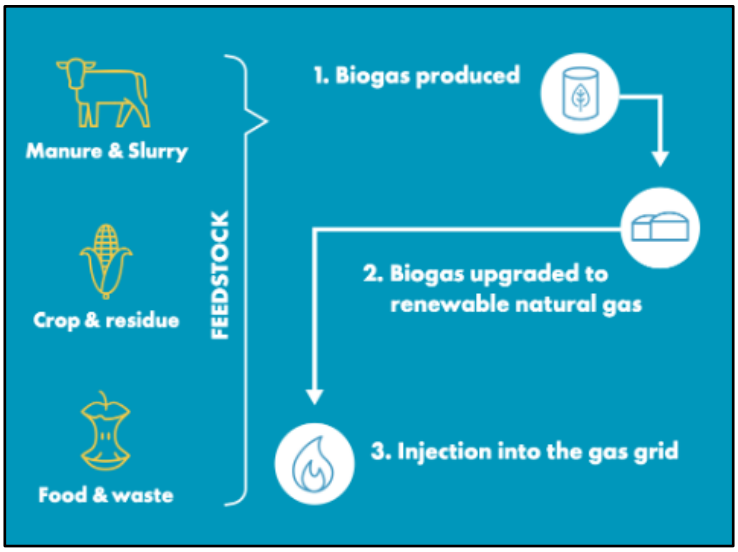

Fig 3: Production process of RNG [16]

RNG finds versatile applications, including electricity generation, heating and cooling (HVAC/HW systems), and vehicle fuel for compressed natural gas (CNG) or liquefied natural gas (LNG) vehicles. We recommend PMC to utilize RNG for electricity and heating and cooling purposes to decrease their direct carbon emissions falling under scope 1, thereby lowering their carbon footprint and fostering a more sustainable energy landscape. Moreover, opting for compressed RNG could facilitate PMC's vehicles designed to run on natural gas, to significantly reduce fleet emissions, contributing to cleaner air and a healthier environment [16].

- Join RTC - Renewable Thermal Collaborative

The Renewable Thermal Collaborative is a global community of corporations, institutions, and governmental bodies dedicated to expanding the use of renewable heating and cooling technologies within their premises. We encourage PMC to join the RTC, as this would give them access to abundant expertise and solutions focused on reducing carbon emissions in thermal operations. This encompasses insights into renewable thermal technologies, developing projects, and deploying effective strategies for implementation. While RTC would provide PMC with a platform for fostering collaboration and exchanging knowledge among its members, it would also assist companies in identifying and implementing renewable thermal solutions, such as biomass, geothermal, and solar thermal systems, to replace fossil fuel-based heating systems and diminish Scope 1 emissions. Moreover, the RTC endeavors to influence policy and market development to support the adoption of renewable thermal technologies, providing companies with an opportunity to contribute to these initiatives and create an environment conducive to transitioning to renewable thermal solutions. Furthermore, transitioning to renewable thermal solutions not only reduces reliance on

grid-supplied energy derived from fossil fuels, but also mitigates Scope 2 emissions, thereby furthering companies' sustainability goals [17].

- Conduct site-specific ESG assessments for each of PMC's eight facilities to better understand areas of opportunity for each specific site:

  Each of PMC's facilities operates differently and has its own unique quirks, which is why we encourage PMC to continue on its journey to conduct site-specific ESG assessments for each of its facilities. Specifically, we recommend that PMC work with one of the following firms: TetraTech, Farrelly & Mitchell, Antea group, Ricardo, Clarkston Consulting, The ESG Group, Salas O'Brien, or Anthesis Group. We see the most potential in Farrelly & Mitchell, as the firm performs ESG due diligence and risk assessments, ESG assessment reports, impact assessments, and helps make supply chains more sustainable within the food and agribusiness industry [26]. Anteagroup, which boasts a unique 7-step approach to helping companies address water and energy management [18] and Ricardo, which has experience developing Net Zero roadmaps for Food and Beverage companies [19], both seem like strong candidates for PMC's business as well.

  While having access to PMC's Greenhouse Gas Emissions Impact Summary [20] is helpful, conducting more robust assessments of each of PMC's eight facilities is imperative to best understand where there are opportunities to make low risk, high reward changes. However, having access to PMC's facility-level energy consumption data taught us a few important lessons: PMC's Warminster facility uses the most electricity per million pounds of pasta produced (which feeds into our below strategy recommendations), PMC's Warminster facility relies primarily on natural gas, and Minot Milling has the highest electricity use but the lowest electricity use per million pounds of pasta produced [20].

- Implement metrics to assess the CSR programs in place:

  The key to improving PMC's performance is tracking progress. KPIs are crucial for evaluating the impact of CSR efforts and monitoring advancements toward sustainability objectives. Below are some potential CSR performance indicators that PMC may implement to track their progress:

  - ➢ Environmental metrics: GHG emissions (mt), Energy consumption (kWh)
    1. Assess, track and lessen greenhouse gas emissions to address PMC's carbon footprint

2. Monitor and decrease PMC's energy consumption across all facilities to advance energy efficiency and conservation. A further break down of energy source (% renewable vs. % nonrenewable used) to accelerate the transition to renewables [21]
3. Supervise and minimize waste production, endorse recycling, and adopt responsible waste disposal methods
4. Tracking water usage to identify leaks and inefficiencies in its use across operations, to preserve water resources
5. Evaluate suppliers' environmental and social practices to ensure ethical sourcing and effective supply chain management

➢ Social Metrics: Community investment, Volunteer Hours and Engagement activities
1. Evaluate the extent and impact of financial donations, volunteer work, and community involvement activities
2. Assess the societal benefits of CSR endeavors, such as enhancements in education, healthcare, or community advancement [22]

➢ Operational metrics: Process efficiency, Product quality
1. Analyze how efficient processes can minimize waste generation, energy consumption, and water usage. Lowering these factors contributes positively to environment
2. Sourcing ingredients responsibly and using safe production methods benefits both the environment and society

➢ Customer metrics: Survey, Market share, Customer loyalty
1. Gather feedback and assess client satisfaction to measure the influence of CSR efforts on customer loyalty and brand perception using surveys
2. Design Loyalty Programs to Drive Repeat Business and Customer Insights by Tracking Purchase Frequency and Customer Retention Rates
3. Market share can be used as an indicator to determine the brand perception

➢ Employee metrics: Employee Satisfaction Index, Engagement and Diversity
1. This score reflects employee satisfaction and helps gauge the effectiveness of internal CSR initiatives [23]
2. Utilize surveys to understand employee contentment and welfare
3. Monitor diversity indicators, such as gender and ethnicity, to ensure fairness and inclusivity in the workplace

Strategy 2: Energy Efficiency Updates

- Energy-optimize the pasta making process in the Warminster facility, PA:

  While comparing electricity use across all eight of PMC's facilities, we noticed that PMC's Warminster facility has the highest electricity consumption per million pounds of pasta produced [20]. This being said, we chose to focus our strategy recommendations on PMC's Warminster facility, as we feel that investments to help optimize the pasta making process there will yield the greatest return on investment.

- Post-Extrusion energy savings:

  Pasta drying generally involves a preliminary drier immediately after extrusion to prevent pasta from sticking. Currently, PMC blasts its long pasta with air post-extrusion to prevent pasta sticking. We recommend that PMC decrease its energy use by decreasing the amount of air it uses to blast its long pasta. Perhaps the air can be closer to room temperature and the long pasta can be organized in a way that helps naturally prevent sticking.

- Drying phase energy savings:

  The drying phase represents the most challenging and crucial aspect to manage within the pasta manufacturing process. Its primary aim is to reduce the pasta moisture content from around 31 percent to a range of 12 to 13 percent. This ensures that the final product achieves hardness, maintains its shape, and can be stored without deterioration [24]. We encourage PMC to experiment with reducing the amount of air needed to adequately dry the long pasta. Throughout the drying process, PMC relies on cooling chambers to help the pasta achieve the optimal ~12% moisture level. That being said, we recommend that PMC assess the temperature and cooling time required for the pasta to reach this moisture level, as there may be room to save energy during this step of the pasta drying process. Finally, we suggest PMC consider investing in a Buhler Ecothermatik dryer, which boasts the highest energy savings of any pasta drying product on the market, as it helps reduce stabilization time during the drying process by about 40 minutes [25]. Not only is Buhler's Ecothermatik dryer the best equipment for the job, but PMC is also familiar with Buhler products, as its Minot Milling facility prides itself on relying on Buhler equipment to reach its goals of innovation and efficiency.

- Increase demand for short pastas by more heavily marketing them:

  We recognize that PMC's long goods require lengthy drying times while its short goods do not and are generally easier to produce. That being said, we encourage PMC to focus on increasing demand for short goods by more heavily marketing its short goods or providing relevant promotions.

- Apply for Tax Incentives for implementing Energy Efficiency Updates:

  IRC 179D was established to incentivize owners of commercial buildings to integrate energy-efficient assets. This involves incorporating energy-efficient commercial building property (EECBP) during the construction or renovation of commercial or government structures [27][28].

  According to IRC 179D, individuals who own or lease commercial buildings can claim deductions for the expenses linked to installing Energy-Efficient Commercial Building Property (EECBP). Moreover, if EECBP is implemented in a government-owned building, the deduction can be assigned to the individual(s) primarily responsible for its design, commonly known as "the Designer(s)."

  EECBP must be integrated into at least one of three systems:
  - ➢ Interior lighting systems (Interior Lighting),
  - ➢ Heating, ventilation, air conditioning, and hot-water systems (HVAC/HW), or
  - ➢ The building's envelope (ENV).

  Notice 2006-52 provides guidelines for commercial building owners or lessees seeking qualification for a tax deduction under IRC 179D. It outlines a procedure to verify that they have achieved the necessary energy and cost savings to claim the deduction. For properties utilized between December 31, 2005, and January 1, 2009, it specifies a particular energy savings rate of 16 2/3 percent for all three systems. Additionally, it allows a deduction for interior lighting systems if the property is in use after December 31, 2005. Finally, the notice states that the Department of Energy (DOE) will host a compilation of software programs on its website that can assist in calculating the energy and cost savings required for claiming the IRC 179D deduction.

  Notice 2008-40 supplements Notice 2006-52 and is intended to be utilized in conjunction with it. This notice elaborates on the allocation of deductions to designers of government-owned buildings, establishes certification requirements for the interim lighting rule, and extends the application of the interim lighting rule to unconditioned garage spaces. Additionally, it introduces new Energy Savings Percentages (ESPs) for partially

qualifying properties under the permanent rule: 20% for interior lighting systems, 20% for HVAC/HW systems, and 10% for building envelope (ENV) systems. These percentages are applicable to properties utilized between December 31, 2005, and January 1, 2014.

Notice 2012-26 modifies Notice 2008-40 by updating the ESPs for partial deductions using the permanent rule: 25% for interior lighting, 15% for HVAC/HW, and 10% for ENV systems for properties in use on or after March 29, 2012. These ESPs are currently valid.

The provisions outlined in IRC 179D can be advantageous for PMC which heavily relies on systems such as heating, ventilation, air conditioning, (HVAC) and Drying for their operations. We recommend PMC to enhance and integrate their energy-efficiency measures into these crucial operating systems and provide evidence of energy savings by 15%. This would lead PMC to potentially qualify for deductions under IRC 179D. They would eventually be reducing emissions, saving energy and utilizing the tax incentives provided by the government for investing in energy-efficient infrastructure.

3. Strategy 3: Renewables Integration

- Unbundled PPAs for small offtakers like PMC

A Power Purchase Agreement (PPA) is an agreement between a producer of electricity and a purchaser, with the terms varying depending on whether it is bundled or unbundled.

- ➢ **Bundled PPA:** This arrangement serves as a comprehensive solution for offtakers' electricity needs. It encompasses both the actual electricity consumed and the accompanying Renewable Energy Certificates (RECs), which symbolize the environmental advantages of renewable energy production. Bundled PPAs frequently extend over long periods, offering buyers stability in pricing.

- ➢ **Unbundled PPA:** This arrangement is slightly different from bundled PPAs where the offtakers acquire the actual electricity and the RECs through separate transactions. The electricity might be obtained from a utility or the spot market, while the RECs are purchased from a broker. While this approach offers increased flexibility, it also demands more effort to oversee the distinct purchases. [29][30]

Feature	Bundled PPA	Unbundled PPA
RECs	Yes, it is included	Not included (purchased separately)
Price Stability	More stable (long-term contracts)	Less stable (separate purchases)
Management complexity	Lower	Higher

Table 1: A table summarizing the key differences of Bundled and Unbundled PPAs

Unbundled PPAs are more suited to be procured by offtakers with energy usage below 100,000 MWh annually. Seeing PMC's current energy usage, we suggest they opt for unbundled PPAs. There are two main reasons for that are:

- ➢ Flexible purchasing: Unbundled PPAs offer greater purchasing flexibility for offtaking agreements of different capacities and acquiring renewable electricity at different locations across USA, potentially resulting in lower initial expenses as RECs can be acquired independently from the actual electricity.

- ➢ Management complexity: Managing individual purchases in unbundled PPAs can get tricky sometimes however PMC can find the simplified complexity of the physical electricity contract easier to manage

- Green tariffs with utilities

Green tariffs are programs provided by electric utility companies and approved by state public utility commissions (PUCs) in regulated electricity markets [31][32]. They are also referred to as green power initiatives or renewable energy tariffs, which offer customers the opportunity to buy electricity sourced from renewable energy. These programs are usually voluntary and cater to consumers seeking to endorse renewable energy

generation. Green tariffs are typically structured into three main models: (1) the sleeved power purchase agreement (PPA) model, (2) the subscriber model, and (3) the market-based rate model [33].

Since PMC seeks to incorporate renewables in their operations, we advise them to choose a green tariff plan offered by the local utility. The renewable energy procurement would involve utility companies sourcing electricity from renewable sources like wind, solar, biomass, or hydroelectric power plants, integrating it into their energy supply. These companies would offer green tariffs enabling PMC to opt into choosing a green tariff plan offered by the local utility, with pricing options varying between premium rates or fixed fees. This plan would ensure that all or a portion of PMC's electricity comes from renewable sources. PMC would then receive renewable electricity through the standard grid, with accurate tracking and allocation by the utility. Engagement in these programs would support renewable energy projects, curbing greenhouse gas emissions, promoting sustainability, and broadening energy diversity. Transparency regarding energy source and environmental impact is typically provided, sometimes including certification to reassure customers of their contribution's authenticity. Green tariffs with utilities would offer PMC, an accessible means to bolster their renewable energy usage, champion environmental stewardship, while maintaining reliable electricity service.

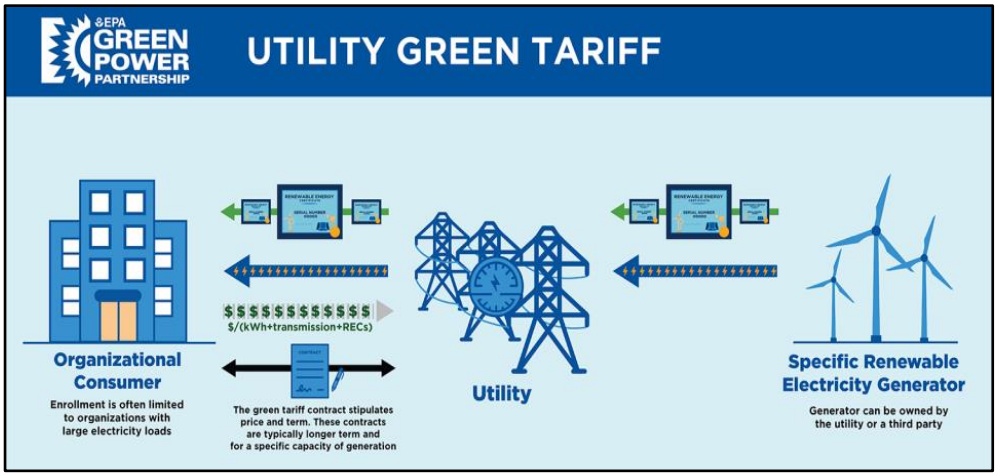

Fig 4: How a typical Utility Green Tariff works [31]

A few considerations for PMC before they would choose a green tariff is the limited number of green tariffs offered by utilities in select regulated states. The tariffs are primarily targeting large customers, and it may entail long-term commitments. These might seem to be far-fetched for PMC. However, an aggregation with PMC's large customers or suppliers would prove beneficial and help them acquire a green tariff.

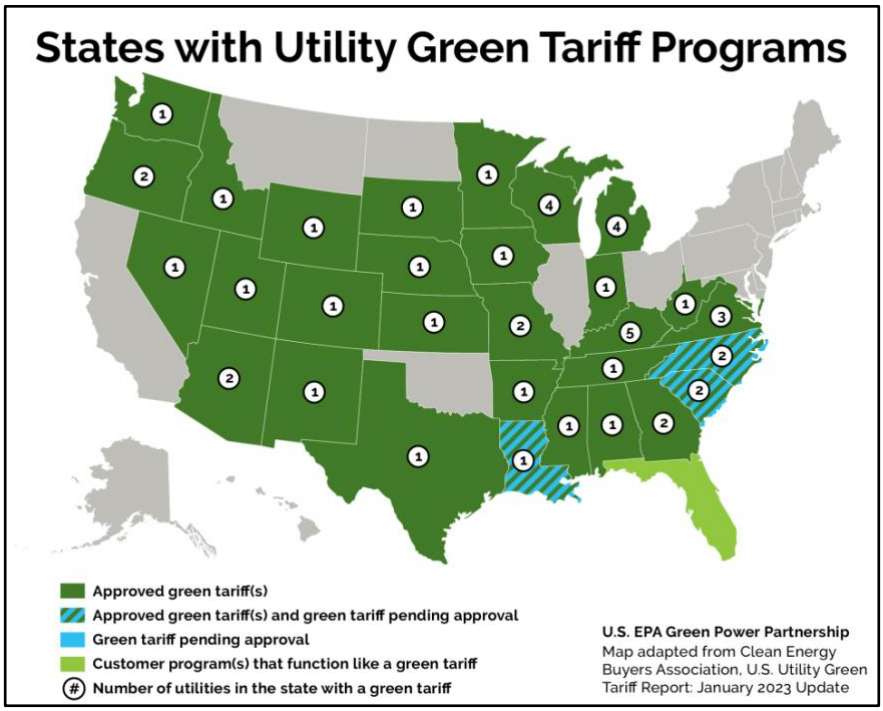

Fig 5: States in USA with Utility Green Tariff Programs [31]

- Go for a VPPA (Virtual Power Purchase Agreement) aggregation - combined offtake projects with PMC's big customers

  A VPPA, or Virtual Power Purchase Agreement, serves as a financial contract between a buyer, typically a corporation, and a renewable energy venture. This arrangement involves a long-term financial commitment, where the buyer doesn't assume ownership or accountability for the physical electricity produced by the project. Instead, the VPPA functions purely as a financial deal, wherein the buyer agrees to ensure the project a predetermined "strike price" for its electricity sold on the wholesale market. In return, the buyer receives a variable-priced cash flow and associated renewable energy certificates (RECs) [34]

  Even with a VPPA in place, the buyer must still fulfill its electricity requirements through conventional means since the VPPA solely serves as a financial tool. Consequently, the buyer's interaction with its utility at the retail level remains unaltered. The VPPA empowers the buyer to reap the benefits of fixed-price cash flow and RECs without direct ownership or oversight of the renewable energy project itself. [35]

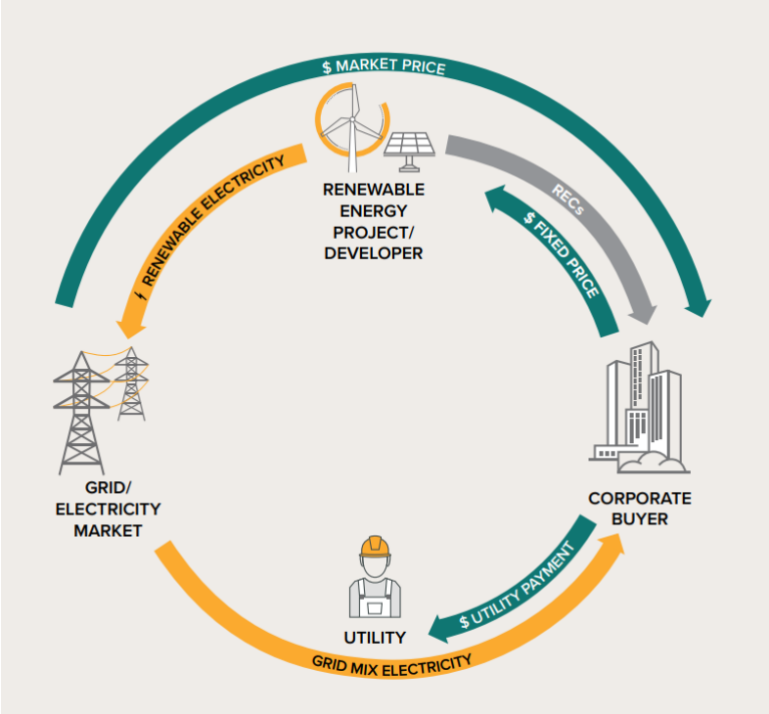

Fig 6: A complete picture of how a VPPA works [35]

Pooling VPPAs together can provide an affordable entry point to renewable energy for small to mid-size offtakers while also enabling large corporations to make a positive impact on their supply chain emissions. We suggest PMC collaborate with its biggest customer and pursue an aggregated VPPA. This would assist PMC in lowering their scope 2 emissions while addressing scope 3 emissions originating from the supply chain for their biggest customer and fellow partner in the VPPA aggregation agreement [36].

PMC should be able to create an appealing offer for renewable energy project developers when pursuing an aggregated VPPA. The following suggestions would be a few strategies PMC could apply before approaching a developer to be considered as a potential offtaker:

- Having manageable count of buyers participating in a single aggregation deal: The size of the procurement significantly impacts the deal's attractiveness. Ideally, developers prefer having one or two offtakers for a project as it makes handling contracts with each party less repetitive and less time consuming. Hence, it's beneficial for PMC to have at least one large customer securing a substantial volume of electricity while the rest is procured by PMC.

- Selecting suitable partners: PMC should be mindful of the various factors such as risk tolerance, environmental impact, location, and timeline, while assessing

VPPAs. Collaborating with organizations that share PMC's priorities would keep negotiations focused on common goals.

- ➢ Engage in a collaborative negotiation: PMC and its partners should have a singular entity or counsel to represent all buyers involved in the aggregation to streamline negotiations and maintain developer interest.

- ➢ Embrace a mindset of adaptability and responsiveness: Given the current market conditions, quick action is essential. PMC as an aggregate buyer must be prepared to seize opportunities swiftly and be willing to compromise on certain terms. The most crucial aspect of this deal is aligning partners and internal stakeholders on priorities and establishing clear decision-making processes from the outset.

- On-site Solar (20% efficiency)

  Deploying solar panels on-site represents the most expeditious method for incorporating renewable energy into PMC's operations. This necessitates conducting a detailed examination of the site to determine the requisite capacity for powering the facility and identifying optimal installation locations. The primary concern is the upfront cost, but there is a remedy available. The US government provides tax breaks and financial perks to companies incorporating solar panels, effectively mitigating the upfront cost of such systems and enhancing their appeal as investments.

  PMC stands to gain from both the Investment Tax Credit (ITC) and the Production Tax Credit (PTC) for renewable energy projects. These credits directly lessen PMC's tax obligations, delivering concrete financial advantages. Opting for the ITC means PMC enjoys a direct deduction from federal income tax liability, calculated as a portion of the installation cost of the solar system. This front-loaded benefit, notably the 30% credit accessible for projects initiated before 2033, provides immediate financial relief, covering various expenses such as equipment, installation, and certain indirect costs. In comparison to the Production Tax Credit (PTC), which grants credits based on electricity generation over a decade, the ITC's instant tax deduction better suits PMC's probable preference for immediate financial gains [37][38].

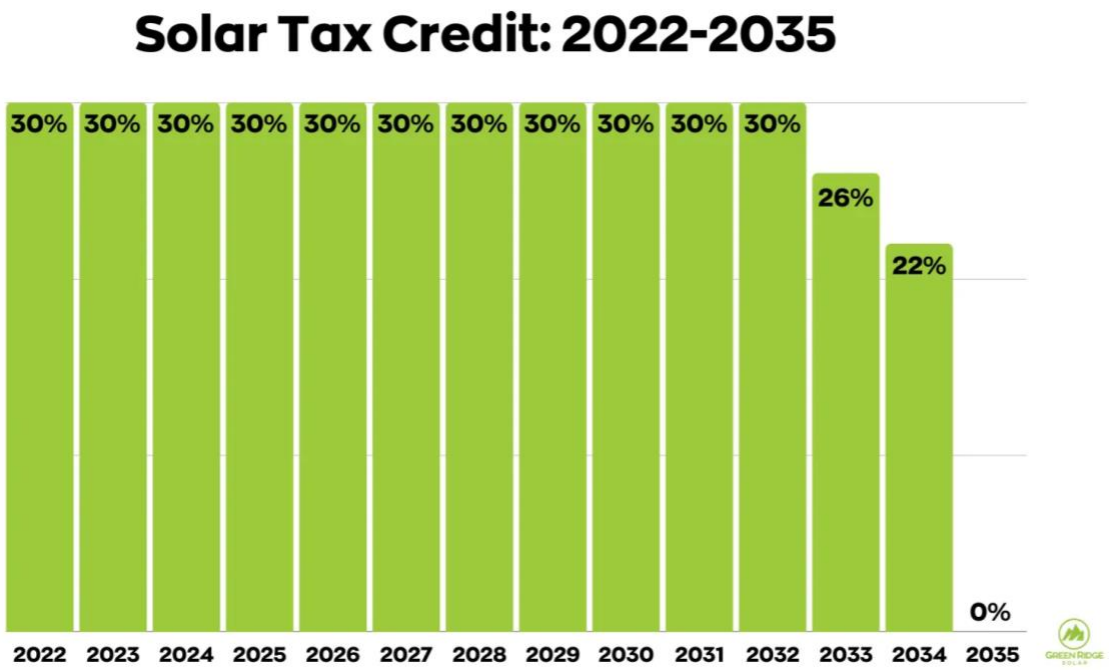

Fig 7: Solar Tax Credit rates over the years from 2022 through 2035 [41]

Additionally, PMC stands to gain from federal and state subsidies aimed at promoting renewable energy initiatives within the United States. For instance, the U.S. Department of Energy (DOE) provides a range of grants and incentives to bolster the deployment of renewable energy, including financial support for the installation of solar panels and enhancements in energy efficiency. Additionally, numerous states have implemented Renewable Portfolio Standards (RPS), mandating that a portion of electricity sales must originate from renewable energy sources. Adhering to RPS regulations may entail utilities engaging in the trading of Renewable Energy Certificates (RECs), which enable buyers to endorse renewable energy production without directly procuring or generating renewable energy. This mechanism can aid PMC in achieving its renewable energy objectives or adhering to state RPS mandates [39].

Significance of Findings

These competitor targets serve as a benchmark for PMC's own sustainability targets. Aligning PMC's objectives with those of industry leaders positions the company as a proactive contributor to global sustainability efforts and enhances its competitiveness within the sector.

The observed focus on sustainable packaging, reduced water and waste, and increased use of renewable energy aligns with current consumer expectations and broader market trends. Adapting PMC's strategies to reflect these findings can strengthen its brand image and meet evolving consumer demands.

PMC's commitment to sustainability, mirroring industry leaders, differentiates it within the competitive landscape. This differentiation can be a key factor in attracting environmentally conscious customers, securing partnerships, and maintaining a positive reputation in the marketplace.

Limitations of Project Approach

The proposed approach for environmental target identification introduces interconnected limitations that necessitate thoughtful consideration. Firstly, the accuracy of competitor environmental data is subject to variation, posing the risk of incomplete or unreliable benchmarks. Relying solely on publicly available information may hinder the attainment of a comprehensive understanding of competitors' environmental targets. Additionally, we are not considering Scope 3 emissions in our carbon footprint analysis. Neglecting Scope 3 emissions could result in an incomplete sustainability strategy, overlooking a critical aspect of PMC's environmental impact. Moreover, the limited consideration of local environmental factors in the approach raises concerns about overlooking regional nuances. Crafting strategies without a thorough understanding of local influences may hinder the development of a holistic and effective environmental plan.

Next Steps for PMC to Assess

Following the completion of the project, PMC enters the next phase of implementation and oversight. The next steps for PMC to undergo is listed below:

- Finalize and Approve Targets: The first step involves a thorough review of the suggested targets by our team and seek final endorsement from company leadership regarding the specific goals to pursue. This review process serves as an additional checkpoint to confirm the strategic coherence and feasibility of the proposed initiatives before moving forward.

- Develop Detailed Action Plan: Create a comprehensive plan for implementation, detailing specific tasks, deadlines, assigned roles, and necessary resources to accomplish the approved targets.

- ➢ Secure Funding and Resources: Determine the financial requirements and resources needed to carry out the action plan. Acquire the essential funding, whether through internal budget allocations, borrowing, or accessing public/private incentives and grants for clean energy initiatives.

- ➢ Establish a Cross-Functional Team: Form a dedicated team composed of representatives from different departments within PMC who will oversee the execution of the strategies.

- ➢ Enhance Data Collection and Reporting: Enhance and update PMC's processes for collecting data and accounting for greenhouse gas emissions.

- ➢ Monitor and Evaluate Progress: Implement effective monitoring and reporting systems to track advancements toward the approved targets. Regularly assess key performance indicators (KPIs) and adapt strategies as necessary to ensure continuous improvement.

Conclusion

In summary, the key observations and findings presented in the discussion section offer valuable insights that serve a dual purpose for the Philadelphia Macaroni Company (PMC). Firstly, they guide PMC in setting realistic and impactful sustainability targets, aligning the company with industry benchmarks, and ensuring its proactive contribution to global sustainability efforts. Secondly, these insights strategically position PMC within a rapidly evolving and sustainability-focused industry landscape.

This discussion section serves as a comprehensive roadmap for PMC, providing actionable steps to navigate the complexities of sustainability. By capitalizing on industry trends and aligning with the identified key takeaways, PMC can not only enhance its environmental footprint but also solidify its role as an industry leader committed to global sustainability goals. Adapting and integrating these key takeaways into PMC's business strategies will contribute to the company's long-term success and resilience.

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