

Decarbonizing practices in the global food and beverage industry

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Index

| Foreword | 3 |
|---|----|
| Executive Summary | 3 |
| Facing the energy transition | 4 |
| Solutions and services that support decarbonization | 14 |
| Conclusion and the way forward | 17 |

Foreword

This whitepaper examines the current state and trajectory of decarbonization within the global food and beverage industries. By examining and establishing a baseline on industry action, early-mid and long-term initiatives can be highlighted to help inform manufacturers and producers in these industries how they can engage and push themselves further towards full decarbonization. This effort also highlights the challenges and complexities in the path towards decarbonization, which is complex and layered. Industrial producers should be looking outwards to determine how to take best steps from within.

The white paper is a joint effort of Siemens AG and Frost and Sullivan.



2

Executive Summary

The global food and beverage industry has a plethora of immediate and strategic opportunities open to it in the drive towards decarbonization. Despite challenges in access to renewable energy and a critical focus on costs to customers, there are effective opportunities in greater energy efficiency in equipment and building maintenance alongside on-site power generation and power purchase agreements that can propel the industry forward. The road to decarbonization, however, is complex. Creating an effective and sustainable strategy with near-to long-term goals often benefits from independent partners to offer guidance and expert insight. Engaging consultants and third parties to ensure a locally tailored strategy can help speed decarbonization in the global food and beverage industry.



Facing the energy transition

The world faces an ever-widening gap between current levels of greenhouse gas emissions and the reduction in levels that must be met in order to mitigate the worst impacts of global climate change. As documented by the United Nation's Emissions Gap Report 2021, the world is currently on track to reach an average temperature rise of 2.7°C, well over the target of 1.5°C. In a globalized, predominantly capitalist economy, the incentives for sustainable growth and profit are often at odds with environmental sustainability.

Fundamentally, however, it is increasingly seen that sustainable economies are reliant on a sustainable environment; industries require raw materials, customers, workers, and transportation and logistics infrastructure that require sustainable and reliable physical and natural environments. The importance of industrial decarbonization to long-term sustainability is well established and leading organizations are taking bold approaches to improving and reimagining business practices.

Sustainability, digitalization, health & wellness and business models are the four underlying factors for future transformation. Influencing the four models will be the need to build resilience and lower the financial risk for customers.





Current status of decarbonization strategies

A central challenge in the food and beverage industry is that centralized decarbonization opportunities and strategies mask the regional and local variations within the industry itself. Key to decarbonization efforts is renewable and green energy, but renewable energy is not evenly available at scale worldwide. Further, affordable food stocks are critically important and would be greatly influenced by more expensive renewable energy. Many food and beverage companies instead focus on emissions in their value chain, as opposed to making improvements within their factories and facilities. Overall, a full decarbonization strategy remains a nice-to-have component for organizations and is not a critical component to future operations. There is great opportunity within the global food and beverage industry to enact bold decarbonization strategies, but in order to see that realization greater incentives and affordable renewable energy access is needed.

Over the course of the year 2020, COVID-19 transformed from a health crisis to a health-andeconomic crisis, which not only impacted the packaged food and beverage industry in terms of top products being sold, but also the channel of sales. 2021 is expected to retain some changes brought in supply chains and consumption patterns but will have a much greater focus on the challenge of climate change and decarbonization.

- Sustainability will become the center stage of all packaged food and beverage businesses across the globe, as all aspects of business are being considered in the purchase decisions by younger generations.
- Localization in both procurement as well as sales is expected, with more and more acceptance of concept of sustaining local economy as well as environment.
- With COVID-19 is the background, as the buying power and purchase priorities of the consumers change, the sales of value-based products across packaged food and beverage categories is expected to increase.
- Increased digitization across the value chain enabled by tracking and tracing technology as well as improved interconnection between channel partners with block-chain technology.
- 5. Packaging of food and beverage products is expected to move towards recyclable and reusable, which will help to meet the nutrition requirement in an environmentally efficient manner.

The food and beverage industry is also characterized by a variety of carbon footprints in the types of products produced and faces pressure to maintain affordable, accessible products for global populations.

Actions to further and achieve industrial decarbonization can be summarized through four key initiatives:

- Decarbonization Roadmap: foundational assessments and action
- Resource Efficiency: improve energy consumption efficiency and develop circular economies
- Infrastructure Enhancement: improve assets and infrastructure
- Innovative Business Models: advanced performance contracting



Figure 2: Develop your decarbonization strategy

Every organization will need to adopt a range of measures within each initiative to deliver an effective, holistic means to achieve decarbonization. The specific set of activities, timeline of implementation, and means of verification will be unique; in many cases industrial organizations and facilities will benefit from third party assistance to ensure strategies are comprehensive and achievable. This whitepaper is a step towards understanding the current landscape of decarbonization to help speed understanding and action for all stakeholders.

Decarbonization actions in the global food & beverage industry

The full lifecycle of the global food and beverage industry is responsible for roughly 30% energy consumption (Sovacool et al, 2021¹). The world's top 20 companies in the industry need to achieve a drop of 134 thousand metric tons of greenhouse gases per year per company in order to meet publicly stated goals. Delivering on ambitious targets in an industry that is a great source of global emissions and energy consumption presents acute challenges to the status quo. Stakeholders in the industry do have a number of key decarbonization actions available:

- Efficiency adoption of more efficient processes to reduce emissions production;
- **Power Purchase Agreements (PPAs)** offset GHG production, especially production outside direct control, through renewable energy purchase agreements, and;
- Renewable Energy Sources: review production processes to identify where renewable energy sources can replace fossil fuels



Figure 3: Developing the right action plan

To successfully exploit these opportunities to reduce energy consumption and emissions, however, requires a strategic and targeted framework. In food and beverage processing facilities refrigeration, freezing, and automation are central in driving electricity use. Targeting these processes with efficiency and consumption reduction strategies requires a strong understanding of the industry landscape at global and local levels.



Processed food & beverage - A major actor in global GHG emissions

It was estimated in 2018 that 26% of total greenhouse gases produced globally can be directly or indirectly attributed to the Food & Beverage industry sector of which over 50% of Food Industry GHG emissions can be directly attributed to livestock production and associated land use.

- The combined 2020 GHG emissions (scope 1&2) for food & beverage production of the top 20 F&B companies is estimated at 97.4 million tons CO₂
- Actual food production within the factory produces 1% of total global GHG emissions, though much smaller compared to other parts of the F&B value chain
- Transport, packaging and retail of F&B products throughout the world accounts for an additional 4% of total GHG emissions
- Livestock and fisheries are highly polluting mostly due to the continuous production of methane from ruminants (cattle/dairy/goats) and meat slaughtering



Figure 4: GHG emissions

Key industry drivers for decarbonization in processed food & beverage manufacturing

Decarbonization has become one of the top industry challenges facing the Food & Beverage space today and market participants are increasingly proactive in staying ahead of stakeholder requirements.

- **Carbon Neutrality:** Carbon neutrality is at the center of sustainability in the food industry, which involves minimizing its overall impact on the environment
- **Decarbonizing the Value Chain:** 34% of total greenhouse gases produced can be attributed to the FMCG, agriculture and nutrition industry sector, of which over 50% of emissions are attributed to livestock
- Focus on What is Controllable: The total burden of scope 1 and scope 2 GHG emissions derived from food processing is only 3.3% of all F&B GHG emissions created
- **Decarbonizing through Dietary Changes:** Lower per capita meat and dairy consumption may help alleviate GHG emission production across the value chain
- Increasing In-plant Energy Efficiency: The use of thermal energy is highly energy intensive. Electricity-based solutions have grown because they tend to be more energy efficient
- Learning to be Carbon Responsible: Currently, many tier 1 and 2 companies have explored a wide variety of GHG production mitigation strategies with the aim to minimize their direct costs and responsibilities.



Figure 5: Trends with high impact on Food & Beverage industry

Achieving carbon neutrality

Carbon neutrality is at the center of sustainability in the food and beverage industry, though the majority of carbon emissions happens outside of the factory door. The packaged food and beverage industry is focused on being more sustainable and carbon neutral, mostly motivated by the belief that the environment conscious consumers are ready to pay premium for environmental sensitivity of the products they consume. Constant progress is being made to make the industry carbon neutral with some success in smaller and regional brands. Some of the common areas being worked upon for carbon neutrality are:

- Production process: As the food and beverage industry deals with organic matter as inputs, often waste is generated in the form of unutilized carbon matter as well as carbon dioxide. The wasted materials should be captured and put back into cycle through value addition.
- Packaging materials: The packaging materials such as glass bottles, steel crowns, labels, paperboard holders, cardboard cartons, wood pallets, shrink wrap all are being considered from a point of how much carbon footprint they add to the final product.
- 3. Utility consumption: The food and beverage industry, uses large amounts of electricity and water for the production for its multiple processes involved in the production. Partnering with green and renewable sources of supply for these utilities has been at the forefront of the carbon neutrality initiatives.
- 4. Transportation and logistics: It is estimated that transportation and logistics contributes to nearly 20% of carbon emissions of the food and beverage industry. Partner with green and carbon negative partners for transportation and logistics.



Energy consumption intensity of food and beverage products by energy source type

Electricity and water use throughout production facilities needs to be reviewed, both in terms of reducing quantity and increasing renewable energy use. Partnerships with green and carbon negative transportation and logistics partners must be reviewed, in order to target the near 20% of industry emissions it creates. Further, production processes need to be evaluated to reduce organic wastes, in solids and gases, and look towards capture and reuse. There is a wide variety of processes available, however, to assist global food and beverage organizations to deliver on decarbonization goals:

- **Decarbonization roadmapping:** energy audit, EED compliance roadmapping, building performance optimization, and energy procurement and supply services
- Energy consumption optimization: energy management and energy efficiency consulting, digitalization and connectivity for performance optimization and CO₂ management, and performance-based contracting solutions for resource optimization
- Energy infrastructure and supply modernization: power purchase agreements, optimize power supply and reduce costs and CO₂ emissions with cogeneration, convert excess renewable power to hydrogen, and load shifting and shedding for efficient peak load management
- Service-based business models: energy efficiency as a service, energy saving performance contracting, PPA green energy supply, decarbonization as a service



Figure 6: Decarbonization of the Food & Beverage Manufacturing Sector: Specific Energy Consumption Intensity (MJ/kg) for Major F&B Sectors by Energy Source Type, Global



Decarbonizing the value chain

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Case studies and regional initiatives

The global food and beverage industry has a range of activity from leaders in decarbonization as well as organizations making initial inroads. The case study examples below highlight key activity that help blaze a path for others in the industry.

Kellogg Company (Global)

The Kellogg Company has committed to raising renewable energy consumption to 50% of total energy use within its global manufacturing facilities by the end of 2022. This commitment is being seen through green electricity purchases of 360 gigawatt hours in North America; energy efficiency upgrades in solar power production and LED technology upgrades in Asia, Europe, and North America; fuel cell technology to generate on-site energy in California, and; energy reduction strategies in Australia and the United States.





Grupo Bimbo (North America)

Grupo Bimbo has entered into green electricity PPAs sourcing power from the US and importing it to facilities in Mexico and the organization became 100% renewable energy powered in 2019. The organization has converted a large share of its commercial fleets to electricity and natural-gas powered vehicles. Further, Grupo Bimbo has reduced energy consumption though LED lightning and translucent flooring/walls to increase the reach of natural lighting.

Flowers Foods (North America)

Flowers Foods has enacted energy efficiency upgrade strategies to deliver LED lighting and compressed air systems upgrades. Heat recovery systems are now used to run proofing machines in El Paso, Texas savings 248 metric tons of emissions per year and in Lewiston, Maine a bakery captures heat waste to heat water and warm the facility, saving 217 metric tons of CO₂ annually. Flowers Foods has also reduced energy consumption by enabling employees to track and report energy use deviations to management, by integrating new equipment with energy efficiency technology, and by sharing best practices in energy optimization across the organization.



4 Solutions and services that support decarbonization

The global chemical industry reviewed in this white paper has established important initiatives to reduce energy consumption, increase the use of renewable energy, and adopt greater rates of electrification.

Energy solutions and services delivering decarbonization are based on a strategic approach, utilizing value-stacking to exploit the full potential rather than execute isolated activities to optimize energy generation and sourcing, energy efficiency, supply security and reliability, or business and asset performance. This ensures the delivery of a positive impact right from the start and in the long-term for the entire organization.



Delivering energy intelligence across the energy value chain

Figure 7: Energy solutions and services for decarbonization



Demand side efficiency

Demand side efficiency is based on a thorough energy audit and performance data monitoring for compete transparency of the energy utilization and asset performance. In a first step energy efficiency solutions reduce the overall energy consumption and optimized energy efficiency of the entire facility.

In addition, asset performance management ensures the reliable and efficient performance of all business assets and advisory services support with the selection of the best suitable solution design and business model.

On-site energy supply

Local energy solutions are based on sustainable generation of power, heat and cooling with a maximized share of renewable energy sources.

In combination with powerful energy storage solutions, e.g. electrical storage or hydrogen storage, an on-site solution provides flexibility and allows for a maximum share of renewable energy.

Energy management and grid control tools ensure a reliable and efficient control of energy supply, usage and storage – and new profit streams by connecting the local energy solution to the energy market or managing it as part of a virtual power plant. All the solutions are supported by advisory and consulting services from initial assessment and concept & design, to engineering, procurement and construction to operation, services and maintenance of the running system.

These are critical components in moving towards decarbonization. Power purchase agreements that deliver green, renewable energy support m activity and provide industrial customers with a faster-toimplement method of reducing carbon footprints. Additional efforts in capturing and using waste heat and the creation of circular economies are also core components of many strategies.



Figure 8: The Comprehensive offerings to support our customer transferring to sustainable and digital enterprise

Business models and digital services

The technical implementation of solutions and services delivering decarbonization is supported by data-driven services and digital twin technologies.

Depending on the customer situation and goals the best suitable business model is selected:

- Customer financing of a project is based on milestone payments during the implementation and therefore cash negative. It requires capital investment and leaves the ownership of the asset and the performance responsibility with the customer.
- A deferred payment agreement is a performance contract, which optimizes CAPEX efficiency. It is based on a payment plan with positive cash-flow financed out of the project savings and requires no initial investment. The ownership of the asset remains with the customer, who can shift the responsibility for operation & maintenance and the solution performance to the solution provider with a respective agreement.
- X-as-a-Service models allow organizations to profit from project benefits regarding energy supply, equipment and facility maintenance for a service fee. They offer a greater value through their holistic nature and significantly reduce the time to profit from a system optimization – without capital investments and without taking over responsibility for new assets or systems.

These solutions enable our customers to take control of their energy supply and business performance.

Global manufacturers also look towards advanced equipment and process efficiencies to reduce carbon footprints of facilities. This includes LED lighting and new equipment with lower energy consumption. These actions should become a global standard in industrial facilities to deliver on quick carbon reduction gains. These early successes should be reinforced and replicated among industry peers.



Figure 9: Business delivery models

Regional and local challenges in implementing the solutions and services for decarbonization

At a local level, however, there are regions that experience renewable energy supply challenges and higher economic costs in these initiatives. This is further complicated by a fragmented competitive landscape that is more greatly influenced by local conditions. As a result, regional and local landscapes can be highly variable. Regions and localities may require structural assistance and incentives in order to help drive decarbonization activity. External third party support can also help manufacturers in these locations navigate these complexities to identify nearterm opportunities as well as long-term initiatives that reflect changing local conditions to keep decarbonization initiatives running.



Conclusion and the way forward

Achieving economic change at the speed and completeness required to successfully respond to the world's decarbonization mandates requires focus and investment at a scale never seen before; this reinforces the need to act as a community and leverage partners to ensure critical success. The successes stemming from current initiatives by global manufacturers need to be replicated globally. Increasing energy efficiency, driving renewable energy consumption, greater electrification, and facility improvements in efficient LED technology and energy efficient process equipment are all actions that must be embraced throughout industries.

1. Focus on Scope 3 emissions in addition to Scope 1 and Scope 2 emissions

In order to meet ambitious global targets, and to achieve sustainable industrial activity through decarbonization, a greater and deeper effort must be made in order to reach these goals. This requires industrial manufacturers to go deeper on Scope 1 and Scope 2 decarbonization initiatives while pushing into strategic Scope 3 emissions reductions. Pushing into Scope 3 emissions reductions will require greater engagement with upstream and downstream partners, which is complex, but necessary in order to deliver sustainable industrial economies.

Tracking one of the most important KPI's: CO₂ emissions with Greenhouse Gas (GHG) Protocol Methodology

SCOPE 3: DIRECT EMISSIONS in facilities SCOPE 3: INDIRECT EMISSIONS SCOPE 3. INDIRECT EMISSIONS Energy / Heat Generation at **Upstream Activities Downstream Activities Company Facilities** Purchased Good and Services Use of Sold Products **Company Vehicles** Transport and Distribution Transport and Distribution . **Fugitive Emissions** End of Life for Products **Business Travel** SCOPE 3: INDIRECT EMISSIONS in facilities Employee commuting Processing of Sold products Purchased electricity, steam, Heat Leased Facilities Investments and Cooling **Operational Waste**

Figure 10: CO₂ emissions with Greenhouse GAS (GHG) Protocol Methodology

2. Focus and invest in technology developments

Thanks to available technologies such as renewable energy sources, energy storage, forecasting, data analytics, and building management services, it's possible to optimize operations, decrease energy usage and to create significant energy and resource savings. Energy management solutions incorporate this to deliver on the sustainability goals of the organization and at the same time support the financial side of the business and foster growth. A holistic approach to sustainability measures ensures that measures are not implemented based only on individual payback time and ROI, but also based on their crosssynergies, allowing positive impacts to start earlier and also slower and less effective measures to be implemented, so that the highest total effectiveness can be achieved.



Figure 11: Technology developments around renewable systems

3. Engage in the industrial community

Engaged industrial organizations exist throughout the world; their activities help form a blueprint for others to follow and from which to expand decarbonization activities. Engaging in the industrial community is critical to delivering success. Further, looking outside of the industrial community for further strategy and innovation success is key; this includes bringing in third party partners to help evaluate facilities and organizations, to develop actionable strategies to push organizations towards decarbonization, and to monitor and confirm success. Smart Infrastructure combines the real and digital worlds across energy systems, buildings and industries, enhancing the way people live and work and significantly improving efficiency and sustainability.

We work together with customers and partners to create

an ecosystem that both intuitively responds to the needs of people and helps customers achieve their business goals.

It helps our customers to thrive, communities to progress

and supports sustainable development to protect our planet for the next generation.

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Our passionate commitment to growth starts with our Growth Pipeline Dialog, an all-hands approach that puts your management team in a room with our growth experts, addresses your top challenges, identifies areas of disruption, and develops tailored roadmaps and go-to-market strategies.

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