The key leverage points (energy hotspots) in the food and beverage manufacturing sector to enable a low-carbon transition

DRAFT FINAL REPORT

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FoodBev Manufacturing SETA

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real Centre For Researching Education and Labour

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Cover image: *Food for Mzansi*

Executive summary

South Africa is in the midst of an energy crisis, and faces a number of associated challenges and trends, notably a widening energy cost gap, deteriorating energy security, climate change adaptation and mitigation, a shift towards sector coupling, evolving energy markets and automation within the sector (SANEA, 2023). Central to this transition is skills. As a critical enabler, planning and provisioning of skills needs to be envisioned as integral to the transition process and it needs a multi-level, multi-dimensional response.

The purpose of this research was to understand the energy hotspots and key energy trends and challenges faced by the South African food and beverage manufacturing sector. These main energy hotspots indicate the strategic leverage points in South African food and beverage manufacturing where occupation and skills development is most needed to enhance energy resilience and enable a low-carbon transition. This short study is intended as an initial analysis, and provides the foundation of how the sector is responding and a leverage point into where the SETA can examine potential energy linked responses.

Key findings

The discussion below highlight some of the main findings,

Major challenges being faced in the food and beverage manufacturing sector that the transition needs to consider

The South African food and beverage sector is grappling with a multitude of challenges that have implications on the industry and the broader economy, which raise sustainability and environmental concerns. These challenges include:

- The socio-economic impact of the Covid-19 pandemic that the industry is still trying to recover from. The pandemic resulted in disruptions in supply chains which led to delays, shortages and an increase in production costs. Additionally, sales and revenue for businesses reduced due to reduced consumer spending, market

uncertainty, and restaurant closures leading to disruptions in the food and beverage supply chain and hence job losses in the industry.

- Loadshedding and interrupted power supply have had enormous effects on the sector seen through operational disruptions, waste and loss, increased costs from investments in backup power solutions, product quality, and food safety concerns.
- Rising prices of materials including ingredients, transportation costs and energy.
- Climate change continues to have an impact on the sector. The challenges are mainly seen through supply chain disruptions due to extreme weather events, resource scarcity, market access due to stricter environmental requirements and carbon tariffs on imports.
- Addressing changing market demands such as diverse consumer preferences, healthy eating trends, dietary restrictions and allergies, and sustainability and ethical consumption concerns, puts pressure on the sector as it has to keep pace with trends and incorporate them into product development.

Main energy hotspots along food and beverage manufacturing value chains

An assessment of the main energy hotspots across the FoodBev SETA Chamber value chains suggests that the greatest cross-Chamber energy impact areas are:

- Energy used for heating (such as cooking and baking), and cooling and freezing (including storage and transport)
- Embedded energy in processing by-products and food waste
- Disrupted power supply and load shedding and
- Increasing energy costs.

However, a more in-depth exploration indicates that while, for example, heating is a significant cross-cutting hotspot the related energy consumption activities differ per sub-sector. For example, in the baking process, most energy is used to generate heat for ovens; while in beverage and confectionery and snacks manufacture, energy is used predominantly for boilers to heat water and generate steam.

Overarching energy-related trends

Six key overarching themes emerged from an analysis of the contextual understanding of the sector, energy hotspots mapping, sector energy-related good practice examples, and in-depth review of FoodBev SETA levy payers' responsiveness to energy reduction and low-carbon activities. These being:

- Loadshedding, has broad based financial, operational and environmental implications and as a result, has been the priority driver of energy related investment in many companies as they scramble to manage the crisis.
- Increases in energy prices of liquid fuels and electricity, and the capital costs of new energy efficiency equipment or generation options like renewables.
- Energy systems management to respond to the energy intensive nature of the sector and the fact that it will require a new skills set. It includes addressing energy efficiency and requires a comprehensive approach to the system to ensure that optimisation between processes can occur.
- Decarbonisation which is a global trend that South Africa has aligned itself with. Some of the major actions taken by South Africa include the approval of a "policy adjusted" Integrated Resource Plan for electricity which enables the implementation of the Renewable Energy Independent Power Producer Programme (REIPPP) and other lower carbon initiatives, development of an energy efficiency strategy, instituting a carbon tax etc.
- Social inclusivity, which touches on a growing switch to automation and potential impact on jobs, as well as how the workforce and local communities are adequately engaged in mitigation activities.

While five overarching trends were identified three emerged as the most significant for the South African food and beverage manufacturing sector - t**hese being loadshedding, energy price increases and decarbonisation.** These three create a 'perfect storm' and collectively have caused some fundamental shifts in the sector players' strategies to energy efficiency, by increasing the use of generators as an initial response to

loadshedding, and then ultimately installing their own renewable energy generation and in some cases depending on the need, accompanied by storage.

Key actions to mitigate energy hotspots

Larger companies across all the chambers, have the available capital, are taking action by adjusting their strategies and business models to reduce energy consumption, installing diesel generators and if possible, switching to alternative sources of energy to either decarbonise or reduce GHG emissions. There is a definite business case for doing so given the intensity of loadshedding, rising energy prices and pressure to decarbonise. Desktop data on smaller companies and SMMEs actions was more difficult to obtain, and highlights an area for future research.

Energy efficiency is being implemented, but in many cases, energy system optimisation is not being carried out as an important first step to reduce demand. This should happen first followed by fuel switching to minimise the required size of alternative energy plants and therefore reduce costs. This includes optimisation across the value chain where transportation plays a key role in overall energy costs. Social and community issues need to be brought to the fore and more community related job provision and/or re- and up-skilling done to mitigate energy hotspots.

Industry associations emerged as key conduits for mitigation efforts. A number of the larger sub-sector associations indicated they are actively involved in presenting the voice of their members to the Government amidst the energy crises. They engage with Ministers and policy developers to present the challenges faced by their members in order expedite the identification of solutions beneficial to their members as a collective, or to inform the direction of policy. In some instances, they have identified the need to develop guiding policy and strategies on climate change and sustainability (which includes energy) to respond to their members' specific energy mitigation efforts and challenges.

Occupations and skills implications of the energy hotspots and trends

The table below, lists some of the occupations, that emerged within the research process and are core to the transition,

Emergent occupations central to transition
• Airconditioning & Refrigeration Technician [Heating & Cooling Technician] • Climate Change Scientist / Analyst • Diesel Mechanic • Electrician • Electrical Engineer • Environmental / Sustainability Manager • Finance Director / Manager • Human Resource Manager • [Installation], Repair and Maintenance Technician • Machine Operator • Maintenance Manager / Planner / Engineer • Mechanical Engineer • Millwright • Operations Manager (Manufacturing) • Production Coordinator / Planner • Production Supervisor (Manufacturing) • Programme or Projects Manager • Renewable Energy Engineer / Technician

Two critical skills gaps emerged in relation to reducing energy consumption and transitioning to low-carbon, these being maintenance and repair [RM], and renewable energy technology specialists (including installation). This finding is further supported by FoodBev SETA (2023) and the Department of Higher Education and Training (DHET, 2022a), who indicate that number of occupations associated with installation, repair and maintenance (IRM) are also deemed as critical or hard-to-fill, such as Airconditioning & Refrigeration and Heating & Cooling Technicians, Electricians, and Engineering [Maintenance] Managers.

Mechanisms for training and upskilling in the sector were predominantly identified through the interviews, with the most commonly identified including learning through: 1) broader sector (national and international) engagements such as events or knowledge-sharing platforms, 2) collaborative working, 3) bringing in international specialist technology skills

and knowledge, 4) work-based learning through apprenticeships, and 5) through on-site company academies or external specialist trainers.

Proposed recommendations

To develop some of the occupation and skills needs identified, and to enable the sector to leverage the necessary change required to enhance energy resilience and to enable a low-carbon transition, a number of recommendations are presented for consideration by FoodBev SETA, in their collaboration with industry associations, and food and beverage manufacturing companies. Some of the key recommendations are:

- Develop learning and support skills provisioning that targets the reskilling, upskilling and where necessary development of new skills that are specifically adapted for the food and beverage sector in order to ensure responsiveness to how occupations and skills need to change in response to the energy-related hotspots and trends. Notable areas that need to be incorporated in learning programmes/plans include:
    - Energy audits
    - Energy optimisation
    - General energy reduction and renewable energy awareness raising
    - Installation, repair and maintenance (IRM),
    - Renewable energy specialisms, notably solar, biomass and batteries,
    - Investment and finance awareness raising and decision making, and
    - Social inclusivity with a focus on local community engagement.
- Identify mechanisms to better support and subsidise the upskilling of food and beverage SMEs in the latest energy management, technological and renewable energy developments. Some possible mechanisms include:
    - Technology transfer programmes between larger corporations and SMEs
    - Create platforms that allow SMEs to share best practices, collaborate and access relevant resources
    - Establish innovation hubs that provide SMEs to learn, work with and develop technology related to energy and sustainability in the food and beverage

sector.

- To be more explicit about energy challenges and decarbonisation and link them to existing initiatives in the SSP such as 4IR to address the automation issues identified, by including them in the following sections:
    - Economic indicators - and the impact they have on imports and exports
    - Key skills change drivers - as an emerging and urgent driver
    - Occupation shortages and skills gaps with recommendations on major areas of focus
    - SETA partnerships - highlight partnership and SETA collaboration platform
    - Skills priority actions - as a complete approach from the SETA to assist levy payers with dealing with energy resilience in general
- Given the proactivity of the sector's industry associations, a review of their energy-related and low-carbon training and course development activities should be undertaken. This will inform FoodBev SETA on how best to collaborate with them.
- Conclude partnership agreements in targeted areas with relevant industry bodies and play a facilitation role to partner them with JET and energy related industry bodies in collaboration with the EWSETA and merSETA.
- Raise awareness of the issues in the sector pertaining to the hotspots and trends and how industry skills and occupations can respond, especially with SMMEs, through publishing information on-line, holding webinars and workshops and working through the industry associations.

Contents

Abbreviations

AAPMP	Agriculture and Agro-processing Master Plan
BevSA	Beverage South Africa
BRICS	Brazil, Russia, India, China and South Africa
CGCSA	Consumer Goods Council of South Africa
CGF	Consumer Goods Forum
DMRE	Department of Mineral Resources and Energy
dtic	Department of industry, Industry and Competition
EAF	Energy Availability Factor
EWSETA	Energy and Water Sector Education and Training Authority
FoodBev SETA	Food and Beverages Manufacturing Sector Education and Training Authority
GHG	Greenhouse Gas [Emissions]
IEA	International Energy Agency
ILO	International Labour Organisation
IRENA	International Renewable Energy Agency
IRM	Installation, Repair and Maintenance
ISO	International Organisation for Standardisation
JET	Just Energy Transition
JET IP	Just Energy Transition Investment Plan
KPI	Key Performance Indicator
MilkSA	Milk South Africa
NDC	Nationally Determined Contributions
NDP	National Development Plan
NGO	Non-governmental Organisation
NSDP	National Skills Development Plan
OFO	Organising Framework for Occupations
PESTLE	Political, Economic, Social, Technological, Legal and Environmental
PCC	Presidential Climate Commission

PSET	Post-school Education and Training
PV	Photovoltaics
SAMPRO	South African Milk Processors' Organisation
SANEA	South African National Energy Association
SETA	Skills Education and Training Authority
SIC	Standard Industrial Classification
SSP	Skills Sector Plan
StatsSA	Department of Statistics South Africa
UNFCCC	United Nations Framework Convention on Climate Change
WEF	World Economic Forum
Wits REAL	University of the Witwatersrand, Centre for Researching Education and Labour

Glossary

Agri-processing: All post-harvest activities applied to products that originate from primary agriculture, forestry and fisheries which involve the transformation, preservation and preparation of products for intermediary and final consumption to make them usable as food, feed, fibre or industrial raw materials. This includes waste and waste products (Pienaar and Partridge, cited in DEDAT, 2021).

Energy: Primary sources of energy include a number of forms, including coal, electricity, [natural] gas, nuclear, oil and petroleum (liquid fuels), and renewables (e.g. solar, wind, ocean, geothermal). These primary sources are converted to electricity, a secondary energy source, which is transmitted through power lines and other transmission infrastructure to consumers (SANEA, 2023; US Department of Energy, 2023).

Energy hotspot: Is a strategic leverage point in a system where most change can be affected, in this case, through attention to occupation and skills development. A **hotspot analysis** is a method that allows for the rapid assimilation and review of a range of information sources, such as life cycle analyses, to ascertain where the areas of greatest impact [hotspot], and therefore leverage, sit within a value chain (Ramsarup and Ward, 2017). With reference to this research an energy hotspot refers to areas of greatest impact in relation to energy use and associated carbon emissions.

Food processing: is a broad word that encompasses a variety of processes and methods used to convert raw agricultural resources into finished products. It involves several processes, from raw material harvesting and storage to final product processing and packaging (Amit et al., 2017).

Just Energy Transition (JET): The just energy transition (JET) focuses on the transition of South Africa's energy sector as the country navigates the shift away from coal towards cleaner sources of energy. It needs to ensure that the lives and

communities that are tied to high-emitting energy industries (e.g., coal) are not left behind in the shift towards a low emissions economy. It must be fair and perceived to be fair. A well-managed JET can be a strong driver for new jobs, better jobs, social justice and poverty eradication (PCC, 2023).

Loadshedding: Is a controlled process that responds to unplanned events in order to protect the electricity power system from a total blackout. The word 'blackout' is used loosely to mean 'no lights' in a local area, a country-wide blackout has much more serious consequences. Blackouts occur when there is too much electricity demand and too little supply, bringing the power system into an imbalance and consequently tripping the power system in its entirety (Eskom, 2023a).

Low carbon transition: Are long-term multi-faceted, disruptive, goal-oriented and non-linear processes that challenge and enable change from current carbon intensive models of operation and thinking, such as a shift from fossil fuels to renewable energy. They involve a wide range of actors, not just industry and business and consumers, but also, for example, civil society, media, local residents, government, political parties, and advisory bodies. Transitioning requires not only new technologies, but also 'changes in user practices, cultural discourse and broader political struggles' (Geels, Berkhout and van Vuuren, 2016; Geels, Sovacool, Schwanen and Sorrell, 2017, p.463). The act of or activities associated with transitioning to a state of low-carbon is often referred to as **decarbonisation**.

Standard Industrial Classification (SIC): Consists of a coherent and consistent classification structure of economic activities based on a set of agreed concepts, definitions, principles and classification rules. It is derived from International Standard Industrial Classification (ISIC) Rev 4.0 1 but adjusted for South African conditions. It provides a comprehensive framework within which economic data can be collected and reported in a format designed for economic analysis, decision-taking and policy-making. The classification structure represents a standard format to organise detailed

information about the state of an economy according to economic principles and perceptions (StatsSA, 2012).

Value chain: Refers to the value addition at different stages of the full life cycle of a product or process, including material sourcing, production, consumption and disposal/recycling processes. From a sustainability perspective, ‘value chain’ has more appeal, since it explicitly references internal and external stakeholders in the value-creation process (CISL, 2023).

1. Introduction

The Government of South Africa has set out, through key strategic plans, an ambition to stimulate economic growth and skills development in the country. Some of these core strategies include the National Skills Development Plan (NSDP) (SA Government, 2019), the White Paper for Post-School Education and Training (PSET) (DHET, 2013), the Economic Reconstruction and Recovery Plan Skills Strategy (DHET, 2022), and the Industrial Policy Action Plan (dti, 2018). The overarching intention of these strategies is to ensure that South Africa has adequate, appropriate, and high-quality skilled people that can enable and contribute to economic growth, job creation and social development.

Regarding the food and beverage sector, and energy resilience, two recent Government plans inform and guide interventions to ensure economic and social transformation, food and energy security, and job creation in the sector. These include the 'Agriculture and Agro-processing Master Plan' (AAMP) (DALRRD, 2022), and the 'Just Energy Transition Investment Plan' (JET IP) (Presidency, 2022), for which a five year Implementation Plan is now being developed. Skills has been identified as a critical enabler of the JET.

FoodBev SETA's mandate is to act as a 'catalyst in initiating and driving crucial skills development initiatives within the sector to support [the above mentioned] plans (FoodBev SETA, 2023, p3). Within the SETA's 'Draft Skills Sector Plan' (SSP) 2024/25 drivers of change, areas of skills mismatch and a labour market outlook are presented. The drivers of change identified for the sector include, amongst others, **climate change, the energy crisis** in South Africa and technological advancement. It is acknowledged that these in turn impact current and future occupations and skills demand and supply in and for the sector (FoodBev SETA, 2023).

To this end, the SETA has identified a number of areas of intervention and research to respond to these drivers of change, but to also inform how it can enhance its support

for the sector to do so. Regarding energy, FoodBev SETA in consultation with the University of the Witwatersrand's Centre for Researching Education and Labour (Wits REAL) identified a need to explore the impact of the energy crisis and climate change on the food and beverage manufacturing sector, and to investigate the associated core occupations and skills implications and requirements to improve energy resilience and enable a low-carbon transition in the sector. This research is set within the context of other FoodBev SETA research, such as the recently published 'Atlas of Emerging Jobs' (FoodBev SETA, 2023a); and research currently being undertaken by the FoodBev SETA funded research chair at Wits REAL.

1.1 Research purpose and objectives

The purpose of this research is to understand, within a broader climate change and sustainability context, the energy hotspots in the South African food and beverage manufacturing sector. This will highlight the areas of greatest energy impact in the manufacturing process, and therefore the main leverage points to enable the sector's low-carbon transition.

The objectives of the research are to:

- Understand the current and future broader climate change issues and trends faced by the South African food and beverage manufacturing sector, with a focus on a just energy transition.
- Identify the main leverage points (energy hotspots) for a low carbon transition within the sector, and key actions for mitigation.
- Provide an overview of key occupations and associated skills required to lever and enable the low carbon transition within the sector, with a focus on energy.

2. Research approach

The research approach comprised five phases, as illustrated in Figure 1 below.

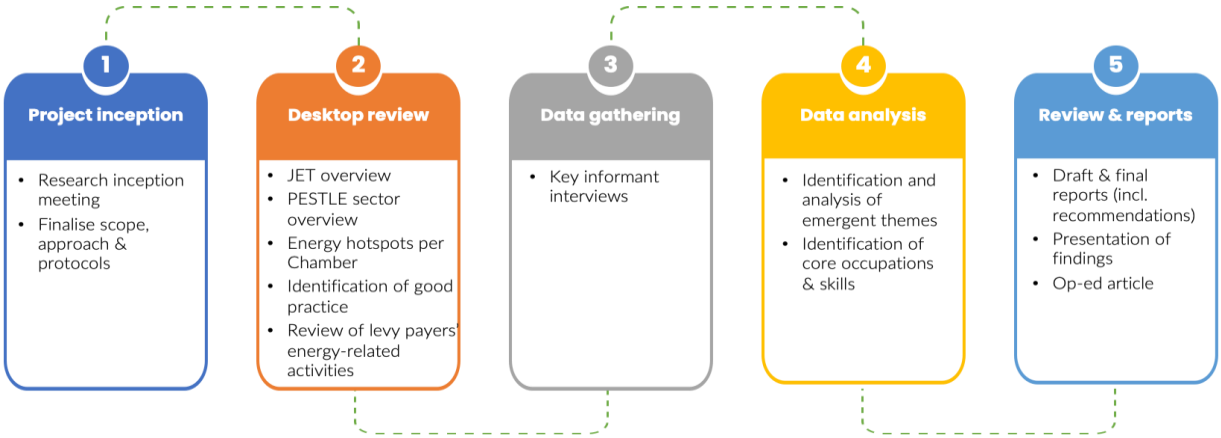

Figure 1: Research approach phases

2.1 Data collection

2.1.1. Desktop review

The purpose of the desktop review was three-fold. Firstly to set the research context by understanding the context within which the South African food and beverage manufacturing sector operates. Secondly, to identify the main energy hotspots (areas of greatest impact) along the different food and beverage manufacturing sub-sector value chains. Thirdly, a review of FoodBev SETA levy payers' sustainability reports and activities was undertaken to identify examples of good practice, and to establish the level and type of responsiveness to an energy resilient and low-carbon transition.

In total, over **275 different sources** were reviewed, including Government department and delivery body policy, strategy and reports; reports published by Non-governmental Organisations (NGO's) and international agencies, such as WWF South Africa and the World Bank; food and beverage manufacturing company sustainability reports and websites; industry association statistics; academic theses, journal articles, and conference papers; and media releases and opinion pieces for current insights.

Understanding the South African food and beverage manufacturing sector operational context

By understanding the context within which the South African food and beverage manufacturing sector operates, its key characteristics (including employment) and challenges it is possible to determine how this context relates to a broader just transitions imperative. A PESTLE approach was used as a framework to draw out both contextual insights (see Ramsarup and Ward, 2017), and to identify an initial set of key informants.

Identification and mapping of main energy hotspots

The desktop review was used to identify and map the major energy hotspots along the different food and beverage manufacturing sub-sector (FoodBev SETA Chamber [see Appendix 1]) value chains. A hotspot analysis methodology (see Ramsarup and Ward, 2017) was used to highlight the main areas of energy impact and therefore where skills will be required to transition the sector to one that is more energy resilient and low-carbon. Typical documents sources used to inform the hotspot identification included food and beverage sector and product value chain and life cycle analyses, academic theses and journal articles, and sector sustainability reports and/or intervention roadmaps and strategies. The sub-sector hotspot maps are presented in Appendix 2.

The energy hotspot maps helped to inform the identification of key cross-cutting sub-sector themes and challenges impacting the sector in relation to low-carbon and energy resilient transitions.

Review of FoodBev SETA levy payers' sustainability reports and activities

The review of FoodBev SETA levy payers' activities involved two phases of review. These being a review of:

- Company websites and on-line media to identify examples of good practice, and

- Sustainability reports and websites to provide a more detailed understanding of member responsiveness and mitigation activities across a broader spectrum levy payers'.

The **review of company websites and on-line media** provided an initial high-level indication of the types of activities being implemented by FoodBev SETA levy payers, and also highlighted potentially suitable stakeholders for interview during the data collection phase of the research. This review generated 3-5 examples of good practice across the FoodBev SETA's Chambers. In addition, this process highlighted that further analysis was required of what a much broader spectrum of levy payers were doing, as most of the mitigation efforts identified through this exercise appeared to only highlight the larger manufacturers. Given FoodBev SETA's interest in also garnering an understanding of their medium to smaller company members it was deemed important to adopt another mechanism for trying to capture this information.

For the broader and deeper understanding of food and beverage manufacturers' responsiveness to the need to reduce energy and transition to low carbon, almost 170 **FoodBev SETA levy payers' websites and sustainability reports were reviewed** to determine what publicly available information exists, and whether this information provides data on the following:

- Does the company have a sustainability report?
- What do they disclose on energy related issues, such as energy efficiency measures, renewable energy installation or purchase, energy storage solutions, information on the use of generators, and transport and logistics energy-related activities.

The companies analysed were a mixture of large companies, and small, medium and micro-enterprises (SMME) (see Appendix 2) for the complete list of companies reviewed), and represented a cross-section of the 7 main FoodBev SETA Chambers. Table 1 illustrates that there was a wide spread of companies representing 31 different food and beverage manufacturing activities.

Table 1: Number of FoodBev SETA levy payers analysed, by manufacturing activity

FoodBev SETA levy payer manufacturing activity	No.	FoodBev SETA Chamber	No.
Baked goods	1	Baking	21
Manufacture of Bakery Products	9		
Baking	11		
Manufacture of beverages	2	Beverage manufacturing	15
Manufacture of soft drinks, production of mineral waters	6		
Distilling, rectifying and blending of spirits, alcohol production from fermented materials and manufacture of wine	7		
Manufacture of Breakfast Foods	5	Cereals	5
Manufacture of cocoa, chocolate and sugar confectionery	2	Confectionery and snacks	2
Manufacture of icecream and other edible ice	1	Dairy manufacturing	20
Processing of fresh milk	1		
Manufacture of butter and cheese	4		
Manufacture of milk powder. Condensed milk and other edible milk products	4		
Manufacture of dairy products	10		
Manufacture of compound cooking fats, margarine and edible oils	2	Manufacture of food preparation products	30
Manufacture of macaroni, noodles and similar farinaceous products	2		
Manufacture of coffee, coffee substitutes and tea	4		
Manufacture of food preparation products	9		
Manufacture of spices, condiments, vinegar, yeast, egg products, soups and other food products	13		
Canned meats	1	Processed and preserved meat, fish, fruit and vegetables	72
Production of lard and other edible fats	1		
Manufacture of nut food	2		
Fishing	3		
Manufacture of canned, preserved and processed fish, crustaceans and similar foods.	3		
Manufacture of canned, preserved, processed and dehydrated fruit and vegetables (except soups)	3		
Manufacture of crude oil and oil seed cake and meal	3		
Manufacture of prepared and preserved meat, including sausage	4		
Processing and preserving of fish and fish products	4		
Processing and preserving of fruit and vegetables	6		
Production, processing and preserving of meat, and meat products	8		
Manufacture of other food products n.e.c.	17		
Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats	17		

Synthesising Table 1 further, the most prominent areas of manufacturing activity can be ascertained. Figure 2 illustrates where 5 or more levy payers were reviewed per activity area. These being the Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats (14%); Manufacture of other products n.e.c (14%); and Manufacture of spices, condiments, vinegar, yeast, egg products, soups and other food products (11%).

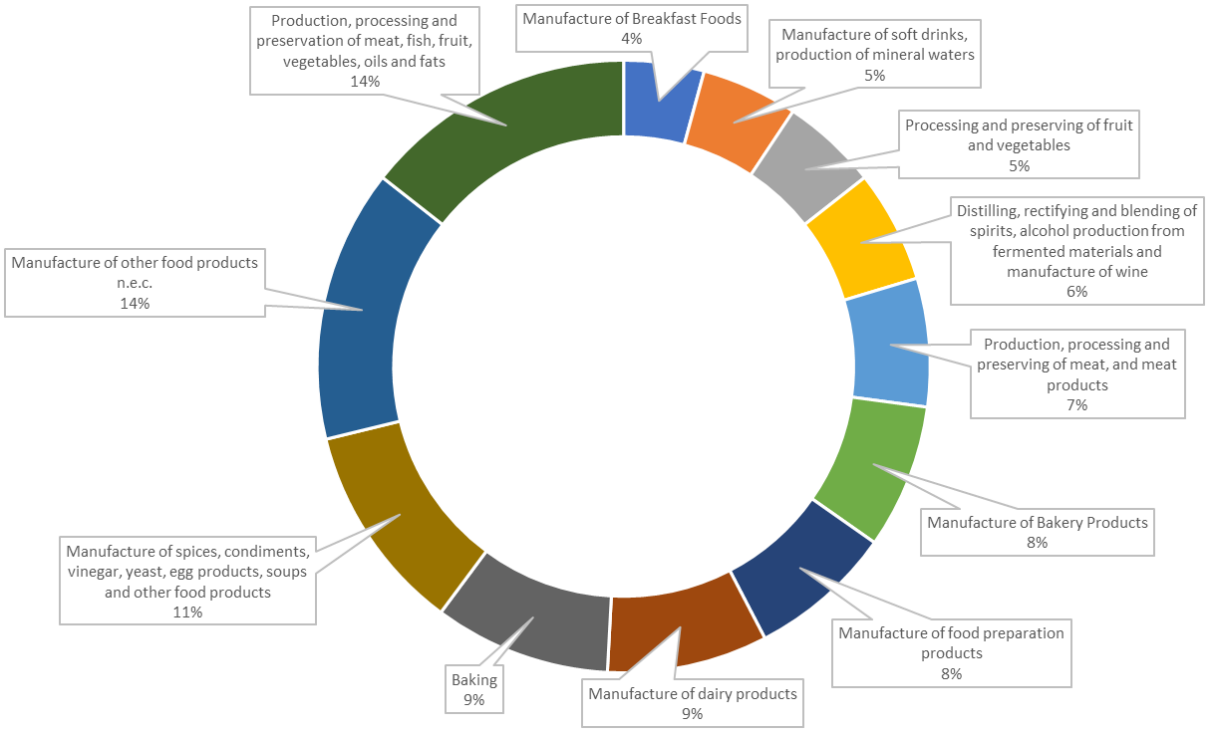

Figure 2: Percentage of companies per area of activity, where 5 or more levy payers were identified

If these are categorised per FoodBev SETA Chamber, the Chamber that had the highest number of levy payers was Processed and reserved meat, fish, fruit and vegetables (44%), Manufacture of food preparation products (18%), and Dairy manufacturing (12%). Cereals (3%), and Confectionery and snacks had the lowest representation. See Table 1 and Figure 3.

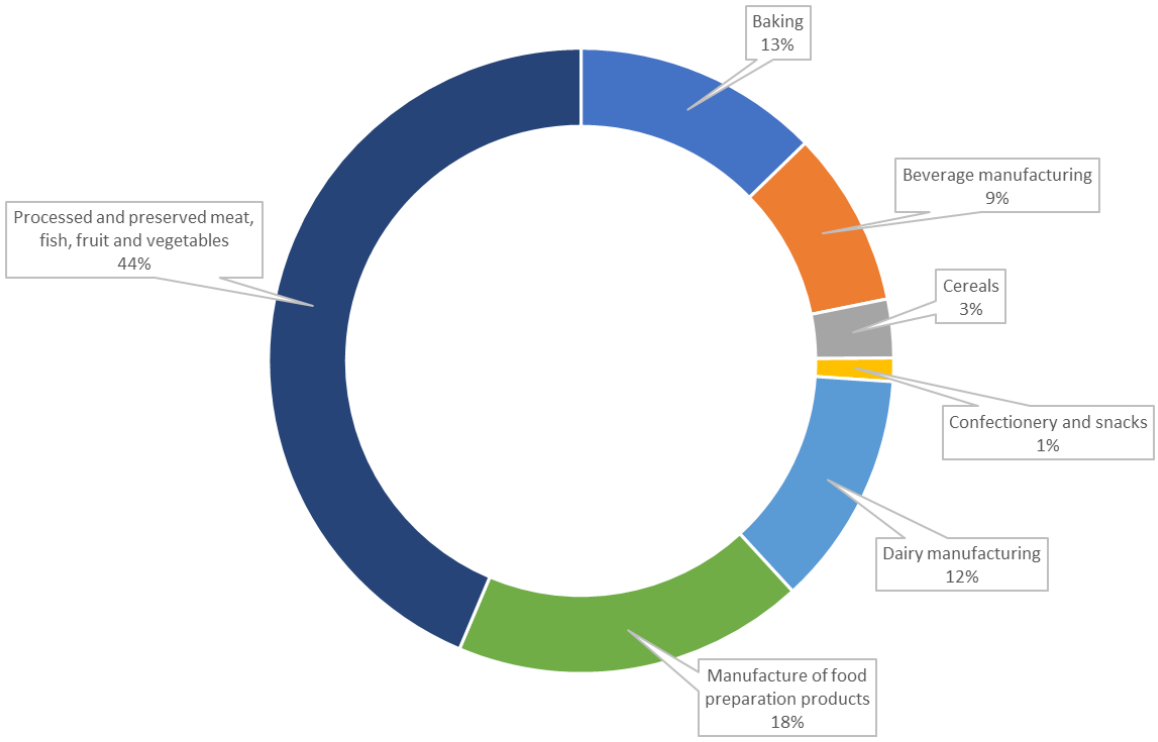

Figure 3: Percentage of FoodBev SETA levy payers reviewed, per Chamber

It must be noted that a number of companies could be categorised into multiple Chambers as they have different divisions or brands, such as holding companies. In this instance, the manufacturing area of activity was estimated.

As described in the findings section below, this data was further analysed to ascertain which companies were disclosing energy and climate related issues and key trends identified. This work also fed into the energy hotspots analysis and provided case studies and data.

2.1.2 Key informant interviews

Following the desktop review, which set a contextual foundation for the research, interviews were undertaken with key informants within the South African food and beverage manufacturing system. The purpose of the interviews was to:

- Reflect on the contextual findings.

- Develop a more nuanced understanding of main energy hotspots within the sector.
- Develop a deeper understanding of the energy-related challenges faced by the sector, and the activities they are putting in place to respond to these challenges or to decarbonise.
- Identify the main occupations involved in energy-related practices, how these are changing in response to the challenges faced, and to ascertain the main current skills gaps to leverage and enable energy resilience and a low carbon transition.

Informants for interview were identified through the desktop review, in particular the case studies of good practice, and from FoodBev SETA's levy payers list. Regarding the latter, companies were identified that represented a cross section of Chambers, and where contact details were provided for a contact within the organisation (many listed intermediaries not based within a member company). From this, a stakeholder interview list and tracker was developed to monitor interview progress. Table 2 provides an overview of the number of stakeholders identified for interview, number of interviews undertaken, and number of people interviewed in total.

A total of 44 organisations were contacted for interview, with 16 interviews undertaken with stakeholders representing a range of sectors and stakeholder types.

Table 2: Overview of stakeholders identified for interview and interviewed

Category / Chamber	No. contacted for interview	No. interviewed	No. people interviewed **
Industry and business (processors, manufacturers and industry associations)			
Baking	2	1	1
Beverage manufacturing	9	4	4
Cereals	2	-	-

Category / Chamber	No. contacted for interview	No. interviewed	No. people interviewed **
Confectionery and snacks	-	-	-
Dairy manufacturing	7	4	4
Manufacture of food preparation products	1	-	-
Processed and preserved meat, fish, fruit and vegetables	7	3	6
Overarching*	9	1	4
industry unions	2	-	-
NGOs and Government delivery agencies	5	3	4
Total	**44**	**16**	**23**

*A number of manufacturers interviewed processed or manufactured more than one product type e.g. producing both dairy and fruit juices, or processed confectionery, cereals and beverages.

**In a number of instances interviews included more than one representative from a company or industry association.

3. Literature Review

3.1. Why a low-carbon transition?

South Africa is in the midst of an energy crisis, and faces a number of associated challenges and trends, notably a widening energy cost gap, deteriorating energy security, climate change adaptation and mitigation, shift towards sector coupling, evolving energy markets and automation within the sector (SANEA, 2023). From a climate change perspective, the global agri-food value chain (including farming, processing, packaging, transportation and waste) is estimated to account for 43%-57% of all global human GHG emissions (TEEB, 2018). In South Africa, the industrial sector (which includes food and beverage manufacturing) contributes 12% to the country's energy-related CO_2 emissions (Climate Transparency, 2021), yet is also very vulnerable to climate change impacts (IEF, 2023).

Given the country's level of energy insecurity, and a need to shift away from a dependence on fossil fuels, the South African government has put in place a Just Energy Transition (JET) investment plan to "establish an ambitious long-term partnership to support South Africa's pathway to low emissions and climate resilient development, to accelerate the just transition and the decarbonisation of the electricity system, and to develop new economic opportunities such as green hydrogen and electric vehicles amongst other interventions to support South Africa's shift towards a low carbon future" (PCC, 2023). This vision is set within the Government's broader Nationally Determined Contribution (NDC) under the Paris Agreement[1], which sets out an ambitious emissions reduction trajectory including enhancing governance and legal frameworks, developing an enhanced understanding of the impacts of global warming on the country, implementation of adaptation priorities and strategies, and support to decarbonise (Republic of South Africa, 2021). Within the commitment, the South African Government acknowledges that "a just transition is core to shifting our development pathway to increased sustainability, fostering climate resilient and low greenhouse gas emissions development, while providing a better life for all" (Republic of South Africa, 2021, p2). Within this context, South Africa's food system has been identified as a key focus area for a just and low carbon transition (IEF, 2023).

From the perspective of the FoodBev SETA, climate change and the energy crisis are identified as two of a number of major drivers of change for the sector in their 'Draft Skills Sector Plan (SSP) 2024/25' (FoodBev SETA, 2023). It is likely that food may become even more expensive as climate mitigation efforts increase, and energy efficiency becomes increasingly important. Therefore, the SSP highlights that there is

[1] The Paris Agreement is a legally binding international treaty on climate change adopted by 196 parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. Its overarching goal is to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels" (UNFCCC, 2023).

a need to recognise and balance food security and sector climate adaptation. The SSP also acknowledges that these drivers in turn impact current and future occupations and skills demand and supply in and for the sector (FoodBev SETA, 2023).

3.2 What is a just energy transition?

While the emphasis of this research is on the topic of energy resilience and a low carbon transition, these activities sit within a broader narrative of a just [energy] transition.

The concept of 'just' reflected in policy and ambitions refers to not only the adoption of a more sustainable and resilient set of practices and processes to reduce environmental impact, but also it ensures broad social inclusion and equality in an economy (IEF, 2023). The notion of a 'just transition' while dominant in contemporary policy discourse, emerged in the 1970s in the United States of America (USA) when labour movements and environmental justice organisations began to address toxic-waste policy, which impacted minority and vulnerable workers (Córdova et al., 2022). Since then it has gained traction globally and the concept has been refined further, including the proposed categorisation of three dimensions of a just transition (see Montmasson-Clair, 2021) - procedural, distributive and restorative justice. Table 3 below presents the key features of these dimensions, which clearly illustrates the importance of social inclusivity in a just transition.

Table 3: The three dimensions of a just transition

Dimensions of justice	Key features
Procedural	Voice Dignity and respect Neutrality, impartiality, and transparency Trustworthiness
Distributive	Labour market policies (passive and active)

Dimensions of justice	Key features
	Industry policy (functional and selective) Social protection (contributory and non-contributory)
Restorative	Socio-economic empowerment Socio-cultural restoration Environmental restoration

Source: Montmasson-Clair (2021)

The link between a just transition and decarbonisation was strengthened with the United Nations Paris Agreement of 2015 acknowledging that the 'imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined [NDCs] development priorities (OECD, 2017; Montmasson-Clair, 2021). Within South Africa, a just transition to net-zero carbon emissions by 2050 has been defined as "a shift towards low carbon, climate resilient and ecologically sustainable economies and societies which contributes to the creation goals of decent work for all, social inclusion, and the eradication of poverty" (NEDLAC, 2020, p. 7). Given South Africa's dependency on fossil fuels, much of the just transition discourse to date has focused on the coal value chain and the implications of a shift away from fossil fuels to renewables on the associated workforce and communities (See for example, COBENEFITS, 2022; Cock, 2019; GreenCape, 2020; Kengani, 2023; and Montmasson-Clair, 2021). In comparison, much of the discourse on a just transition in South Africa's food system centres around equitable access to land, ecological farming practices, food sovereignty and food security (see for example Bennie and Satgoor, 2018; IEF, 2023; Pereira, 2014), with energy seen as a critical dimension of the transition, covering both energy efficiency and carbon reductions (CGCSA, 2023).

As indicated, a core feature of South Africa's just transition discourse has centred around a transition towards a more resilient and just energy system. To this effect, a

specific just energy transition (JET) framework and investment plan (JET IP) have been put forward by the South African government, through the Presidential Climate Commission (PCC). The JET focuses on the transition of South Africa's energy sector as the country navigates the shift away from coal towards cleaner sources of energy. Its intention is to ensure that the lives and communities that are tied to high-emitting energy industries (e.g., coal) are not left behind in the shift towards a low emissions economy. The aim of the JET IP is to move the South African economy towards a low carbon trajectory and resilience by:

- Creating quality jobs in new sectors like electric vehicles, green hydrogen, renewable energy, and manufacturing.
- Increasing energy security and ending load shedding through large-scale rollout of new, sustainable energy sources.
- Addressing the risks of climate change and positioning South Africa to be an important global player in the future green economy.
- Boosting economic growth through more than R1 trillion of new investment in the South African economy.

It also acknowledges the transition needs to be fair and perceived to be fair. A well-managed JET is also considered to be a strong driver for new jobs, better jobs, social justice and poverty eradication (PCC, 2023).

3.3. Skills for a just energy transition

Skills have been recognised as a critical element for a just energy transition and thus form a critical element in national and international strategies and plans (Hermanus and Montmasson-Clair, 2021; PCC, 2023). This study aims to understand the jobs and skills central to the energy transition, hence we start with distinguishing between occupations, jobs and skills. Broadly an occupation is defined by the set of jobs it requires, and a job is defined by the set of skills it requires.

Figure 4 presents this distinction and the conceptual orientation followed in this research.

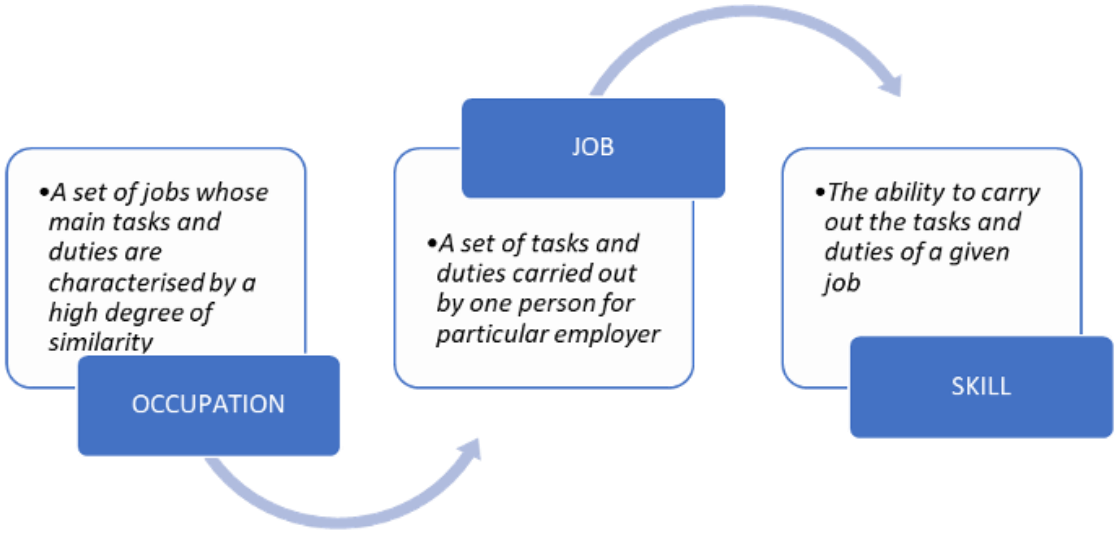

Figure 4: Relationship between skills, job and occupation underpinning the study

The distinction between jobs and skills is important because the labour market dynamics of 'greening' the economy are and will be complex in the future. This research focuses on trying to highlight how the energy transition will impact jobs and hence try to surface some of the relevant skills implications.

Broadly the Just Energy Transition process, presents a foundation for contemplating how skills are considered within the transition to a just, resilient and sustainable economy and society. It emphasises that skills need to be reframed as a continuum from naïve approaches that focus on counting present-day energy transition (green) jobs to activity focused on eradicating a dependence on fossil fuels, to more circular economies and to transform our economy from inequality towards racial, gender, and class equality (Ramsarup, 2022). The understanding of skills required to transition are a slow, long-term endeavour, that requires multilevel engagement with hidden structures and mechanisms, including history and power relations, as often socio-economic lock-ins have deep historical roots. To understand the skills and capabilities

needed to support the transition to a sustainable and renewable energy sector in SA, an understanding of the necessary changes at multiple analytic levels, which are related to all the other levels in the transitioning system, is required (Rosenberg et al 2020).

From the perspective of the FoodBev SETA, climate change and energy insecurity have implications on skills development and planning for the food and beverages manufacturing sector. These implications are highlighted in FoodBev SETA's draft 2024/2025 SSP (see Table 4).

Table 4: Climate change and energy crisis implications for skills planning in the food and beverage manufacturing sector

Change driver	Implications for skills planning
Climate change	● The impact of climate change will inevitably change the skills required and the tasks involved in many of the existing occupations. ● A proactive approach is needed for the development of new skills for greening the economy, sustainable development planning and managing risk. ● Expertise is required in fields of research and development, material science engineering and packaging technology to deal with issues related to climate change. ● Environmental Engineers, Renewable Energy Scientists, Manufacturing and Packaging Managers will be highly sought after. In this regard, the SETA needs to increase its bursary uptake for graduates.
Energy crisis	● The energy crisis has significant skills implications on the food and beverage manufacturing sector. Therefore, the sector's workforce requires skills to manage change and adopt an effective approach to the energy crisis in the country. ● To provide employees with information and training on energy conservation. ● To mitigate the impact of the energy crisis, the sector may need to invest in developing skills related to energy efficiency, renewable energy, maintenance and repair of alternative energy sources, supply chain management and innovation to ensure sustainability of their business.

Source: FoodBev SETA (2023, p39).

It is within this context that this research attempts to better understand the food and beverage manufacturing energy context, challenges and transition opportunities and

implications on occupations and skills required to transition the sector to one that is energy resilient, low-carbon and just.

4. Discussion of Research findings

4.1 Overview of the food and beverage manufacturing sector

The food and beverage manufacturing sector in South Africa encompasses companies that process raw food materials and package and distribute them. Processing and manufacture is part of the broader food value chain, and encompasses:

- Food production, which includes farming and production of raw agricultural produce.
- Food processing, which includes the production, processing and preservation of raw and processed produce into finished products.
- Food distribution, which includes the distribution and retailing of finished products, and the consumer, which refers to the customer of the final processed food (FoodBev SETA, 2020).

FoodBev SETA categorises these activities into seven Chambers (or sub-sectors) including: Baking; Beverage manufacturing; Cereals; Confectionery and snacks; Dairy manufacturing, Manufacture of food preparation products; and Processed and preserved meat, fish, fruit and vegetables. See Appendix 1 for an overview of activities covered within each FoodBev SETA Chamber, by SIC code.

South Africa has more than 1,800 food processing companies, of which the ten largest account for more than 80% of the sector's revenue (Reddy and Woody, 2023, TIPs, 2021). The total value of the food and beverage manufacturing sector was estimated at R750 billion in 2022 (26% of total manufacturing industry in the country) (Ermes et al., 2022; Reddy and Woody, 2023), and is estimated to account for 60% of the country’s agro-processing sector (Chitonge, 2021a). The sector is characterised by a diverse scale of players, from small informal operators through to large multinational

vertically integrated companies that have a significant stake in the various aspects of the food processing chain (TIPS, 2021). Drawing on an analysis of FoodBev SETA's levy paying companies, it is possible to intimate the scale of formal South African food and beverage manufacturing operations. With 16,720 registered entities in 2023, an estimated 5.5% represent large[2] companies, 7% medium, and the majority being small at 87% (FoodBev SETA, 2020, p7). However, these statistics do not adequately recognise the role of the informal sector in food and beverage manufacture. It is estimated that 50% of South Africa's informal economy are food and beverage operations, and therefore also play a vital role in the country's food economy and job creation (Dhlamini, 2021; Kushitor et al., 2022).

In 2023, an estimated 186,700[3] people are employed in the food and beverage manufacturing sector, of which the majority are employed in Food preparation products (45%), and the Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats (28%) (FoodBev SETA, 2023). From a just transition and equal opportunity perspective, it is recognised that 59% of the workforce are male and 41% female. The percentage of females is higher than the national manufacturing sector average of 36%, and has been steadily increasing since 2015 (StatsSA, 2023; TIPS, 2021). In terms of race, 70% of the workforce is Black Africans, however, 41% of those holding managerial positions are white (FoodBev SETA, 2023).

Major challenges currently facing the sector are recovery from the COVID-19 pandemic, **load shedding and interrupted power supply**, **rising prices** (e.g. materials, ingredients, transportation and **energy**), transport infrastructure (notably rail and roads), **climate change** (including carbon tax), addressing changing market

[2] Small companies have less than 50 employees; medium sized companies between 50 and 149 employees and large companies greater than 150 employees (SARS, 2021)
[3] This figure has been rounded.

demands, and policies favouring other BRICS[4] markets (Fraser, 2023; Reddy and Woody, 2023; Wilson, 2022).

4.2 Energy hotspots in the food and beverage manufacturing sector

This section provides an overview of the main energy hotspots along the FoodBev SETA Chamber value chains. These hotspots highlight the areas of greatest energy consumption and carbon emission impact, critical challenges faced by a sub-sector, and therefore the main leverage points to enhance the sector's energy resilience and enable a low-carbon transition.

These hotspots help to inform and guide where occupations and skills are likely to be most needed to support the transition. Table 5 presents the main energy hotspots identified through the desktop review, per FoodBev SETA Chamber, with emphasis on the processing and manufacturing stage of the value chain. It should be noted that this represents indicative value chain hotspots, and that hotspots will vary significantly depending on e.g., the food type being handled, process technologies and manufacturing methods used, and energy sources used. See Appendix 2 for more detailed value chain hotspot maps, per Chamber.

[4] Brazil, Russia, India, China and South Africa

Table 5: Main energy hotspots identified in the food and beverage manufacturer, by FoodBev SETA Chamber

FoodBev SETA Chamber	Main manufacturing processes	Main energy hotspots
Baking	Milling, mixing, shaping, baking, cooling, coatings, packing, distribution	• 50-70% total energy use and carbon emissions in the manufacturing process attributed to proving, oven use, cooling and freezing (Masanet et al., 2012; Phillipson , 2017) • 40-50% waste heat generated from industrial ovens (Masanet et al., 2012) • Disrupted power supply and loadshedding • Increasing electricity and diesel costs
Beverage manufacturing	Malting / mashing, brewing / fermenting, pasteurisation, bottling, packaging, distribution	• Efficiency losses through and carbon impact associated with steam, boilers, (water) heating, ventilation and cooling (refrigerated storage and transportation, and compressed air (Australian Government, 2023; CSIR, 2018; Hancock, 2022; NBI, PSEE and UKAid, 2015; Strum, et al., 2015; EPA Victoria, 2022) • Disrupted power supply and loadshedding (AfricaNews, 2023) • High energy costs
Cereals	Milling/grinding, mixing, shaping, cooking, extruding, puffing, shredding, cooling, packing, distribution	• 23% of energy used in the breakfast cereals is attributed to the manufacturing stage (EPA, 2020) • The driving of equipment such as mixers, dryers, bulk loaders pumps and air compressors, is the most intensive process (EPA, 2020; Kermeli and Worrell, 2018; Sulaiman et al., 2018)
Confectionery and snacks	Roasting, grinding, frying, baking, cooking, steaming, cooling, packing, distribution	• Most energy intensive activities are hot water and boiler systems, cool rooms, cooling towers, cooking and conveying systems (EPA Victoria, 2022; Tarangkumar, 2012)
Dairy manufacturing	Milking, pasteurisation, fermentation, aging, packing, distribution	• Most significant use of energy is in cooling, refrigerated storage and transport (Mason-Jones, 2014) • Embedded energy in processing food waste (Jenkin, 2022) • Disrupted power supply and loadshedding affecting cooling and equipment use (Lechman, 2023; van Dijk, 2023)

FoodBev SETA Chamber	Main manufacturing processes	Main energy hotspots
Manufacture of food preparation products	Filtration, refining, fermentation, packing, distribution	• Embedded energy in byproducts (bagasse) (IRENA, 2019; Mbohwa, 2013) • Disrupted power supply and loadshedding (Reddy and Woody, 2023)
Processed and preserved meat, fish, fruit and vegetables	Butchery / cutting / peeling, cleaning, baking, steaming, cooking, preserving, packing, distribution	• Heating, cooling and freezing (storage and transport) are significant users of energy (Mason-Jones, 2014; Obiero et al., 2021) • Embedded energy in processing food waste (Jenkin, 2016, 2021) • Disrupted power supply and loadshedding (Rambau, 2023)

An assessment of the main energy hotspots presented in Table 5 suggests that the greatest cross-Chamber energy impact areas are: Energy used for heating (such as cooking and baking), and cooling and freezing (including storage and transport); embedded energy in processing byproducts and food waste; disrupted power supply and loadshedding; and increasing energy costs. However, a more in-depth exploration indicates that while, for example, heating is a significant cross-cutting hotspot the related energy consumption activities differ per sub-sector. For example, in the baking process, most energy is used to generate heat for ovens, while in beverage, confectionery and snacks manufacture, energy is used predominantly for boilers to heat water and generate steam.

These key energy hotspots indicate the strategic leverage points in South African food and beverage manufacturing where most change can be affected. For the purposes of this research, this would be through occupation and skills development and planning, which is presented in Table 9

4.3 Desktop review of FoodBev SETA levy payers' sustainability and energy-related activities

As outlined in the Research Approach above, 165 FoodBev SETA levy paying companies were analysed to provide an indication of the South African food and beverage manufacturing sector's responsiveness to the low-carbon agenda, and to ascertain their energy-related mitigation activities. An overview of this analysis is presented in Table 6.

Table 6: Overview of selected FoodBev SETA levy payers' responsiveness to the low-carbon agenda

Information of Interest for analysis		No. of companies (% of total)	Comments
Does the company have a sustainability report?	**Yes**	11 (6.5%)	A mixture of stand-alone sustainability reports and integrated reports identified
	Yes but only at holdings level	16 (9.5%)	In most cases South African companies had information on their websites but the holding company whether in South Africa or internationally had a full sustainability report
	No, but information provided on their website	15 (9%)	This information varied in detail, some was quite detailed with Key Performance Indicators (KPIs) reported in the form of a sustainability short performance report summaries, whilst others were very high level and just stated the company was committed to, for example, reducing GHGs.
What do they disclose on energy-related issues?	**Mention energy and climate change related issues**	39 (23%)	Generally in the context of climate change, many had long term net-zero carbon emission targets where energy played a key role
	Energy efficiency measures	23 (20%)	Generally done for resource efficiency but some mentioned it in terms of reduction of GHG emissions
	Information on the use of generators	0 (0%)	There was little information on load shedding, but many cited load

Information of Interest for analysis		No. of companies (% of total)	Comments
			shedding as a driver for an increase in emissions as a result of using diesel generators
	Renewable energy installation or purchase and related storage solutions	34 (20%)	Most companies with publicly available sustainability information are investing in renewables and for companies that require 24-hour operations, they are backing up the renewables with storage solutions, such as batteries or diesel generators (see above)
	Transport and logistics energy-related activities	2 (1%)	Very few mention transport or a shift to electric vehicles

If the distribution of the FoodBev SETA levy payers that mention energy or climate in their publicly available information is viewed per Chamber, then the picture detailed in Figure 5 emerges.

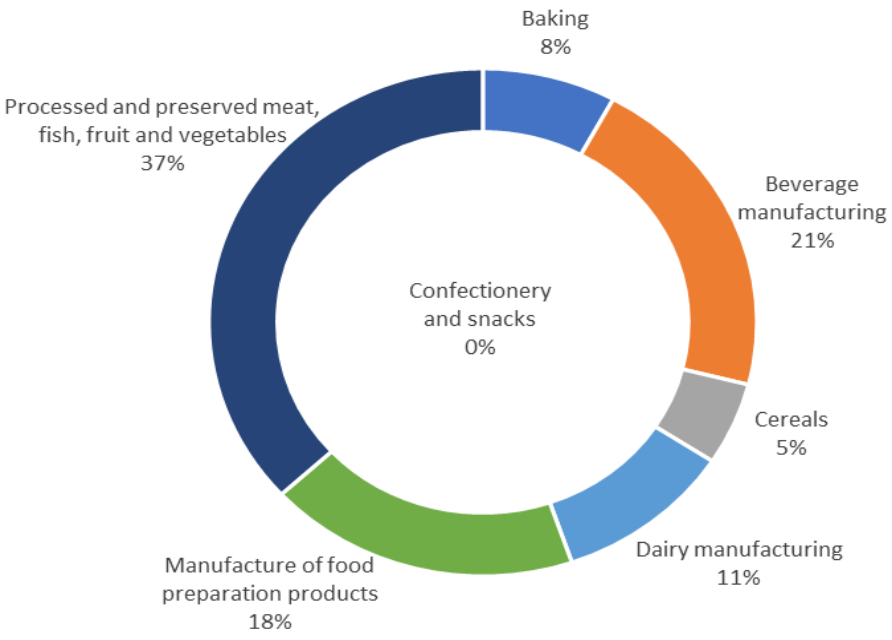

Figure 5: Distribution of FoodBev SETA levy payers that mention energy or climate, by Chamber

The data reveals that the largest number of companies disclosing energy and climate information are from the Processed and preserved meat, fish, fruit and vegetables; and Beverage manufacturing Chambers, with none in the Confectionery and snacks Chamber.

The levy payer analysis indicates that in general sustainable development is growing in importance in the sector, those that disclose climate change and energy information are generally larger companies or part of a bigger holding company or multinational group. This does not suggest that smaller companies are not impacted and/or taking action on energy and climate, it is difficult to determine from this analysis.

All Chambers are impacted by energy and climate related issues due in part to the carbon intensity of South Africa's electricity and the energy intensive nature of the sector. As such, climate change and loadshedding are major drivers for decisions around renewable energy, and energy efficiency which is implemented by most of the levy payers reviews. The review indicates that there is a drive from some companies to reduce coal use for steam or hot water generation to reduce emissions and either use a lower carbon source such as gas or switch to using renewables if their self-generation has the capacity. Solar photovoltaics (PV) is the technology of choice for the vast majority switching to renewable energy technologies.

Many of the review levy payers appear to contract out their logistics and transport services. As such, the carbon emissions association with these activities are not included in the levy payers Scope 1 reporting. The GHG Reporting Protocol defines Scope1, 2 and 3 GHG emissions as follows (GHG Protocol, 2023) :

> *The GHG Protocol Corporate Standard classifies a company's GHG emissions into three 'scopes'. Scope 1 emissions are direct emissions from owned or controlled sources. Scope 2 emissions are indirect emissions from the generation of purchased energy. Scope 3 emissions are all indirect*

emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions

This may explain the low level of activities identified to reduce transport energy-related emissions if they are Scope 3, i.e. contracted not in-house as most companies generally focus on Scope 1 first as those emissions are in their direct control and only deal with Scope 2 and then Scope 3.

From a skills and social inclusivity perspective only two of the reviewed levy payers mentioned skills in their publicly available information and this was generally discussed under Human Resources (HR) or SMME development. While many companies that disclosed information have community and stakeholder engagement programmes, very few are related to energy. This indicates that the energy issues being dealt with by the company are viewed as purely operational and financial issues and not seen in the light of being just for all involved and a possible mechanism for social upliftment.

4.4 Overarching energy hotspots and low-carbon trends impacting the food and beverage manufacturing sector

The following section provides an overview of the overarching energy-related and low-carbon trends that emerged from the desktop review, levy payer analysis and interviews as impacting on or influencing how the food and beverage manufacturing sector in South Africa operates. Table 7 captures the key trends that emerged from the different data collection methods.

Table 7: Energy hotspots and decarbonisation trends identified for the food and beverage manufacturing sector, by data collection method

Overview of the sector	Levy payer analysis	Energy hotspots
• Recovery from the COVID-19 pandemic • **Load shedding** and interrupted power supply • **Rising prices (**e.g. materials, ingredients, transportation and energy)	• All Chambers are impacted by energy and **climate** related issues • Sustainable development is growing in importance • Larger companies, especially multinationals are	• Energy is used for a wide variety of reasons in all chambers and a plethora of processes including cooking and baking, cooling and freezing. storage and

Overview of the sector	Levy payer analysis	Energy hotspots
• Energy consumption in heating and cooling is a major contributor to **carbon emissions** • Embedded energy in production by-products and food waste • **Climate change** (including carbon tax) • Ineffective transport infrastructure (notably rail and roads) • Addressing **changing market demands** • Policies favouring other BRICS[5] markets	more likely to disclose **climate change energy information** • **Climate change and loadshedding** are major drivers for decisions around renewable energy and **energy efficiency** • Solar PV is the **renewable energy** technology of choice • **Social inclusivity is barely evident** in reported energy-related mitigation activities	transport, processing by-products and food waste • Disrupted power supply and **loadshedding** • **Increasing energy costs**.

By consolidating the energy hotspots and trends highlighted in Table 7, five overarching trends emerge (see Figure 6). It is important to note that some of the trends emerged from an identified lack of information, when they should be issues of importance to the sector. In other words they were identified as a trend by their omission. These are social and inclusivity and energy systems management.

[5] Brazil, Russia, India, China and South Africa

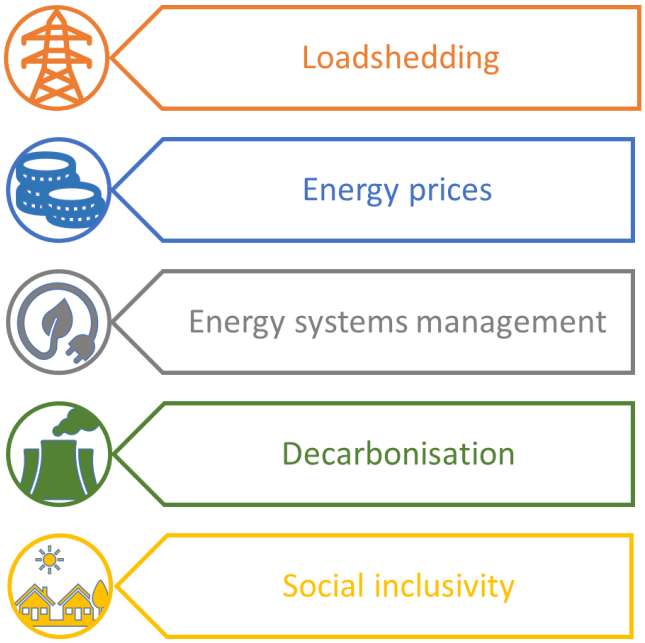

Figure 6: Major energy resilience and low-carbon trends impacting the food and beverage manufacturing sector

4.4.1 Loadshedding (deteriorating energy security)

Loadshedding was identified as the major short to medium term energy trend impacting on the food and beverage sector. The data showed that it was an issue across all food and beverage Chambers. It has broad based financial, operational and environmental implications and as a result, has been the priority driver of energy related investment in many companies as they scramble to manage the crisis. When interviewed, Respondent 5 stated that from a risk perspective, company investment in own supply was more than financially viable as a result, and the fact that renewable energy prices were dropping was an added bonus. Figure 7 shows how the trend has accelerated over the last 7 years until 2022 (Labuschagne, 2022). In 2023 it has worsened, as by July 2023 loadshedding stood at 170 days, the loadshedding hours were therefore already considerably higher than the whole of 2022 (Parker, 2023a). The economic implications are staggering with Bloomberg estimating between R204 million and R899 million a day for loadshedding between Stages 3-6 (Parker, 2023a).

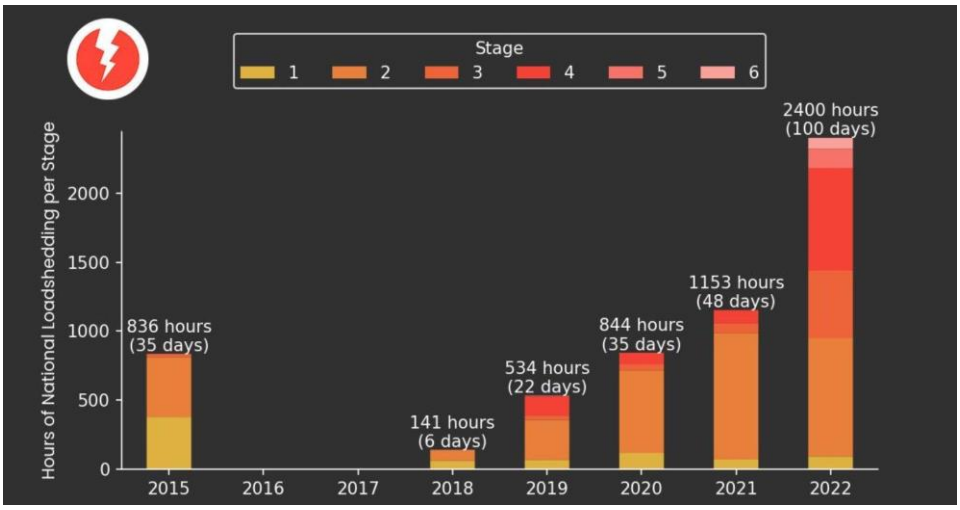

Figure 7: Loadshedding trend in South Africa 2017-2022, Source: Labuschagne, (2022)

The loadshedding has primarily been driven by the Energy Availability Factor (EAF) of Eskom's power plants which impacts supply of electricity and the demand for electricity which has been declining (BusinessTech, 2023). This decline is evidenced in Figure 8 which shows a continual decline in the availability (and therefore increase in breakdowns) of Eskom plant (MyBroadband, 2023). Many of the respondents indicated that this worsening of the frequency of loadshedding, together with the carbon abatement pressure, were the two main reasons for them taking additional action.

Figure 8: Eskom's Energy Availability Factor (EAF) trend from week 1 for 2021, Source: MyBroadband, (2023)

The table below provides an overview of the insights garnered on loadshedding, the likely time horizon of the impact (hotspot), uncertainties associated with the challenge, the likely drivers or reason for the trend, and how this is impacting the South African food and beverage manufacturing sector as a result of this trend.

Table 8: Overview of loadshedding as a trend

TREND: LOADSHEDDING (DETERIORATING ENERGY SECURITY)	
Time horizon	It is unclear how long loadshedding will go on for as there are many interlinked factors. However, in October 2023, Electricity Minister Ramokgopa stated that load-shedding will no longer be required as soon as 2024 due to more units from Kusile Power Station coming on-line (Daily Investor, 2023). It is however clear that the longer loadshedding continues, the more consumers will make plans to use either generators (and stop when loadshedding ends) or develop their own supply which also addresses climate change issues (Tshabalala, 2023).
Uncertainties associated with this trend	● Duration until it ends completely ie electricity supply consistently meets demand ● Loadshedding stage as it impacts frequency of outages as well as duration ● % of demand that will return post loadshedding as many consumers are installing own supply options

TREND: LOADSHEDDING (DETERIORATING ENERGY SECURITY)	
	• Impact on investor confidence in the country and how they perceive whether the country cannot deal with new demand for energy or not
What is this trend impacted by?	• Level of energy efficiency as this impacts demand and therefore the stage of loadshedding required • Willingness to participate in demand management activities such as voluntary curtailment (demand response) • Skills availability for and quality of power plant maintenance and management given that the level of breakdown of plant is high • Age of infrastructure as much of Eskom plant is more than 40 years old • Rate of new plant construction within Eskom as well as consumers, the faster this is in both cases, the quicker loadshedding will decline • Electricity demand and therefore the stage of loadshedding required • Ambient temperature, rainfall, cloud cover and wind speeds as this impacts the level of renewable energy generation available to deal with loadshedding • Available funds/budget that consumers have which impacts their ability to switch to alternatives • Eskom Energy Availability Factor as this impacts the amount of available plant and therefore the extent of loadshedding required
Challenges faced by and impacts on the food and beverage manufacturing sector as a result of this trend	• Investor confidence which impacts overall capital costs and availability • Economic growth and therefore disposable income which impacts the spend in the food and beverage sector • Cost increases/inflation • Food loss and waste due to disrupted electricity supply from loadshedding resulting in damaged or spoiled food • Profit may be negatively impacted if additional capital is required and costs increase • Skills availability and retention as skills needs change • Need to readjust staff shift rotations • Diesel generators have been brought in to keep production going where alternatives are not immediately available It has therefore had a catastrophic impact on food and beverage processes which oftentimes require power 24 hours a day, as well as associated costs to manage, food storage and cold chain impacts, transportation and ultimately revenue and profit. The uncertainties detailed above also drive companies to invest in plants they can control and not have to deal with changing loadshedding stages and requirements (Tshabalala, 2023).
Some key mitigations required by the food and beverage manufacturing sector to adapt to the trend	• Purchase and installation of generators to deal with loadshedding and continued production, this does however increase costs and GHG emissions • Batteries and inverters and renewable energy so that they can supply their own energy • Energy efficiency as a way to reduce costs and lower demand so therefore decrease the costs of generator fuel • System optimisation in order to be more efficient but also lower the capital costs of new plant • Upskilling of food and beverage sector staff to deal with own supply etc

TREND: LOADSHEDDING (DETERIORATING ENERGY SECURITY)	
Impact on the world of work in the Food and Beverage Sector	• The skills implications are for procurement and finance to source and fund generators, renewables etc. • Skills to then run and maintain that equipment is also necessary (see decarbonisation trend) • Skills for emissions monitoring and reporting due to diesel usage

Sources: Parker (2023a, 2023b), Respondents 3, 4, 5, 6, 7, 8, 10 and 11; Wits REAL (2023).

4.4.2 Energy prices

Given that energy is a large input cost, along the value chain, the food and beverage sector is sensitive to changes in energy prices, both liquid fuels, electricity and the capital costs of new energy efficiency equipment or generation options like renewables. In most food and beverage sectors, energy prices are a key element and not only price but certainty around price trajectories in the medium to long term as it drives investment decisions on alternatives (White, 2023).

Food price inflation for certain food and beverage products has been above national inflation rates and, in some cases, >10% including for some basic processed foods like bread and maize meal (Campbell, 2023). Although not the only contributor, energy prices are certainly a major one (White, 2023). Figure 9 shows how rising electricity prices granted to Eskom were significantly above inflation after 2007 and continue to rise given the levels of debt and shrinking customer base of Eskom (Moolman, 2022).

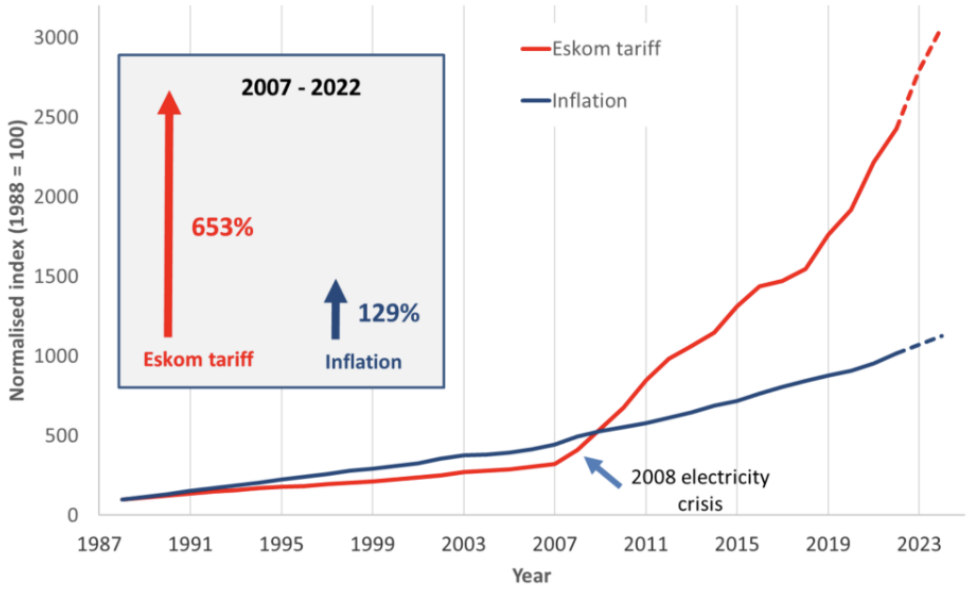

Figure 9: Eskom average tariff versus inflation[6], Source: Moolman (2022)

Liquid fuel prices are also rising due to various (mostly international) factors, putting further upward pressure on the cost of living, with the current price of a litre of 95 unleaded being more than the minimum hourly wage (Parker, 2023b). Figure 10 shows this increase over the last year where a more than 15% increase took place over the last 10 months (Fuel SA, 2023).

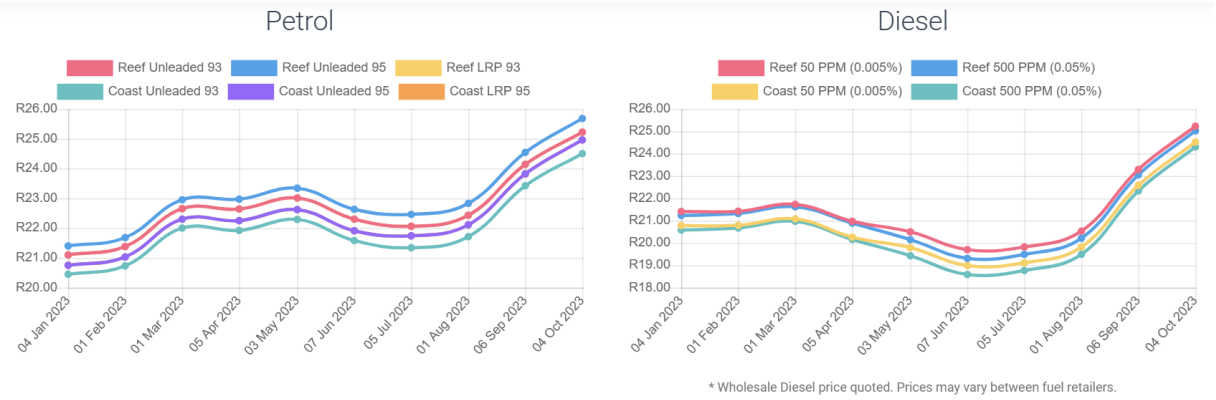

Figure 10: Fuel increases in South Africa in 2023, Source: Fuel SA (2023).

[6] The graph depicts overall average increases, actual increases will be different for different types of consumers (residential, commercial and industrial) and will vary between municipalities.

In a sector where there are generally transport costs both up and downstream in the value chain, this type of increase is significant. This is especially true when it is not only liquid fuels but also electricity prices that are increasing above inflation and the sector is energy intensive and in some cases long transport routes (Habanabakize and Dickasaon-Koekemoer, 2021.; White, 2023).

The table below provides an overview of the insights garnered on increases in energy prices, the likely time horizon of the impact (hotspot), uncertainties associated with the challenge, the likely drivers or reason for the trend, and how this is impacting the South African food and beverage manufacturing sector as a result of this trend.

Table 9: Overview of energy prices as a trend

TREND: ENERGY PRICES	
Time horizon	It is predicted that the electrification of the world will continue, and liquid fuels will either be phased out or will be replaced by green hydrogen products in hard to abate sectors like shopping and aviation. Fuel prices will therefore be technology and availability dependent. Renewable prices will continue to drop as will batteries and inverters as the demand and scale increase (IEA, 2022; IEA 2023).
Uncertainties associated with this trend	● Global geopolitics and their impact on fuels prices for example the war in the Ukraine which has impacted gas prices around the world. ● Investment in new refineries in South Africa is not occuring so it is unclear what (if any) the additional costs for importing and storing finished products will be. ● Electric vehicle sales and what that will mean for the rate of uptake, especially for bulk transport and logistics ● Changes to the business models of Eskom and municipalities
What is it impacted by?	● Global oil and gas prices which are not in South Africa's control ● Technology cost curves and the speed at which the cost of various technologies declines over time especially electric vehicles, renewables, batteries etc ● Investment in Research and Development (R&D) for new more efficiency processes energy for example green hydrogen ● Energy intensity of processes which impacts fuel spend
Challenges faced by and impacts on the food and beverage manufacturing	● Economic growth and therefore available income for spend in the food and beverage sector ● Profit will be impacted given the energy intensity of the sector and therefore energy input costs ● Input costs for ingredients due to increased processing and transport costs

TREND: ENERGY PRICES	
sector as a result of this trend	● Transport costs will increase due to rising fuel and in some cases electricity costs ● Production costs due to higher energy prices ● Cost increases/inflation ● Small and local bakeries who cannot switch to more efficient equipment
Some key mitigations required by the food and beverage manufacturing sector to adapt to the trend	● Own generation especially with declining renewable energy costs. Some respondents said it made sense even without loadshedding as it was less expensive than a grid connection and the payback period was only a few years. it also had added climate benefits and reduced carbon tax obligations ● Energy efficiency even with own use ● System optimisation as it decreases the costs of own generation requirements ● Logistics optimisation to ensure transport costs are managed optimally ● Upskilling of food and beverage sector staff to deal with own supply and energy management/efficiency (see below)
Impact on the world of work in the food and beverage manufacturing sector	● Increased energy prices impact vulnerable and smaller companies so skills that enable a decrease in energy use (eg energy efficiency) and business case development for alternative energy will be required ● Energy Audit skills are required to set an energy baseline and monitoring and evaluation skills to check implementation ● Energy systems optimisation skills to reduce costs ● Skills to understand electricity tariffs and integration of that knowledge into production cycles

Sources: Respondents 1, 2, 3, 4, 5, 6, 8, 10 and 11; Wits REAL (2023). SANEA (2023)

4.4.3 Energy systems management

Energy systems management is a critical issue given the energy intensive nature of the sector and the fact that it will require a new skills set. It includes addressing energy efficiency and requires a comprehensive approach to the system to ensure that optimisation between processes can occur (Respondent 7).

In a research study done on the wine sub-sector, it was found that by taking an integrated and systemic approach, which also encompasses raising awareness with staff, energy savings could be made and some at a low cost (Brent *et al,* 2016). This and other studies show the need for not only systems and processes for understanding where energy is used and opportunities to reduce that energy, but also for the need to monitor and control those savings over time. Given that this is the case, this trend links

very closely with the automation and digitalisation of the sector where system optimisation is managed centrally through appropriate software applications (IndustryWeek, 2018).

This trend is strongly driven by the trends on energy price and decarbonisation as it provides a mechanism to manage these issues. In addition, and very importantly, respondents when interviewed, identified that this is a critical first step before installing a renewable energy plant, as it prevents the over designing of the renewables plant for energy that is being wasted or not used as efficiently as it could be (Respondents 4, 5 and 7).

From a skills perspective this is one trend that requires a very human centric approach as changes in behaviour are needed in some cases (Millán et al., 2020).

The table below provides an overview of the insights garnered on energy systems management, the likely time horizon of the impact (hotspot), uncertainties associated with the challenge, the likely drivers or reason for the trend, and how this is impacting the South African food and beverage manufacturing sector as a result of this trend.

Table 10: Overview of energy systems management as a trend

TREND: ENERGY SYSTEMS MANAGEMENT	
Time horizon	This trend will continue to evolve over time as technologies improve and more automation is put in place.
Uncertainties associated with this trend	● Technology cost curves for new technologies ● Government policy on energy efficiency standards which may become regulated requirements ● Standards that may be required by buyers of the product
What is it impacted by?	● Cost of energy and associated costs e.g. carbon taxes which would drive an increase in energy systems management and especially energy efficiency ● R&D and new technology development/uptake as more and more efficient equipment and/or new processes are developed ● Automation trends to drive productivity and improve quality

TREND: ENERGY SYSTEMS MANAGEMENT	
Challenges faced by and impacts on the food and beverage manufacturing sector to deal with this trend	● Cost of replacing/adding equipment may be significant, especially if the equipment is not that old ● Behavioural change for operators etc to ensure that they prioritise energy efficiency and the system and do not operate in silos ● New skills required in digitalisation, sensors, systems thinking, integration, climate finance etc ● Aging equipment that loses efficiency over time, so targets may not be met
Some key mitigations required by the food and beverage manufacturing sector to adapt to the trend	● Integrated strategy to ensure that the optimisation happens first then any further carbon abatement energy technologies if required ● Energy audits to ensure there is a verified baseline against which to monitor performance and identify low hanging fruit or prioritise areas of greatest energy use ● Repair and maintenance of electrical systems and machinery ● Investment in SMART energy management systems to automate energy and production flows in an optimised manner and override human behaviour or error e.g. switching off lights ● Replacement of non-efficient technologies ● Switch to electric vehicles ● Work with the value chain to optimise the system even further
Impact on the world of work in the food and beverage manufacturing sector	● Energy Audit skills are required to set an energy baseline and monitoring and evaluation skills to check implementation ● Energy systems optimisation skills to reduce costs

Sources: Brent *et al*. (2020), Millán *et al*. (2020), Respondents 4, 5, 8, 10 and 13, Wits REAL (2023).

Although energy efficiency was being implemented by a number of the food and beverage manufacturers, an integrated energy management plan was not necessarily being done. Some refer to energy efficiency as “the first renewable” or the “first fuel” (International Passive House Association, 2023; WEF, 2022). It was identified that this has quite impactful implications on two fronts as follows:

- The manufacturer could regress once loadshedding is over if that is the major driver and lose the benefits of lower energy consumption and therefore cost
- If the integrated system is not optimised, then if a manufacturer is installing renewable energies, then a bigger system may be purchased than would be required if the system was optimised before the renewables were installed,

which has cost implications (International Passive House Association, 2023; IRENA, 2017)

Given the pace at which renewable energy is being installed by food and beverage manufacturers in South Africa (all respondents) this is a significant insight for additional cost and energy savings.

4.4.4 Decarbonisation

The decarbonisation trend is being driven globally through the United Nations Framework Convention on Climate Change (UNFCCC) and then subsequent national policy such as in South Africa's case the NDC (DFFE, 2021a). The recently released South African National GHG Inventory shows that South Africa's net greenhouse gas emissions only decreased 0.8% over the last 20 years (DFFE, 2023) (see Figure 11).

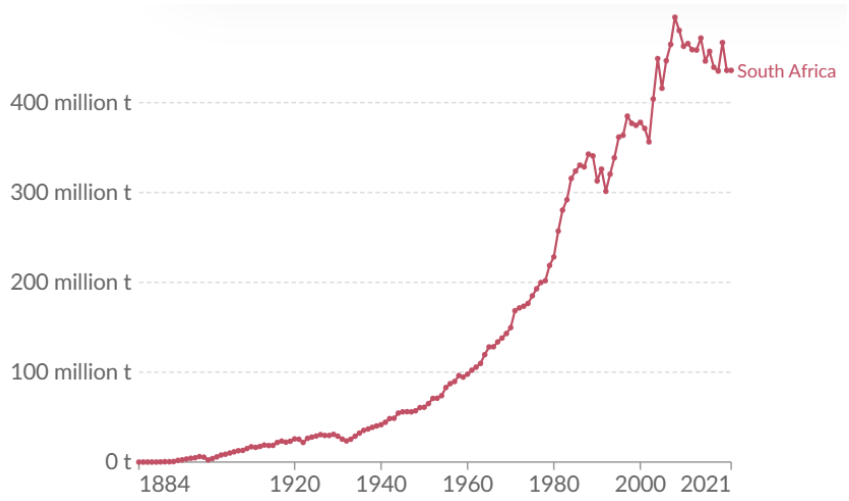

Figure 11: The annual carbon dioxide (CO_2) emissions from fossil fuels and industry in South Africa, Source: Global Carbon Project (2022) cited in Our World Data (2023).

The Paris Agreement has the ambition to reach net zero GHG emissions by 2050 and South Africa has aligned itself with that target as have many other countries (DFFE, 2023). The major actions, amongst others, that South Africa has taken in support of reaching this target are to:

- Approve a “policy adjusted” Integrated Resource Plan for electricity which enables the implementation of the Renewable Energy Independent Power Producer Programme (REIPPP) and other lower carbon initiatives
- Develop an energy efficiency strategy
- Institute a carbon tax
- Develop a Climate Change Bill which sets sector budgets
- Remove the constraints around self-generation and
- Give a tax incentive for installing renewable energy (DEFF, 2021, DoE, 2005, 2009; DMRE, 2021a)

The trend will only intensify over time as the EU and other countries introduce carbon intensity measures into industry. The EU Green Deal has paved the way for the carbon border adjustment mechanism (CBAM) or taxes on imported goods which began on 1st October 2023 (EU, 2023).

CBAM does not currently cover food and beverages but it will be expanded over time, so it is a risk (EU, 2023). Many food and beverage sector companies in South Africa are either owned by a developed country holding company who have their own national targets to meet, or export some of their products (Respondents 5, 8 and 9). They are therefore impacted from a competitiveness point of view if their products are taxed, particularly given the high carbon intensity of South African electricity. This has further incentivised (over and above loadshedding) food and beverage sector companies to install renewables with in some cases storage and not use grid or diesel generators both of which are high carbon, as well as drive energy efficiency (Respondents 5, 6, 8, 9 and 11). These are all new skills that will be required to not only implement carbon mitigation projects, but to also finance them and potentially industry carbon credits.

The table below provides an overview of the insights garnered the decarbonisation trend, the likely time horizon of the impact (hotspot), uncertainties associated with the challenge, the likely drivers or reason for the trend, and how this is impacting the South African food and beverage manufacturing sector as a result of this trend.

Table 11: Overview of decarbonisation as a trend

TREND: DECARBONISATION	
Time horizon	The global ambition is to reach net zero by 2050. However, the EU CBAM process and other national targets may force earlier action
Uncertainties associated with this trend	● Feasibility of net zero 2050 target ● Level and application of carbon taxes both nationally and internationally e.g. CBAM ● Ability of enabling infrastructure to support the shift to lower carbon technologies eg ports and transmission lines
What is it impacted by?	● Global negotiations at the UNFCCC which may change over time in terms of targets and obligations ● National priorities as we have seen recently with the Electricity Minister stating Komati should not have been shut down as it could have helped address loadshedding ● Cost of the mitigation technologies ● Tax levels applied nationally and internationally
Challenges faced by and impacts on the food and beverage manufacturing sector to deal with this trend	● Reduction of the use of coal fired boilers ● Integration of the new systems into the overall production process ● Additional capital costs ● Potential taxes which adds costs and decreases competitiveness ● New skills required to report and manage climate change issues which include renewable energy and energy efficiency and management skills, climate finance, carbon mapping and sustainability reporting skills together with knowledge of the various stakeholder reporting requirements ● Emissions from transport
Some key mitigations required by the food and beverage manufacturing sector to adapt to the trend	● Reducing energy consumption (e.g. undertaking and energy audit, upgrading machinery/motors, installing efficient lighting) ● Use of low emission fuels / fossil-fuel alternatives ● Increasing their electric vehicle fleet / zero emission propulsion ● Adopting reverse logistics systems ● Increasing the uptake and use of renewable energy technologies for energy production, heating and cooling ● Reducing food loss and waste (embedded energy) ● Use of biogas from food waste as an energy source ● Incentives being put in place to encourage companies to produce and use renewable energy ● Adoption of energy storage systems to enhance energy security, and to sell excess
Impact on the world of work in the food and beverage	● Decarbonisation will change in countries' and companies' energy mix and therefore new technologies and new employment pathways. This will present new work opportunities ● There is therefore a significant shift happening in current education and skills provisioning in the country which will benefit the Food and Beverage Sector as

TREND: DECARBONISATION	
manufacturing sector	the refinement and development of new education programmes, courses, research and curricula is happening (SANEA, 2023). ● The growth of an uptake of energy efficiency and self generation renewable energy in the Food and Beverage Sector will require new jobs or upskilling in installation and construction, operations, management and maintenance,and associated financial and social skills. ● SANEA reported that there is a scarcity of specialist renewable energy technical and managerial skills which will impact the Food and Beverage Sector but many respondents indicated that they a;ready have engineering and technical skills that they can upskill to deal with new energy efficiency and/or renewable plant (SANEA, 2023) ● Skills for policy input and understanding and dealing with legal requirements for self-generation would also be needed

Sources: CGCSA (2023), EU (2023), FoodBev SETA (2023), GreenCape (2023), White (2023).SANEA, (2023)

4.4.5 Social inclusivity

Some food and beverage manufacturers in the sector have embraced the concept of sustainability and social inclusivity and have programmes both from a Corporate Social Responsibility Perspective, but also from the perspective of employing from local communities, especially at plants in rural areas (FoodBev SETA, 2023, Respondents 4, 5, 6 and 9). Social justice is supported when distributive justice, restorative justice, and procedural justice are enabled. This has to occur through an inclusive process with all relevant stakeholders involved and included in decision-making processes; with a fair distribution of risks and responsibilities, taking into consideration past injustices (Montmasson-Clair, 2021).

This is embodied in many pieces of South African legislation and is reflected in the food and beverage sector in general and when implementing their renewable energy and energy efficiency projects (Respondents 5, 6, 8, 9 and 11).

Of concern is the level of automation that was identified in the literature review and the interviews, which is increasing over time, especially in the bigger players in the sector, which will impact levels of employment in those jobs that are easily automated

(FoodBev SETA, 2023; Respondents 5, 6, 8, 9 and 11). The table below provides an overview of the insights garnered on social inclusivity, the likely time horizon of the impact (hotspot), uncertainties associated with the challenge, the likely drivers or reason for the trend, and how this is impacting the South African food and beverage manufacturing sector as a result of this trend.

Table 12: Overview of social inclusivity as a trend

TREND: SOCIAL INCLUSIVITY	
Time horizon	Given South Africa's unequal society this trend will continue for many decades to come, and is currently less recognised with food and beverage manufacturing company strategy.
Uncertainties associated with this trend	● Economic growth which supports social upliftment through employment ● Timeline for new build
What is it impacted by?	● Climate change related weather changes which can be floods droughts etc and impact on those most vulnerable ● Economic growth ● Level of education in local communities
Challenges faced by and impacts on the food and beverage manufacturing sector as a result of this trend	● Crime and theft ● Lack of local community and/or workforce understanding of energy mitigation or low-carbon activities of the company, therefore the potential to sabotage or have low participation rates in efforts
Some key mitigations required by the food and beverage manufacturing sector to adapt to the trend	● Continuous engagement with key stakeholder groups, including workforce and communities ● Involvement of stakeholders in company processes and implementation thereof ● Reskilling, upskilling and training local community members rather than importing skills that are not local ● Community awareness programmes
Impact on the world of work in the food and beverage manufacturing sector	● Skills on the Just Energy Transition and specifically the socio-economic implications ● Knowledge on local community opportunities for employment into new areas ● Transformative stakeholder engagement skills

Sources: FoodBev SETA (2023), GreenCape (2023), PCC (2023), Respondent 5.

Although some companies, when interviewed, did mention social programmes, it was seldom considered in terms of the just energy transition, with the exception of some companies who saw the need to source new technologies from local communities or businesses rather than importing skills. Given that energy efficiency and automation will have a major impact on skills and jobs in the sector, as well as the fact that there are already social justice issues in some value chains for the manufacturers and widespread poverty and joblessness, this is a major insight from the work (all respondents; IEJ, 2023b).

Overall, just transitions are a focus in many sectors and in the food sector itself it is a topic that is gaining momentum. A national policy dialogue on Just Transition and Adaptation in the South African Food System was held in September 2023 (IEJ, 2023a). The scope defined by the Institute for Economic Justice (IEJ) is outlined in Figure 12 where energy is identified as a critical part of the food system:

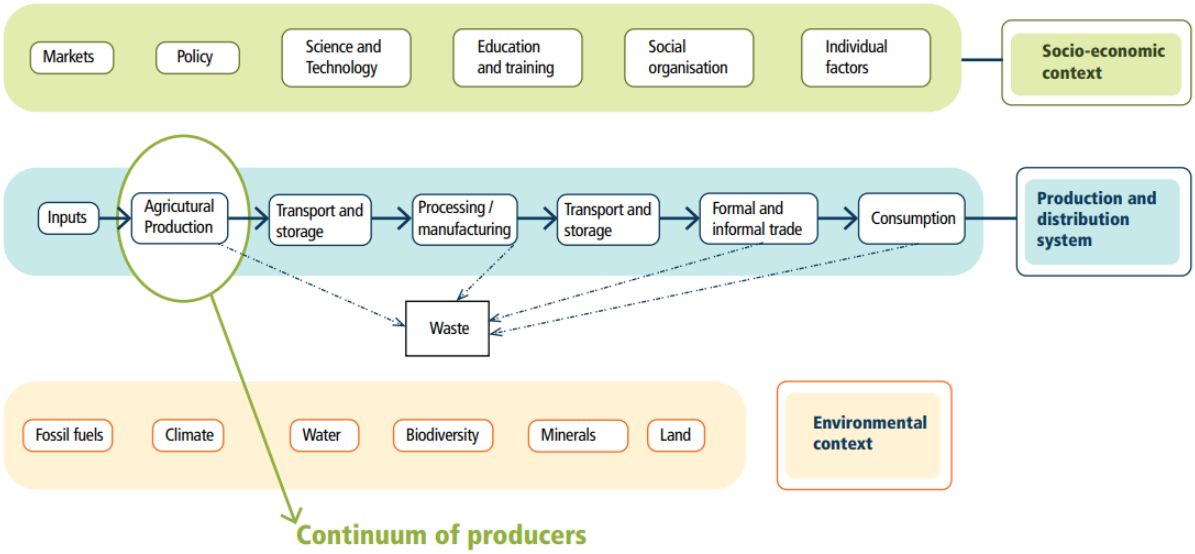

Figure 12: The food system and a just transition, Source: IEJ (2023a).

It is anticipated that this issue will emerge as of higher importance and focus once the burning issues around security of supply are dealt with.

4.4.6 Some potential implications of the trends on the food and beverage manufacturing sector

Interconnectedness and clusters of disruption

These trends, although articulated separately, are all interconnected and overlap in key areas (see Figure 13). These trends are often not a single trend but clusters of sub-trends and cross-cutting which also interconnect. The trends will also change in impact, pace of change and probability over time, as well as be impacted by the changes happening in other trends and shifts that are global or national in nature.

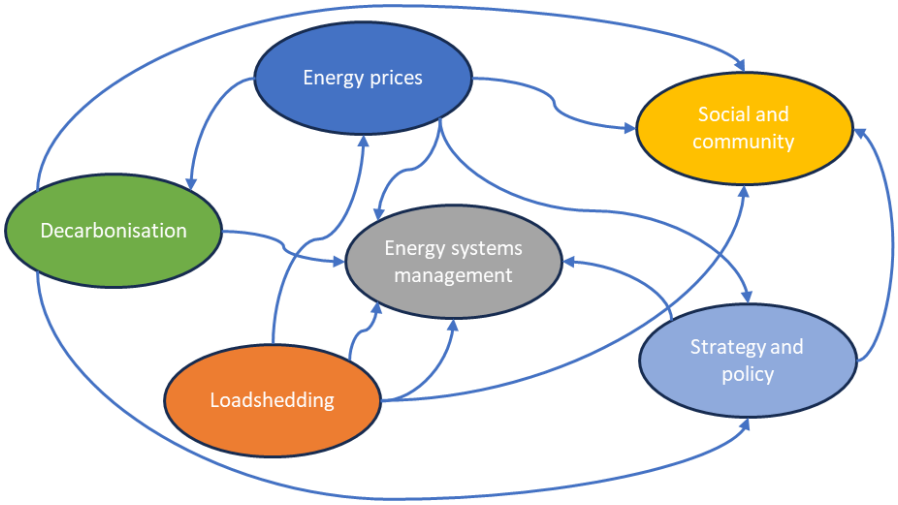

Figure 13: Systems diagram illustrating the interconnectedness of the major trends

Figure 13 illustrates how the trends interconnect and which are the major influencers of strategy and policy, and potentially levers of change. **The diagram shows that energy prices, decarbonisation and loadshedding are the major drivers of the system (mostly arrows out), whereas the outcomes of the system (responses to the drivers and mostly arrows in) are the impact on social and community and energy management.** Predictability, decarbonisation and strategy and policy are pivots (mixture of arrows in and out) in other words, when you change them, the whole system changes. This is critical to understand when developing strategy as to where to place effort as well as identify risks, both positive and negative.

In the South African context the three drivers of energy price increases, loadshedding and decarbonisation form a cluster of disruption where the impact of the three together is much larger than they are on their own. Decarbonisation is a big driver, especially for exporters and internationally owned companies, so it impacts some food and beverage manufacturers and is also a national pressure, but more on the electricity producers side to decarbonise the grid in the short term. When however you add rising energy prices and interruptions to energy supply, the business case for energy management and self-generation, especially with declining renewable energy prices, becomes an easy business decision (Respondents 5, 7 and 9).

Interestingly, the interviews showed that although electric vehicles can contribute to lowered emissions and local environmental impacts, companies have seldom invested in those just yet, more the capital spend has been on renewable energy installations (all respondents).

Strategy, policy and legislation

Manufacturers have adjusted their strategies in response to the above trends and are able to have energy security as well as reduce their greenhouse gas emissions with short pay back periods, even with the current battery and renewable energy capital costs (all respondents). For a plant that operates 24 hours, this switch can become extremely expensive if manufacturers want to go completely off the grid, but as battery prices decline as expected, the business case will become even better (Reuters, 2023). The rate of decline is linked to electric vehicle sales as well as overall demand and the prices of input components such as metals (Reuters, 2023). They have also implemented energy efficiency measures as a result of rising energy prices and decarbonisation trends (all respondents). This means that new skills are required in order to manage these new systems and processes as well as new mindsets and knowledge in the procurement department, finance department and operations (SANEA, 2023).

From a policy point of view, the government has put in place the following which is impacting on decision making in business with regards to energy:

- South African Electricity Act of 2006 and Electricity Regulation Act amendments that allow a multi-market and self-generation without having to obtain a license and allows IPPs, industry and wheeling across networks (DMRE, 2009)
- The Carbon Tax introduced by the National Treasury which is set to escalate over time (National Treasury 2022).
- South Africa's NDC which sets long term targets and trajectories for decarbonising the South African Economy (SA Government, 2021).
- Just Transition Frameworks (PCC, 2023)
- New Climate Change Bill which proposes sectoral carbon budgets (SA Government, 2022).

What is however clear, is that much government policy is developed in silos and has not, in some cases, kept pace with market developments. This means that policy can be perceived by business as confusing. A good example of this is the development of climate taxes and carbon budgets by different Government departments. This has led to different policies which have had to be aligned post publication (DFFE, 2021b; Netshithuthuni, 2020; SANEA, 2023).

4.5 Strategies for mitigating energy insecurity and enabling low carbon transition

Drawing on the desktop review, levy payer responsiveness analysis and the stakeholder interviews, it is clear that the energy challenges and trends identified for the sector are impacting and influencing strategy and mitigation efforts to varying degrees. In response to the three big drivers of energy prices, loadshedding, and decarbonisation, the data consistently showed that the majority of larger players are all taking their energy supply into their own hands through the installation of renewable energy and storage as well as the use of generators and buying power from renewable

(all respondents, WITS REAL, 2023). The levy payer review showed that the largest number of companies publicly disclosing energy and climate information and indicating they are taking action are from the Processed and preserved meat, fish, fruit and vegetables and Beverage manufacturing Chambers, followed by Manufacturers of food preparation products, Dairy manufacturing and Baking, with none in the Confectionery and snacks Chamber. As these Chambers made up the largest numbers of levy payers reviewed this is understandable and also because many of them run 24 hour processes and are relatively large companies. The Dairy manufacturing and Bakery Chambers will consist of many small, locally distributed companies which may not report public information but could also be severely impacted by the trends.

What is a major gap that was identified was that many of the larger companies are implementing energy efficiency but are not doing energy system optimisation to mitigate the risk of installing more renewable energy and storage than may be needed.

For smaller players and SMME's it was found that this was not always the case as they may not be able to afford to switch to lower or no carbon energy sources. Table 13 highlights some of the many mitigation efforts identified by South African food and beverage manufacturing companies in relation to enhancing energy resilience and decarbonisation. See Appendix 3 for further examples.

Table 13: Examples of South African food and beverage manufacturers' strategies to mitigate energy insecurity and to decarbonise

Company	Energy strategy and mitigation efforts
Heineken South Africa	Heineken has a Brewing a Better World strategy including a goal to reach next zero carbon emissions in all production sites by 2030, including a focus on brewery efficiency, solar PV and concentrated solar, biomass boilers to supply heat.
Fair Cape Dairies	Several renewable energy resource projects have been implemented, a Power Purchase Agreement is in place with SOLA and biodigestion is under consideration.

Company	Energy strategy and mitigation efforts
Kerry Group	The company has implemented low energy usage equipment, solar power generation, waste heat capture and efficient water capture, reuse and reduction.
Oceana	Several energy projects and initiatives are underway or implemented including energy efficiency along the value chain and on vessels and replacing generators with alternative fuels or technologies.
Lowveld nut processing	The company generates electricity for its own use through solar power (1MW) and an additional 2 MW will be generated by using the macadamia nut shells which are a waste product of the process produced during the cracking process as a fuel.
Backsberg Wine	The company has installed solar water heaters, ceilings, and compact fluorescent energy efficient light bulbs have been installed in 2,100 homes in Kuyasa resulting in reduced household expenditure on coal-fired electricity, local job creation, a reduction in local air pollution and setting up food gardens in the area and bamboo has been planted to sequester carbon dioxide.

Source: Wits REAL (2023).

Most companies have adjusted their skills and training frameworks to include energy management into existing electrical, operational, financial and sustainability jobs, amongst others and have relied on OEMS to assist if there is new knowledge that is required (Respondents 2, 5, 8, 9 and 11). Some also report that in order to retain skills they select and train from local communities (Respondent 5).

What was identified was that company strategies do need to evolve to be more cognisant of the social justice issues and engage with communities not just for corporate social responsibility purposes but also to deal with the three areas of social justice namely, restorative, distributive and procedural. Although some companies were found to be doing some activities in this area, many were not and therefore it will become a risk if not addressed adequately.

Industry associations emerged as key conduits for mitigation efforts (Respondents 1, 3, 6 and 10). A number of the larger sub-sector associations indicated they are actively involved in presenting the voice of their members to the Government amidst the energy crises. They engage with Ministers and policy developers to present the challenges

faced by their members in order expedite the identification of solutions beneficial to their members as a collective, or to inform the direction of policy. An example of the latter being Respondent 6's involvement in the development of the Agriculture and Agri-processing Master Plan (AAPMP). They undertook a survey with their members on the impact their members are facing in relation to the deteriorating electricity system. This survey was used to inform AAPMP's focus on energy security (DALLRD, 2023). While this emphasis has been justified, it has been argued that the private sector's energy security challenges have skewed the emphasis of the plan away from other growth constraints, such as biosecurity, infrastructure, and widening export markets (Sihlobo, 2023). In addition, and in some instances, the industry associations have identified the need to develop guiding policy and strategies on climate change and sustainability (which includes energy) to respond to their members' specific contexts (see for example Respondent 3, 6; IFC, 2020; SAPA, 2021).

5. Overview of key occupations and skills required to enable a low carbon transition in the sector

As indicated previously, skills development and planning are recognised as a critical element for a just energy transition, and for the food and beverage manufacturing sector to become energy resilient and respond more broadly to climate change (FoodBev SETA, 2023; Hermanus and Montmasson-Clair, 2021; PCC, 2023). This section presents an overview of the key occupations and skills identified as core to enabling the sector to respond to the identified major energy and related trends to become more energy resilient, and decarbonise; indicates how these jobs and skills may be changing, and the implications of this on skills development and planning.

5.1 Key occupations and skills

A set of occupations and skills were identified through the desktop review (including examples of good practice and levy payer responsiveness review), are inferred from

the food and beverage manufacturing energy hotspots, and insights gathered from stakeholder interviews. Table 14 presents a list of the proposed key occupations and associated technical and core skills identified as central within South African food and beverage manufacturing companies to become more energy resilient, and to leverage and enable low carbon transition. These are presented against the five main energy hotspots and decarbonisation trends identified as impacting the food and beverage manufacturing sector (see Section 4.3). They are considered as being required in the short (2023/2024) or medium (next 3-5 years) term. This can indicate potential new areas for skills development for job seekers entering the sector, or provide possibilities where upskilling may be required to enable a transition in the medium- to long-term.

Table 14: Key occupations and skills identified as core to enabling energy resilience and decarbonisation in South Africa's food and beverage manufacturing[7]

Energy hotspots and trends	Identified mitigation activities	Implications on the world of work	Core occupations Medium term (next 3-5 years)	Skills key to energy resilience and decarbonisation
Loadshedding	• Purchase and installation of generators to deal with loadshedding and ensure continued production • Adoption of energy efficiency practices to reduce load requirement (see energy systems management below) • Switch to renewable energy technologies and invest in battery storage (see Decarbonisation below) • Adjustments to worker shift plans to accommodate loadshedding • Development of loadshedding mitigation and planning strategy	• Increased understanding of loadshedding schedules to manage continuous energy supply • Current and future energy-related infrastructure plans will require workforce to review plans to ensure infrastructure is resilient • Need to plan and adjust shift patterns to accommodate line stoppages / loadshedding • Need to increase working hours to cover production output • Increased demand for diesel technicians to install, maintain and repair large diesel / fuel oil generators • Scope of current jobs may need to be expanded to include new plant • Diesel emission will need to be monitored and reported by sustainability department	**Diesel Engineer / Mechanic**	**Technical skills** • Installation, repair & maintenance of **new** electronic and electrical machinery such as diesel generators and energy efficiency modifications • Performing emergency repairs on diesel generators **Core skills** • Communication under pressure about availability of diesel generators, diesel stock etc
			General Manager / Director	**Core skills** • Negotiation and communication skills to engage with public sector officials and industry associations to overcome loadshedding solutions • Strategic, critical thinking and decision making skills to inform investment in mitigation options • Leadership skills to manage change across the business as it adjusts to the loadshedding pressure
			Human Resource Manager	**Technical skills** • HR / skills planning to adjust worker shifts to accommodate loadshedding • Ability to adjust or develop job descriptions to accommodate energy resilience experience / skills **Core skills** • Negotiation with workers about changing job profiles and requirements
			Environmental / Sustainability / SHEQ Manager	**Technical skills** • Emissions monitoring and reporting as diesel generators will result in additional GHG emissions • Knowledge of legal requirements for climate change, noise,

[7] Occupations highlighted in **red** have been identified as skills gaps, and in **blue** as hard-to-fill vacancies in FoodBev SETA's SSP 2024/2025. Those highlighted in **green**, are also recognised as hard-to-fill vacancies by the Energy and Water Sector Education and Training Authority (EWSETA)(2021). Those highlighted in **orange** have been identified by DHET (2022, 2022a) as critical for South Africa's economic reconstruction and recovery plan.

Energy hotspots and trends	Identified mitigation activities	Implications on the world of work	Core occupations Medium term (next 3-5 years)	Skills key to energy resilience and decarbonisation
				other air emissions **Core skills** ● Collaboration and stakeholder engagement skills will be needed to engage with the local community and government
			Production Coordinator	**Technical skills** ● To manage and coordinate the production line to reduce issues associated with loadshedding e.g. refrigeration, turning off of equipment, or machines abruptly stopping **Core skills** ● Communication and coordination skills as loadshedding is unpredictable and needs quick turnaround times
			Production / Operations Supervisor / Manager (Manufacturing)	**Technical skills** ● Conduct shift meetings with team members to plan around loadshedding ● Ensure operational standards and procedures are implemented even under uncertain conditions ● Conduct weekly evaluations to mitigate potential loadshedding implications on operations ● Also see Production Coordinator above
Energy prices	● Switching to own electricity generation (see decarbonisation below) ● Adoption of energy efficiency practices (see energy systems management below)	● Increased need to monitor and respond to energy price fluctuations. ● Increased need for international understanding of on-site energy generation trading, pricing and legislation ● While increased prices could lead to job losses, optimisation of energy use to cut costs could lead to job retention ● Increased energy prices also affect vulnerable communities (see Social Inclusivity)	**Business Strategy Director**	**Technical skills** ● Coordinate electricity sales / purchase pricing forecasting, planning and budgeting processes **Core skills** ● Critical thinking and problem solving to develop a new strategic direction and understand the implications of energy crisis on current strategy ● Stakeholder engagement on energy pricing (incl. negotiation)
			Finance Director	**Technical skills** ● Strategic financial planning and analysis to mitigate the effects of energy prices on the company's operating costs Analyse financial data, market trends and industry benchmarks to inform and make decisions on investments to achieve energy resilience ● Climate financing if required to get additional funds and possibly concessional finance or carbon trading credits ● ESG requirements for new investments and what lenders will require **Core skills** ● Skills to negotiate: ○ Pricing of e.g. on-site generated electricity, trading

Energy hotspots and trends	Identified mitigation activities	Implications on the world of work	Core occupations Medium term (next 3-5 years)	Skills key to energy resilience and decarbonisation
				○ agreements, energy-efficient machinery ○ Financing
Energy systems management	Integrated strategy to ensure energy the optimisation is a priority (including engagement with suppliers and customers) Energy auditing Energy reporting and monitoring Energy reduction solutions identification Investment in SMART energy solutions (technical and behavioural) Installation of new technologies Consistent repair and maintenance of electrical systems and machinery Replacement of non-efficient technologies	Increased automation may lead to job losses or need for upskilling, particular those involved in repetitive tasks Automated machinery requiring specialist machine operators to deal with robots and digital systems A need to adopt energy optimisation culture across the business, including increased maintenance and repair Increased climate change knowledge in management to make informed decisions / develop adaptation plans Need for high-level technical environmental / energy management skills for advanced measuring, monitoring and reporting. Increased internal knowledge of energy efficient systems / technology procurement Those involved in operations and energy management need increased understanding of energy / sector policy landscape	**Energy Auditor**	**Technical skills** ● Energy systems management standards and best practice that can be applied ● Food and Beverage manufacturing processes and energy requirements along the value chain ● Auditing processes and reporting **Core skills** ● Systems thinking to ensure a holistic approach is taken to energy management ● Problem solving to find new solutions to deal with risk and opportunity eg load shedding and renewables integration
			Airconditioning & Refrigeration / Heating & Ventilation Engineer Technician [also EWSETA hard-to-fill]	**Technical skills** ● Installation, repair & maintenance (IRM) of HVAC equipment and systems that are more energy efficiency or required for system optimisation ● Mechanical, electrical and electronic diagnosing of equipment and control systems in an integrated energy system ● Ensuring compliance with appliance standards and health and safety ● Identification of maintenance risks on equipment
			Electrician / Electrical Engineering Technician / Millwright / Electromechanician	● As per above
			Electrical [Design] Engineer	**Technical skills** ● Design energy efficient electrical systems for new installations and optimise existing systems to reduce demand ● Develop quality checking documentation for energy efficient designs **Core skills** ● Communication with e.g. IRM teams to ensure that a siloed approach is not taken
			Engineering [Maintenance] Manager [and hard to fill]	**Technical skills** ● Maintenance planning and scheduling to ensure optimisation of the system before any renewable are procured ● Ability to ensure machinery used is in best possible working

Energy hotspots and trends	Identified mitigation activities	Implications on the world of work	Core occupations Medium term (next 3-5 years)	Skills key to energy resilience and decarbonisation
				order by undertake maintenance inspections and analysing the risk of process and machinery failure ● Critical spares and stock management and monitoring so there are no stoppages - link to loadshedding **Core skills** ● Analytical and problem solving skills to deal with the complexity of the integrated system ● Communication skills so that other parts of the system are able to support and align with the engineering requirements
			Environmental / Sustainability / SHEQ Manager	**Technical skills** ● Environmental compliance requirements such as energy efficiency performance as they relate to carbon emissions ● Energy measurement, monitoring and reporting ● Identification of behavioural solutions to energy use ● Knowledge of energy consumption issues and energy-related regulations **Core skills** ● Circular system thinking to ensure ESG issues are fully integrated upfront ● Collaboration as ESG is a cross cutting discipline
			Finance Director	● See Energy Prices
			Machine Operator	**Technical skills** ● Ability to operate machinery efficiently to reduce energy losses and food waste ● Ability to identify and contribute to energy saving solutions to ensure efficient machine operation ● Change over product lines efficiently ● Measure, record and control efficiency parameters **Core skills** ● IT literacy as automation is increasing ● Problem solving in a collaborative environment to ensure integration
			Industrial [Efficiency] Engineer / Process Design Engineer / Plant Engineer	**Technical skills** ● Knowledge of supply chain management systems e.g. distribution, energy ● Develop and lead process improvements to reduce energy use ● Conduct time studies to improve energy efficiency and productivity

Energy hotspots and trends	Identified mitigation activities	Implications on the world of work	Core occupations Medium term (next 3-5 years)	Skills key to energy resilience and decarbonisation
				• Efficiency monitoring and tracking **Core skills** • Analytical and problem solving skills as a systems level • IT literacy due to increased automation of systems • Communication skills e.g. change protocols for integration of new equipment and processes
			Mechanical Engineer / Industrial Machinery Engineer / Maintenance Management Engineer	**Technical skills** • Design and administer HVAC systems, domestic hot water generating plant and reticulation, wet services design • Relevant machinery/ processes knowledge to improve energy efficiency **Core skills** • Problem solving, critical thinking and analytical thinking at a systems level to find new solutions • Coordination across the business and in particular within production processes
			Procurement Manager	**Technical skills** • Procurement criteria development for energy efficient machinery, equipment and services • Identify and manage inefficient stock / 'dead stock' • ESG or sustainability requirements **Core skills** • Communication with ESG team and production to ensure fit for purpose purchases that meet environmental criteria • Negotiation skills with new service providers and technologies
			Automation Engineer	**Technical skills** • Identify and evaluation automated efficiency solution • Design, develop and implement automation solutions to maximise efficiencies • Support planning and implementation **Core skills** • IT literacy to deal with increased automation of systems • Negotiation with new service providers • Problem solving / Critical thinking to ensure the holistic implications of automation are considered
			System Modernisation Engineer	**Technical skills** • New energy efficiency technology knowledge • Robotics knowledge linked to automation as process efficiency increasingly turns to robotics, automation and AI • Lean manufacturing processes to ensure competitiveness in

Energy hotspots and trends	Identified mitigation activities	Implications on the world of work	Core occupations Medium term (next 3-5 years)	Skills key to energy resilience and decarbonisation
				the markets **Core skills** • Innovative thinking to find new ways to modernise the systems considering cost and job implications • Communication with existing engineering staff and upskilling them in new equipment or ways of work • Systems thinking to ensure the entire production process is considered
Decarbonisation	Reducing energy consumption Use of low emission fuels / fossil-fuel alternatives Increasing electric vehicle fleet / zero emission propulsion Adopting reverse logistics systems Increasing uptake, installation and use of renewable energy technologies (incl. biogas) Reducing food waste (embedded energy) Incentives to encourage companies to produce and use renewable energy Reporting and monitoring of GHG emissions Adoption of energy storage systems to enhance energy security, and to sell excess. Development of a climate change mitigation and planning strategy	Increased adoption of technologies to reduce logistics / transport GHG emissions will require new knowledge and skills e.g. use of drones, electric vehicles, blockchain The electrification of the economy will have a significant impact on jobs, as new technologies, innovative industrial processes and rules are rolled out and energy-consuming sectors e.g., industry become interconnected with the energy sector. Initially the impact will be felt in the electricity sector, due to the expansion of renewables, but will shift into the food and beverage sector as renewables and clean energy interventions are adopted High-level technical environmental / GHG emissions management skills for advanced measuring, monitoring and reporting. If do not, could lose jobs by not meeting carbon reporting / tax customer requirements. Need for increased in-business knowledge of renewable energy technologies (incl. IRM) and intervention planning. This could include increased employment of renewable energy specialist occupations. Need for internal skills or jobs to identify, implement and monitor renewable energy solutions - notably wind and biomass (from food waste) Need for business culture shift in thinking to lean manufacture and circular practices	**Climate Change / Environmental Scientist / Analyst**	**Technical skills** • Carbon footprinting / tax legislation and implications • Data analysis and reporting on GHG emissions as well as adaptation measures • Digital modelling for predictive forecasting • Life cycle analysis in order to work along the value chain for potential Scope 2 and 3 emissions • Remote sensing / forecasting as part of early warning systems for adverse weather events **Core skills** • IT literacy as modelling and analysis is a key function of this occupation • Analytical thinking to determine the most prudent course of action taking into consideration the other objectives of the company • Decision making and ensuring ESG is considered
			Electrician / Electrical Engineering Technician / Millwright / Electromechanician	• See Energy Systems Management above
			Environmental Manager / Sustainability / SHEQ Manager	• See Energy Systems Management above
			Engineering [Maintenance] Manager [and hard to fill]	• See Energy Systems Management above
			Finance Director	• See Energy Prices

Energy hotspots and trends	Identified mitigation activities	Implications on the world of work	Core occupations Medium term (next 3-5 years)	Skills key to energy resilience and decarbonisation
		Those involved in operations and sustainability need increased understanding of climate change / sector policy and legislation landscape Trading of electricity to become more of a business focus, requiring internal legislative, financial and contract management skills Also see Energy Systems Management above.	**Industrial [Efficiency] Engineer / Process Design Engineer / Plant Engineer**	**Technical skills** ● Identification, planning, design and implementation of circular solutions, use of byproduct eg utilisation of waste for heat production ● Knowledge and understanding of key renewable energy technologies **Core skills** ● Circular system thinking to ensure ESG issues are fully integrated upfront See Energy Systems Management above
			Production / Operations Supervisor / Manager (Manufacturing)	See Loadshedding
			Renewable Energy Engineer / Technician	**Technical skills** ● Manage and coordinate all technical aspects of multiple renewable energy projects ● Develop protection and control schemas for renewable energy projects e.g. solar PV, biomass ● Develop technical specifications ● Identify and mitigate constraints and risks ● Understand financial drivers and metrics of renewable energy systems **Core skills** ● Analytical thinking so that trade-offs and uncertainties are managed ● Communication with multiple team members including production, ESG, finance etc ● Critical thinking to ensure an optimised system is in place
			Carbon Cost Accounting Manager	**Technical skills** ● Accounting to manage carbon budgets, carbon financing and trading of carbon emission reduction certificates ● Carbon offset / tax calculations to understand the new legislative requirements locally and internationally if exports to the EU for example, are being carried out **Core skills** ● Analytical thinking so that a robust and logical system is developed ● Critical thinking to ensure all risks both positive (selling credits) and negative (paying tax) are considered ● IT literacy for modelling and finance tools

Energy hotspots and trends	Identified mitigation activities	Implications on the world of work	Core occupations Medium term (next 3-5 years)	Skills key to energy resilience and decarbonisation
			Circular Economy Designer / Specialist	As with Industrial [Efficiency] Engineer / Process Design Engineer / Plant Engineer (see above) but with a circular economy emphasis
			Green Hydrogen Engineer	As with Industrial [Efficiency] Engineer / Process Design Engineer / Plant Engineer (see above) but with green hydrogen emphasis
			Legal Advisor / Contracts Manager	See Energy Prices above
			Feasibility Study Manager / Researcher	**Technical skills** ● Development of scope, cost, schedule, and quality outcomes, for renewable and circular interventions / projects ● Risk identification, analysis and implementation for new projects or modification to the plant eg for energy efficiency improvements ● Feasibility report writing to document and provide motivation for change **Core skills** ● Analytical thinking so that trade-offs and uncertainties are managed ● Communication with multiple team members including production, ESG, finance etc ● Critical thinking to ensure an optimal proposal(s) are considered
Social inclusivity	● Continuous engagement with key stakeholder groups and communities ● Involvement of stakeholders in company processes ● Training and upskilling local community members rather than importing skills ● Community awareness programmes ● Inclusion of worker and community voice / benefits in business sustainability (energy / climate change) strategy	● Increased need to acknowledge business operations impact on surrounding communities, requiring development and implementation of risk and adaptation strategies ● To shift thinking and problem solving beyond 'factory walls' to include suppliers, customers and local community in solution development ● Increased involvement of workforce in problem solving and solution identification	**Community Liaison Officer**	**Technical skills** ● Ethnographic to understand people and cultures with their customs, habits and differences ● Ability to do qualitative research on local communities and socio-economic factors ● Stakeholder engagement to ensure inclusivity in energy-related mitigation activities **Core skills** ● Communication with cultural sensitivity when dealing with local and affected communities ● Local community knowledge ● Negotiation skills for addressing any community complaints or issues
			HR Manager	**Core skills** ● Worker knowledge and engagement so that revised

Energy hotspots and trends	Identified mitigation activities	Implications on the world of work	Core occupations Medium term (next 3-5 years)	Skills key to energy resilience and decarbonisation
				structures, job profiles can be developed ● Labour negotiations to address any labour issues with changing jobs and/or roles See Loadshedding
			Industry Union Representative	**Technical skills** ● Understanding of Union practices ● Worker-employer liaison / engagement to ensure inclusivity in energy-related mitigation activities ● High level understanding of the JET and associated technologies to allow good representation of union members **Core skills** Communication with company representatives Negotiation with management on wages, changing jobs and role roles/profiles
			Social Scientist	See Community Liaison Officer
Education and training	● Development and implementation of a just energy transition skills implementation plan (national / business) ● Improved knowledge / upskilling of energy, and food and beverage education and skills providers	● Increased internal energy-related knowledge and skills needs will require significant upskilling across all skills levels within the business ● A more focused articulation of energy-related business skills need plans, strategies, and personal development plans	**Skills Development Strategist**	**Technical skills** ● Energy / Green / Just transition skills planning ● Qualification design for new and changing roles ● Research and analysis to inform transition skills implementation plans ● Skills ecosystem thinking that allows innovative career development pathways for employees **Core skills** ● Analytical thinking to be able to deal with complex data ● Communication to get insights from and them communicate back to the business
			TVET Educator [food / electrical / energy]	**Technical skills** ● Latest energy efficiency and decarbonisation knowledge ● Curriculum development skills so that energy issues can be integrated into existing curricula or new curricula developed ● Teaching drawing on latest insights and keeping up to date with developments as they occur in this rapidly changing environment **Core skills** ● Communication of the need for change to TVET management and to collaborate with other educators to leverage synergies and a;ign on common areas for change

Sources: Appunn, 2018; DHET (2022, 2022a); EWSETA (2021); FoodBev SETA (n.d.; 2023; 2023a); IRENA, 2022a; Respondents 1, 2, 3, 4, 6, 7, 9, 12; SANEA (2023).

An analysis of the list of core occupations and associated skills identified above, indicates that technical occupations and skills are essential for both the short- and medium-term transition. While technical occupations and skills are predominant, it is evident that human and/or social science related occupations are becoming more in demand as the sector grapples with issues of loadshedding on workforce planning, and the social dimension of the energy transition requires a broader scope of community engagement and inclusion in decision-making. For all occupations listed, there is a broader recognition of core skills requirements, including those related to conceptual thinking and people-related or interpersonal (social and emotional). The same applies to basic computer literacy, which is no longer confined to computer or automation occupations, but is now considered a critical skill for operating in a contemporary work environment.

It is within the context of the medium (or longer) term that occupations more relevant to the social dimension of a just transition emerge, and a shift from fossil fuels emerges. For example, the need for community liaison officers and social scientists to engage with customers and affected communities to incorporate their voice into mitigation efforts and decision making. From a technological advancement perspective, emerging occupations reflect the transition for more automated processes, renewable and low-carbon technology uptake and more efficient circular and logistics systems thinking. These emerging technical occupations were also highlighted in FoodBev SETA's (2023) Atlas of Emerging Jobs.

5.2 Availability of skills and changing jobs

While currently the skills pool appears satisfactory it was noted that the development of youth and/or new entrants is problematic. Some reasons given included: 1) Companies investing in training and knowledge transfer, and then for that person to leave (Respondent 1, 2, 7), and 2) businesses not having the financial capacity to employ the number of adequately (STEM, new specialisms) qualified students (Respondent 1, 7). This has resulted in students with emerging skills not finding jobs

as places are limited, or over-educated individuals taking low-skilled positions, such as a till operator in a retail store. Other potential reasons indicated for applicants not taking up available positions included candidates not having adequate experience or relevance, unsuitable job location, unsuitable working hours, poor remuneration, equity considerations i.e. a mandate to hire female or Black Africans for management positions (FoodBev SETA, 2023, Respondent 1, 3, 6).

In addition, the skills assessment suggests there are some critical skills gaps (as highlighted in Table 4). However, two areas emerged as common areas of concern through the interviews, these being maintenance and repair (Respondent 2, 4, 6), and renewable technology specialists. Repair and maintenance skills are critical for maintaining the efficiency of machines and systems, and repair ensures the extension of a machines or technologies lifespan. As indicated in Table 4, a number of occupations associated with IRM are also deemed as a critical or hard-to-fill skills need, such as Airconditioning & Refrigeration and Heating & Cooling Technicians, Electrician and Engineering Maintenance Manager. It is in response to this that the National Business Initiative (NBI, 2023) has been 'spearheading a multi-faceted and multi-sector partnership, focused on expanding and growing pathways for young people to access IRM occupations.'

A number of respondents (3, 6, 7) indicated that with the growing need for renewable energy technologies, engineering and technical jobs are changing from traditional e.g. fossil fuels knowledge, to a need for these roles to begin to specialise in renewable energy technologies e.g. Solar PV technician, or Biogas Manager, or Renewable Energy Engineer. It was indicated that due to a lack of adequately qualified individuals in this space, businesses are going outside South Africa to seek the relevant technologies and skills. It was noted by a respondent (7) that given the focus on renewable technologies, there is tendency to aim for upskilling skills provisioning at engineers, scientists and research-related jobs. In their research on the employment impacts of solar energy in Turkey, Çetin and Eğrican (2011), propose that this is likely due to increased employment opportunities in the design and manufacturing of

renewable [solar] energy products. This emphasis suggests that medium to lower skill level occupations are being neglected. This could be one of a number of reasons for the lack of IRM-skilled individuals.

Another area where jobs are changing is in response to food and beverage manufacturing companies needing to urgently deal with loadshedding and energy insecurity. As is evident from Table 9 job roles such as Human Resource Managers and Financial Directors are needing to grapple with the impact of loadshedding on e.g., workforce shift planning to accommodate loadshedding, or in the case of the Financial Directors, Operational and General Managers needing to rapidly upskill their knowledge on pricing of e.g. diesel generators and or renewable energy solutions to inform their procurement decisions.

5.3 Skills training mechanisms adopted

Mechanisms for training and upskilling in the sector were predominantly identified through the interviews. The most commonly identified included learning through: 1) broader sector (national and international) engagements such as events or knowledge-sharing platforms, 2) collaborative working, 3) bringing in international and/or local specialist technology skills and knowledge, 4) work-based learning through apprenticeships, and 5) through on-site company academies or outside specialist trainers.

A number of respondents (1, 2) indicated the importance of being connected to a larger network for knowledge generation. It was noted that the food and beverage manufacturing sector is well connected internationally, with many operating internationally or representing the sector on international forums. It was suggested that this enabled the sector to keep up to date on the latest sector knowledge, new technologies and sectoral interventions. In addition, it provides opportunities for business to benchmark their performance and/or learn from their contemporaries (Respondent 2, 7).

Collaboration is also identified as a key internal mechanism for learning, particular with regards to problem-solving and intervention identification and implementation (Respondent 1, 2, 9, 12). The most common example cited, included the setting up of internal task-focused teams composed of multiple job functions and skills to overcome problems, such as loadshedding. The significance of collaboration in the food and beverage manufacturing sector is regularly cited as an effective mechanism for skills development and learning for climate change and sustainability transitions (see for example Adams et al., 2021; Eppinger et al., 2021).

With regards to offering training through on-site academies or procurement of specialist training service providers, it was noted that this was a 'privilege' assigned to larger manufacturers who can afford to invest in regular and specialist on-the-job training or upskilling e.g. legislation and compliance, and new technologies (Respondent 1, 2). In addition, it was suggested they have the human resources to undertake the various administrative tasks required to offer training and apprenticeships (Respondent 1, 6) in turn, it was acknowledged that SMEs do not have the same budget, time or human resources to access training, and as such they can become isolated from the food system and commercial opportunities (Respondent 1, 6). Linked to financial capacity, some respondents (3, 6) indicated they seek financial assistance e.g. bursaries for employer skills development. However, it was noted that when approaching SETA's it was difficult to access funding if the job or training fell outside the remit of the SETA. For example, seeking funding for sustainability courses currently does not fall within the FoodBev SETA remit.

5.4 What does this mean for skills planning and development?

The assessment of occupations and skills demand provides a steer on how this may impact the provisioning of these core skills, and what may be required to enhance skills provisioning to ensure it is relevant and responsive. Some of the main implications identified include a disconnect between skills demand and supply, the need for consolidated and collaborative effort, a need to respond to skills needed for energy

resilience and decarbonisation, and the adoption of a systems approach to skills research and planning.

It was indicated that there is a disconnect between skills demand and supply, with training providers offering skills based on their know-how or what they wish to provide and not necessarily what the sector needs (Respondent 3). There needs to be improved engagement between skills providers and employers to ensure a more effective skills match (Respondents 3, 6). Given energy-related skills cover a broad spectrum of sectors and manufacturing activities it would be effective and efficient to consolidate efforts not only between sectors (e.g. industry associations), suppliers and employers but also with the relevant SETAs[8] e.g. EWSETA and merSETA, Government departments such as DHET, and delivery bodies, such as GreenCape and NCPC-South Africa who are implementing demand- led skills programmes on [renewable] energy.

Given the current energy crisis, there is an urgent need to respond to climate change, and a broader sustainable transition agenda, respondents (3, 4, 7) indicated that there is a growing need to focus upskilling efforts on energy and renewable technologies. This is substantiated by SANEA (2023), in the Energy Skills Roadmap for South Africa, which indicates that reskilling and upskilling adults to be better equipped to navigate the energy transition at various points in the energy value chain is required.

Skills requirements for the energy system necessitates an ecosystem approach and should acknowledge that the transformative process occurs over time and local geographic areas. Siloed approaches need to be avoided to maximise any opportunities and build any industry-offs into decision making (SANEA, 2023). This includes cross-sectoral (e.g. agriculture, energy, water) and multi-actor involvement at both a macro (e.g. national government) and micro-level (placed-based). In addition, it requires a much broader investigation and understanding of all occupations and skills

[8] It is understood that FoodBev SETA has a number of Memorandums of Agreement (MoA) with other SETAs.

required across the multi-layered system to leverage change of time. Source: FoodBev SETA (2023, p39).

6. Conclusion and recommendations

The research indicates that South Africa's food and beverage manufacturing sector is currently facing a number of critical energy-related challenges, with loadshedding, energy prices and decarbonisation emerging as the most prominent. While social inclusion is acknowledged as a requirement for a just energy transition, there was little evidence to suggest that it was being adequately considered by the sector. This is most likely due to other more pressing risks and challenges such as the need to be energy resilient and combat the impact of loadshedding, a deteriorating electricity system, across the board price increases and pressures from customers (i.e. retailers), holdings companies and government to drive climate adaptation and mitigation efforts within their supply chain, and to report on their GHG emissions and low-carbon interventions.

With regards to mitigation efforts, many companies are taking action and adjusting their strategies and business models to reduce energy consumption and if possible, switch to alternative sources of energy to either decarbonise or reduce GHG emissions. In addition, there is a valid business case for doing so given the intensity of loadshedding, rising energy prices and pressure to decarbonise. There is however room for improvement. Energy related activities should be undertaken in a specific sequence to optimise results and reduce costs. That is to firstly optimise the production and ancillary systems and implement energy efficiency to reduce demand and only then switch to alternative energy sources for a least cost approach. It was identified that many companies are not doing that in their haste to deal with loadshedding and so have purchased renewable energy and storage plants, that is what would have been required, if they had optimised the system first.

From a social inclusivity perspective JET has many commonalities with the just transition happening in the food system more broadly, and that is that they both require

intensified engagement with local communities, especially for job creation or assistance where jobs may be lost as a result. Another area for improvement is in terms of social justice and equality and doing more with local communities beyond corporate social investment (CSI) and integrating the community voice into decision making and problem solving, or sharing the benefit (shared value) of energy-related practices, such as electricity generated from on-site solar technologies.

These challenges and mitigation efforts inform the occupation and skills needed to enable change in the sector. Within the short-term there is an emphasis on financial and technical occupations and skills, notably engineering and technical (specifically maintenance and repair) expertise and know-how to not only implement low-carbon alternatives and strategies, but to deal with the immediate impact of loadshedding. This includes skills required in:

- Strategy, finance and procurement to identify strategic objectives and then plan, fund and procure them. This includes knowledge of climate finance options, carbon tax implications etc so that a comprehensive risk adjusted business case can be developed
- Skills in energy audit, efficiency and optimisation, to ensure demand for energy is minimised and utilised in the most efficient and productive manner
- Skills to install or manage contractors to install the plant and equipment
- Operators that can run the plant on a day to day basis and either do maintenance or bring in service providers to do so
- Monitoring and evaluation skills to measure progress and report on them

This also calls for increased intervention and involvement of high-level managerial roles, such as Finance and Operational Directors who need to engage and negotiate with the public sector or make informed decisions on spend and proposed solutions.

There is also a need for awareness raising at Board level where they will ultimately approve strategy and capital expenditure. In the medium-term occupations with a social

and specialist role emerge as a need for example a Community Liaison Officer as detailed in Table 9 above. This is in response to the recognition of social inclusivity and increased stakeholder engagement, and new renewable technologies and automation become commonplace on site. While this need exists, issues around retention (especially of youth and new entrants), a need for relevant industry and technology experience, capacity to provide or access training, and critical skills gaps (e.g. IRM) prohibit the sector from meeting its skills needs. This in turn impacts on the ability of the sector to transition.

6.1 Proposed recommendations

To mitigate some of the occupation and skills challenges identified, and to enable the sector to leverage the necessary change required for a just energy transition, a number of proposed recommendations are presented for consideration.

Table 15: Proposed recommendations for the Food and Beverage SETA

Skills development enabler	Proposed recommendations
FoodBev SETA	● Conduct research on food and beverage specific tools and methodologies to support companies in: ○ Embedding energy management systems (together with the EW SETA) ○ Aid in engaging and implementing a broader range of social inclusivity activities for a just energy transition ● Undertake a curriculum review of energy transition-related course content for relevance and specialisms (especially within the identified hotspot areas). This review will provide a more nuanced evidence-base on the implications of energy-related skills demand for education and skills providers, and how they can respond. ● Develop and support skills provisioning specifically adapted for the food and beverage sector, or in partnership with another SETA in the following areas: ○ energy audits ○ energy optimisation ○ general energy reduction and renewable energy awareness raising for members, ○ installation, repair and maintenance (IRM), ○ renewable energy specialisms, notably solar, biomass and batteries,

Skills development enabler	Proposed recommendations
	○ investment and finance awareness raising and decision making, and ○ social inclusivity with a focus on local community engagement. This will ensure the sector is responsive to how occupations and skills are changing in response to energy-related trends, such as decarbonisation. ● Identify mechanisms to better support and subsidise the upskilling of food and beverage SMEs in the latest energy management, technological and renewable energy developments. ● To be more explicit about energy challenges and decarbonisation and link them to existing initiatives in the SSP such as 4IR to address the automation issues identified, by including them in the following sections: ○ Economic indicators - and the impact they have on imports and exports ○ Key skills change drivers - as an emerging and urgent driver ○ Occupation shortages and skills gaps with recommendations on major areas of focus ○ SETA partnerships - highlight partnership and SETA collaboration platform ○ Skills priority actions - as a complete approach from the SETA to assist levy payers with dealing with energy resilience in general ● Adopt a skills ecosystem approach to ensure a multi-actor, multi-level approach to better understand all occupations and skills required across the food and beverage manufacturing system to enable the sector to become more energy resilient, and transition to low-carbon practices. This requires a skills mapping exercise to be undertaken, and skills pathways identified
Broader PSET system	● To identify and/or initiate a collaborative platform to support skills provisioning across the SETAs to enhance energy resilience and to enable a low-carbon transition. The intention is to encourage cross-sharing of research and to reduce duplication of efforts. ● From the above point to then identify specific skills development and/or research partnership with key role players such as EWSETA and merSETA
Food and beverage manufacturing relevant industry associations	● To facilitate better coordination between skills providers and employers to identify and support the development of relevant accredited energy-resilience and low carbon transition courses (see proposed areas above). ● Given the proactivity of the sector's industry associations, a review of their energy-related and low-carbon training and course development activities should be undertaken. This will inform FoodBev SETA on how best to collaborate with them.

Skills development enabler	Proposed recommendations
	• Conclude partnership agreements in targeted areas with relevant industry bodies and play a facilitation role to partner them with JET and energy related industry bodies in collaboration with the EWSETA and merSETA.
Food and beverage manufacturing companies	• Start a focus group with leading levy payers in these areas, as identified in the analysis, to extract key learnings, best practice and use this information to inform future strategic objectives and focus areas • Raise awareness of this issues, especially with SMMEs, through publishing information on-line, holding webinars and workshops and working through the industry associations

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Appendix 1: Food and beverage manufacturing activities covered by FoodBev SETA's Chambers

FoodBev SETA Chamber	Category	SIC Code	Constituency
Processed and Preserved Meat, Fish, Fruit and Vegetables	301	**Production, processing and preservation of meat, fish, fruit, vegetables, oil, and fats**	
		Meat Industry	
		30110	Production, processing and preserving of meat and meat products
		30112	Manufacture of prepared and preserved meat including sausage
		30113	Production of Lard and other edible fats
		Fish industry	
		30120	Processing and preserving of fish and fish products
		30121	Manufacture of canned, preserved and processed fish
		Fruits and vegetables industry	
		30130	Processing and Preserving of Fruits and Vegetables
		30131	Manufacture of canned, preserved, processed and dehydrated fruits and vegetables and potato flour meals
		Oils and Fats industry	
		30140	Manufacture of vegetables and animal oil and fats
		30141	Manufacture of crude oil and oilseed cake and meal
		30142	Manufacture of compound cooking fats, margarine, and edible oils
Dairy manufacturing	302	**Manufacture of dairy products**	
		Dairy Industry	

FoodBev SETA Chamber	Category	SIC Code	Constituency
		30201	Processing of fresh milk (pasteurised, homogenous, sterilised, and vitamin)
		30202	Manufacture of butter and cheese
		30203	Manufacture of ice cream and other edible ice, whether containing cream or chocolate
Cereals	303	**Manufacture of breakfast products**	
		Grain mill industry	
		30312	Manufacture of breakfast products
	304	**Food preparation products**	
Baking		*Baking industry*	
		30401	Manufacture of bakery products
Confectionery and snacks		*Confectionary industry*	
		30430	Manufacture of cocoa, chocolate and sugar confectionary
		30491	Manufacture of coffee, coffee substitutes and tea
		Snacks industry	
		30492	Manufacture of nut foods
		Other food products industry	
Manufacture of food preparation products		30440	Manufacture of macaroni, noodles, couscous and similar farinaceous products
		30490	Manufacture of other food products N.E.C.
		30499	Manufacture of spices, condiments, vinegar, yeast, egg products
	305	**Manufacture of Beverages**	
		Wine and Spirits industry	

FoodBev SETA Chamber	Category	SIC Code	Constituency
Beverage manufacturing		30510	Distilling, rectifying, blending of spirits, ethyl alcohol production from fermented materials, manufacture of wine
		Beer and Malt industry	
		30520	Manufacture of beer and other malt liquors and malt
		30521	Breweries except sorghum beer breweries
		30522	Sorghum beer breweries
		30523	Manufacture of malt
		Soft drinks and water industry	
		30530	Manufacture of soft drinks, juices and juice extracts and production of mineral water (both carbonated and non-carbonated)

Appendix 2: Some examples of FoodBev SETA levy payers' energy-related good practice

Baked goods manufacture

FORDCORP is a subsidiary of RCL who have committed to becoming an energy self-sufficient business as they have identified the risk loadshedding poses to employees, equipment and productivity. They also recognise the climate change implications of using coal based power. In addition to the many other initiatives including:

- Using bagasse for cogeneration at the sugar mills and waste to value projects
- Solar PV installed at national offices, Nelspruit Bakery and Vector Logistics' Peninsula hub
- Once self-sufficient, they will investigate selling surplus electricity

One of Pioneer Foods' brands is Sasko bread. The company has been on a journey to help address loadshedding, carbon footprint by:

- Implementing a strategy of installing solar power at some major factories
- More than 2 531 kilowatt peak (kWp) will be generated across 5 sites and is estimated to result in a cost saving of R116-million over the next 25 years

Beverage manufacturing

Coca-Cola Beverages South Africa

Coca-Cola Beverages South Africa is the largest bottling partner of Coca-Cola in Africa, accounting for 40% of all brand-owned beverages sold on the continent. Coca-Cola has placed emphasis on ensuring energy security and reducing its energy impact. It has set a number of associated targets: 25% of electricity needs supplied by renewable energy sources by 2025. The company sees an investment in solar as crucial for realising significant financial savings, especially given that most plants were/are sourcing electricity from Eskom, who use coal as a fuel source. The shift to solar will reduce the impact of load shedding and dependence on electricity from the national grid. Activities and initiatives planned/undertaken:

- First 10% of this green energy rollout will come from rooftop solar panels at 11 of its facilities across South Africa (Averda, 2023).
- Installation of energy efficient lighting and high-efficiency motors installed in machinery (Averda, 2023).
- Over the past 10 years the company has reduced its energy use per litre of product produced by 60% (Massmart, 2021).
- Solar has also been the focus of a social programme of solar-powered groundwater harvesting and water treatment facilities which began in 2020. To date nine sites have been constructed in Limpopo, the Eastern Cape, Gauteng and KwaZulu-Natal and > 150-million litres of water has been harvested for >15,000 households (Sowetan, 2022).

Heineken South Africa

Heineken is one of the World's largest brewers. In South Africa it owns a number of recognised beer brands, such as Heineken, Amstel, Windhoek and Strongbow Cider. They have set a number of commitments under their Brewing a Better World strategy including a goal to reach next zero carbon emissions in all production sites by 2030. They acknowledge the journey is continuous and involves using global best practices to improve their systems and to implement new technologies, where applicable.

- A focus on brewery efficiency, with a focus on electricity and thermal.
- First phase of solar PV (Sedibeng Brewery) and concentrated solar to supplement the brewery electricity supply.
- Investigating the use of biomass boilers to supply heat by using own waste streams.

From a just transition perspective the company acknowledges that the company needs to ensure they look after the people and environments in which they operate, as this is crucial for the business' survival. From an employee perspective this includes ensuring an inclusive and diverse culture and environment in which to operate (Willems, 2023).

Sir Fruit

Sir Fruit is a fruit juice, smoothie shots and cordials manufacturer committed to the principle of 'People, planet and prosperity. It focuses on initiatives to ensure production is energy efficient, sustainable and products are low carbon. They have been working with the National Cleaner Production Centre South Africa (NCPC-SA) to assist them on this journey. Activities and initiatives undertaken:

- Assessment of technology and identification of more environmentally sustainable technologies enabling far less use of energy to cool products and to heat water. These upgrades are set to reduce energy consumption by 40%.
- Installation of solar panels to reduce their Soweto plants energy consumption and resilience further (CSIR, 2018).

Backsberg Wines

Backsberg Wines is best practice as follows:

- The wine production process is certified carbon neutral wine
- Solar water heaters, ceilings, and compact fluorescent energy efficient light bulbs have been installed in 2,100 homes in Kuyasa resulting in reduced household expenditure on coal-fired electricity, local job creation, a reduction in local air pollution and setting up food gardens in the area
- Bamboo has been planted to sequester carbon dioxide (Backsberg 2023)

South African Breweries

South African Breweries is planning to transition to 100% renewable energy by 2025 by:

- Producing Castle Lite using only renewable energy by 2025 by building 191MW of solar plant
- Driving towards all breweries in South Africa using solar power generation
- Generate biogas electricity at the Alrode brewery which generated 9.7GWh of renewable electricity over a 10 month period in 2021 (Illidge, 2022)

Cereals manufacture

Premier Foods

The company has committed to reduce the energy required to produce and distribute products by:

- Investing in improved and/or alternative energy sources such as: solar power, alternative fuels, new transport fleets
- improved route management and improved technologies energy strategy that will increase the share of cleaner and renewable energy in our supply mix and implement measures to improve energy efficiency. Converting to natural gas from poly fuels and coal, which emits significantly less carbon dioxide and fewer pollutants

Tiger Brands

Tiger Brands has det a companywide target of reducing their GHG emissions by 45% by 2030 for scope 1 and 2 emissions off a 2019 baseline and a longer term ambition to be at net zero by 2050. They aim to achieve this by achieving reductions in electrical energy intensity, water intensity, GHG emissions and a reduction in waste to landfill as follows:

- 65% of all electrical energy from sustainable energy solutions through a roll out of their clean energy plan solar power at 35 plants and purchasing clean electricity from independent power producers
- Exploring biogas, wind, batteries and hydrogen
- Reduce energy intensity (kWh/tonne) across all sites by 30% by 2030 and also reduce thermal energy consumption (Tiger Brands, 2022)

Confectionery and snacks manufacturing

PepsiCo's Simba Chips

PepsiCo is a major global brand owner. In South Africa, one of its most notable brands is Simba Chips. PepsiCo has set net-zero emission goals. GHG emission and energy activities include:

- PepsiCo recently began construction of a food processing waste to energy facility, in partnership with Anaergia and Tecroveer, at the Johannesburg plant. The plant will convert approx. 11,500 tonnes of food scraps, fryer waste and wastewater sludge into 800kWh per annum. A natural fertiliser will be generated from the plant and used by PepsiCo's agriculture division (Bailey, 2023).

Lowveld Nut Processing (LNP)

Is a subsidiary of Golden Macadamias, based in Nelspruit and its major activity is to process macadamia nuts. It is based in Nelspruit, Mpumalanga. It is a major supplier of macadamia nuts globally. Energy activities include:

- The company has recently built a new processing facility which has been designed right upfront to have a low carbon footprint and ultimately become self-sufficient in terms of energy
- Electricity is generated for own use through solar power (1MW)
- An additional 2 Megawatts of power will be generated by using the macadamia nut shells which are a waste product of the process produced during the cracking process as a fuel. (FNB, 2023)

Dairy manufacturing

Clover

Clover is one of the largest dairy producers in the country. The company recognises the need to limit the impact of an insecure energy supply and to identify opportunities within the business to reduce energy consumption (e.g. refrigeration and steam supply) and reduce costs, as well as to generate energy and therefore an income. Activities and initiatives planned/undertaken:

- Entered a servitude agreement with Energy Partners (EP) to secure a reliable supply of refrigeration and steam. EP designed and constructed an integrated refrigeration, power and steam plant at Clover's Queensburgh site in KwaZulu-Natal. This will lead to a reduction in operation costs, a cooling efficiency of 40%, and avoid 132 million tonnes of CO_2 emissions over 20 years (Burger, 2023; Masilela, 2023).

Fair Cape Dairies

Fair Cape Dairies is one of South Africa's leading commercial dairies, having been in operation for more than 70 years. Core to the way they do business is animal, environmental and social welfare. They have been investing in solar PV since 2018 across its milking parlour, milk processing facility and associated cold storage distribution centre (Van Dijk, 2023). One of the main drivers of shifting to renewables is to mitigate the disruptions of load shedding which severely damages equipment, can lead to under sterilised dairy products and compromised quality and productivity (Majola, 2023a). Some activities and initiatives:

- Several renewable energy resource projects have been implemented at their mega facility in Humansdorp, with the milking parlour switching entirely to solar power during daylight hours in 2018 (Bulbulia, 2021, ProAgri, 2023).
- Began work on 1MW solar power farm between 2020 and 2021 to generate 3.32GW of power. Resulting in a reduction of over 1 million kilograms of CO_2 (Majola, 2023a).
- Entered a Power Purchase Agreement with SOLA at their milking parlour in Durbanville, Western cape to install solar PV. This initiative provides clean energy to the farm during the day, and is estimated to reduce the farm's total consumption by 16% per year over its 25 year lifespan (SOLA, 2021).
- The company is investigating biodigestion to produce fertiliser or biogas which could be used to fuel the company's delivery vehicles (Majola, 2023a).

Woodlands Dairy

Woodland Dairy is one of the largest dairy manufacturers in the country. It is committed to bringing environment, social and governance considerations to the core of the way they do business, and started their sustainability journey in 2012 (ProAgri, 2023). As a large user of water and energy, they have invested in water and energy management and reduction (amongst other initiatives). The company has five main sources of energy: electricity, diesel, heavy fuel oil, biomass and solar. (Woodlands Dairy, 2020). Energy-related activities and initiatives planned/undertaken:

- Biomass as an energy source is the most widely used in the production of steam. They installed a biomass boiler in 2016 to reduce the company's carbon footprint (a reduction of 78% in GHG emissions), energy costs and dependence on non-renewable sources. A second biomass boiler has been commissioned this year (Massmart, 2021; ProAgri, 2023; Woodlands Dairy, 2020).

Manufacture of food preparation products

	Illovo Sugar Africa Illovo Sugar produces about 90% of its own energy through renewable resources, such as bagasse (Illovo Sugar, 2023). Activities and initiatives planned/undertaken: ● Use of sugar bagasse to generate electricity which is primarily used within the sugar manufacturing process to power milling, refining, and packaging processes, as well as to provide electricity for the irrigation of agricultural estates and other business requirements (Illovo Sugar, 2023).
	Tongaat Hulett Given the company produces bagasse, it generates part of its own electricity requirements from a renewable energy source. in 2021, 606 407 MWh electricity was consumed of which 74% was self-generated. The company aims to: ● Improve progressively until 2030 with the aim to decouple growth from environmental degradation ● Improve energy efficiency by 5% by 2025. (Tongaat, 2021)

Processed and preserved meat, fish, fruit and vegetables

	In2food The company has committed to reduce GHG emissions by 25% each year by 2030. In South Africa, this prepared food and beverage business in South Africa has: ● Expanded production capacity with a new 4500m² facility with energy and water saving built in right from the start ● Installed 8000m² of solar panels which produce 25% of the energy needs ● Utilised natural gas for the boilers, staff kitchens and ablution geysers (In2food, 2023)

Kerry Group
The Kerry Group is an Irish Food company producing various food products including frozen meals, hot and cold pies, processed meats and dairy spreads. It has operated in South Africa since 2011. It is committed to investing in

sustainable practices that have a more holistic ambition to create a ‘world of sustainable nutrition’. Activities and initiatives planned/undertaken:

- In 2022, it invested in a state of the art production facility in Hammarsdale, KwaZulu-Natal, which is considered one of the company’s most environmentally efficient manufacturing sites globally. Some of the energy-related considerations have been low energy usage equipment, solar power generation to reduce consumption from the local grid, waste heat capture and efficient water capture, reuse and reduction (BusinessTech, 2022).

McCain Foods South Africa

McCain Foods recognises that as a food producer it needs to accelerate efforts to build a sustainable future through producing less waste, addressing food security, adapting to changing consumer demands and disruptions along the food supply chain. As a business it has committed to aligning its ambitions with the UNs Sustainable Development Goals (BizCommunity, 2020). From the perspective of JET this cover dimensions of climate action, responsible consumption and production, decent work and economic growth and food security. Energy-related activities and initiatives planned/undertaken:

- Solar PV has been installed at both their Springs and Delmas sites, which will result in a reduction of 9,000 tonnes of CO_2 emissions.
- A reduction in average transport distance from farm to plants by 16%.
- To establish and evaluate partnerships for onsite solar and wind generation (BizCommunity, 2020).

Appendix 3: FoodBev SETA levy payers' reviewed

A.I.B (BAKERIES)	GRAINVEST OIL (PTY) LTD
AAM CC	GRAND FOODS (PTY) LTD
ACE BAKERY	GROFRESH (PTY) LTD
ADM HUMAN NUTRITION (PTY) LTD	HALEWOOD INTERNATIONAL SOUTH AFRICA
AFRICA PALM PRODUCTS (PTY) LTD	HALLS KARSTEN RIPENING COMPANY
AFRISUN FOOD CORPORATION PTY LTD	HATFIELD BAKERY
AFRO FISHING (PTY) LTD	HEINEKEN SOUTH AFRICA
AGRANA FRUIT SOUTH AFRICA PTY LTD	HEINZ FOODS SOUTH AFRICA PTY LTD
AGRO-MILLS SA CC	HERSCHEL FOODS (PTY)LTD
AIB (BAKERIES)	IMANA FOODS SA PTY LTD
AJ OILS CC	IN2FOOD
ALBANY BAKERIES	IN2JUICE (PTY) LTD
ALGOA FISHING PTY LTD	IRVIN & JOHNSON
ALLIED FOODS SA	KELLOGG'S COMPANY OF SOUTH AFRICA
ALOE MEATS (PTY) LTD	KHOISAN GOURMET (PTY) LTD LIBSTAR
ALPEN FOOD COMPANY SOUTH AFRICA PTY LTD	KING PIE
AMA SQUEEZA ONE PTY LTD	KITAMU GROUP
AMALGAMATED BEVERAGE CANNERS	KOLI FOODS (PTY) LTD
AMBASSADOR FOODS A DIVISION OF LIBSTAR	KWALITY GROUP AFRICA
AMC FRUIT RSA PTY LTD	KWV SOUTH AFRICA PTY LTD
ANCHOR YEAST	LABORIE FOODS (PTY) LTD
APPLETISER SA (PTY) LTD	LADISMITH CHEESE COMPANY (PTY) LTD
AQUA TIQUA NATURAL RESOURCES	LAMBERTS BAY FOODS (PTY) LTD
ATLANTIS SEAFOOD PRODUCTS PTY LTD	LANCEWOOD HOLDINGS - A DIVISION OF LIBSTAR
BACKSBERG ESTATE WINES	LANGEBERG AND ASHTON FOODS (TIGER BRANDS)
BARVALE PTY LTD	LITTLE GREEN BEVERAGES PTY LTD
BEAN THERE COFFEE COMPANY	LIVING HARVEST FRUIT AND VEGGIES (PTY)
BECKS BISCUITS (PTY) LTD	LOWVELD NUT PROCESSING PTY LTD
BEST GRADE FACTORY	LUCKY STAR (OWNED BY OCEANA)
BIDVEST BAKERY SOLUTIONS	LUSITANIA TRAWLING SERVICES
BIG JOE 'S PIES	MAGPINE HOLDINGS MAGPINE HOLDINGS
BISCUIT KIMG	MAHLALELA PTY LTD
BLUE RIBBON BAKERY - PART OF PREMIER FOODS	MAITLAND MEAT MERCHANTS PTY LTD
BOLAND BOTTLING (PTY) LTD	MANDATE MEAL MANAGEMENT PTY LTD
BROOKLYN FOODS (PTY) LTD	MANDISA HOLDINGS
BULL BRANDS FOODS	MARINE PRODUCTS (A DIVISION OF FOODCORP)
BUTTERFIELD BAKERY	MATHEBULA DAIRY (PTY) LTD
CADBURY SCHWEPPES SA LTD	MCCAIN FOODS SA PTY LTD
CAKE WORLD SOUTH AFRICA	MCCOORMICK SOUTH AFRICA PTY LTD
CALAMARI FISHING (PTY) LTD	MERCA FISHING (PTY) LTD
CAMPUS CATERING SERVICES CC	MISTER SWEET PTY LTD
CANI RUSKS PTY LTD	MNANDI MEATS
CAPE CHICKENS	MONDELEZ SOUTH AFRICA (PTY)LTD
CAPE COASTAL HONEY A DIVISION OF LIBSTAR	MONTAGU FOODS - A DIVISION OF LIBSTAR
CAPE HERB AND SPICE - A DIVISION OF LIBSTAR	MOOI RIVER CHEESE (PTY) LTD
CAPE MEAT PACKERS (PTY) LTD	MYRA FOODS (PTY) LTD
CARGILL FLAVOR SYSTEMS (RSA) PTY LTD	NATAL DRY BEANS SA
CATERCORP MEGA (PTY)LTD	NATIONAL BRANDS LTD
CAVALIER GROUP OF COMPANIES	NATURES CHOICE (PTY) LTD

CECIL VINEGAR A DIVISION OF LIBSTAR	NESTLE SA (PTY) LTD
CERES FRUIT JUICES PTY LTD	NOLA 'N DIVISIE VAN FOODCORP (EDMS)BPK
CHEETAH MILLING	NOVO FRUIT PACKERS PTY LTD
CHESA NYAMA	OCEANA GROUP LTD
CHUBBY CHICK ENTERPRISES	PEPPADEW TZANEEN EDMS BPK
CITY DEEP DEBONING PTY LTD	PEPSICO
CLAYVILLE NUTRITIONALS (PTY) LTD	PIONEER FOODS (PTY) LTD
CLIPPER COFFEE AND TEA CC	POWER YEAST
CLOVER SA LTD	PREMIER FOODS
COCA-COLA BEVERAGES SOUTH AFRICA	RAINBOW CHICKEN PTY LTD
COEGA DAIRY	RHODES FOOD GROUP (PTY) LTD
COLDCHICKS MEATS AND CHICKEN (PTY) LTD	ROBERTSONS FOODS (PTY) LTD
CONSOLIDATED STARCH INDUSTRIES	ROYAL ALGOA FISHING COMPANY PTY LTD
CREIGHTON VALLEY CHEESE	SA BREWERIES (SAB)
CRICKLEY DAIRY (PTY) LTD	SALDANHA BAY CANNING CO. PTY LTD
CROWN FOOD INDUSTRIES (PTY)LTD	SASKO (PTY)LTD
DAIRYBELLE (PTY) LTD	SEA HARVEST CORP LTD
DAIRYMAID ICE CREAM	SEED OIL SA
DEL MONTE FRUITS SA PTY LTD	SGS SOUTH AFRICA (PTY) LTD
DENNY MUSHROOMS A DIVISION OF LIBSTAR	SIMBA PTY LTD (OWNED BY PEPSICO)
DIAGEO SOUTH AFRICA PTY LTD	SIR FRUIT (PTY) LTD
DICKON HALL FOODS A DIVISION OF LIBSTAR	SOUTH WESTERN DAIRY (PTY) LTD
DISTELL/HEINEKIN(PTY) LTD.	SPIER WINES PTY LTD
DRIED FRUIT FOR AFRICA (BRACKENFELL) BK	STILLVEST (PTY) LTD
ETHEKWINI CHEESE (PTY)LTD	SUNBAKE EDMS BPK
EUREKA MILLS PTY LTD	SUPA OILS
EXCELLENT MEAT PACKERS CAPE PTY LTD	SUPER OIL MILLS PTY LTD
FAIR CAPE DAIRIES PTY LTD	TASTIC RICE CORPORATION
FAIRVIEW CHEESE COMPANY PTY LTD	TERBODORE COFFEE ROASTERS GAUTENG
FATTIS & MONIS LTD	THE GOOD FOOD COMPANY
FIRST CHOICE MEAT	TIGER BRANDS
FLAVORPACK (PTY) LTD	TONGAAT HULETTS PTY LTD
FOODCORP PTY LTD (OWNED BY RCL FOODS)	UNIFRUTTI SOUTH AFRICA PTY LTD
FORTIFIED FOODS MARKETING PTY LTD	UNIGRAIN COMMODITIES (PTY) LTD
FOURNOS BAKERY	UNILEVER SOUTH AFRICA PTY LTD
FREDDY HIRSCH GROUP	VRYBURG ABATTOIR
FREE STATE OIL PTY LTD	WEDGEWOOD NOUGAT PTY LTD
FUNKY OUMA	WESTFALIA

Appendix 4: Interview guiding questions

FoodBev SETA: Project 2: Energy hotspots

GUIDING INTERVIEW QUESTIONS:
FOOD PROCESSORS AND MANUFACTURERS

Interviewee: [Insert name, company]
Interviewer: [Insert name]
Date: [Insert interview date]

Introduction
South Africa is in the midst of an energy crisis, and faces a number of associated challenges and trends, for example a widening energy cost gap, deteriorating energy security, climate change, and automation (SANEA and Wits REAL, 2023). In response, the South African government has put in place a Just Energy Transition (JET) investment plan, and is currently working on an associated skills implementation plan. The food and beverage manufacturing sector needs to and is responding to these challenges.

The purpose of this research, and interview, is to:

1. Better understand the food and beverage manufacturing sector's energy challenges and impacts.
2. Identify the main areas for energy use improvement and impact mitigation.
3. Identify current sector mitigation practices, opportunities and challenges.
4. Identify the main jobs and skills required to reduce energy use and mitigate impact.

Job role and company information

1. What is your job role?
2. In which location(s) do you operate?
3. What products does your company process / manufacture?

Energy and GHG emission reduction activities

4. What areas of your operations consume the most energy?

Probe: e.g. Energy use, Packaging, Transport / logistics, Waste, Water use Water use and treatment. Why are these the most intensive? How do they know these are the most intensive?

5. What initiatives do you implement to reduce energy use / reduce GHG emissions?
   Probe: Why do they focus on these areas [drivers]? How do they determine which initiative(s) to implement/prioritise? Are these technical, behaviour, social/community interventions?

6. What challenges do you face in identifying, planning, implementing and monitoring energy / GHG emission reduction initiatives?
   Probe: e.g. financial, human resources, time, lack of knowledge, skills etc. Why do they face these challenges? Probe any human resources / skills challenges e.g. specific jobs, skills etc

7. What do you think is required to improve or scale energy / GHG emission reduction activities within your business and across the sector?
   Probe: Why do they suggest this support / enabler / consideration? Who do they suggest should be involved in these improvements / scaling? Why?

Skills and energy / GHG emission reduction

8. Who is involved in identifying, developing, financing, implementing and monitoring energy / GHG emission reduction initiatives?
   Probe: To name specific job functions / roles e.g. energy manager? Are these job functions internal / external to the company? If external, why do they select external

9. What are the main skills required to identify, develop, finance, implement and monitor energy / GHG emission reduction initiatives?
   Probe: This should be for some of the key job functions they list above. Probe for both technical and core skills.

10. What are the main human resource and/or skills challenges you face when identifying, developing, financing, implementing and monitoring energy / GHG emission reduction initiatives?
    Probe why these are challenges?

11. How do you think these human resource and/or skills challenges can be improved?
    Probe why? Probe who should be involved?

Do you have any other comments on this topic?

Thank you for your time!

FoodBev SETA: Project 2: Energy hotspots

GUIDING INTERVIEW QUESTIONS: STRATEGIC

Interviewee: insert
Interviewer: insert
Date: insert

Introduction

South Africa is in the midst of an energy crisis, and faces a number of associated challenges and trends, for example a widening energy cost gap, deteriorating energy security, climate change, and automation (SANEA and Wits REAL, 2023). In response, the South African government has put in place a Just Energy Transition (JET) investment plan, and is currently working on an associated skills implementation plan. The food and beverage manufacturing sector needs to and is responding to these challenges.

The purpose of this research, and interview, is to:

1. Better understand the food and beverage manufacturing sector's energy challenges and impacts.
2. Identify the main areas for energy use improvement and impact mitigation.
3. Identify current sector mitigation practices, opportunities and challenges.
4. Identify the main jobs and skills required to reduce energy use and mitigate impact.

Job role and company information

1. What is your job role?
2. How are you or your organisation involved in energy reduction and transitions with South Africa's food and beverage manufacturing sector/?

Energy and GHG emission reduction activities

3. From your perspective, what areas of operation consume the most energy within the food and beverage manufacturing sector?
   Probe: e.g. Energy use, Packaging, Transport / logistics, Waste, Water use Water use and treatment. Why are these the most intensive? How do they know these are the most intensive? Does this differ from one sub-sector to the next e.g. bakery vs fish processing?

4. What initiatives do promote/support within the sector to reduce energy use / reduce GHG emissions?
   Probe: Why do they focus on these areas [drivers]? How do they determine which initiative(s) to implement/prioritise? Are these technical, behaviour, social/community interventions?

5. From your perspective, what are the main challenges faced by the sector in identifying, planning, implementing and monitoring energy / GHG emission reduction initiatives?
   Probe: e.g. financial, human resources, time, lack of knowledge, skills etc. Why do they face these challenges? Probe any human resources / skills challenges e.g. specific jobs, skills etc

6. What do you think is required to improve or scale energy / GHG emission reduction activities within the sector?
   Probe: Why do they suggest this support / enabler / consideration? Who do they suggest should be involved in these improvements / scaling? Why?

Skills and energy / GHG emission reduction

7. From your perspective, who are the main people/job roles involved in identifying, developing, financing, implementing and monitoring energy / GHG emission reduction in and for the sector?
   Probe: To name specific job functions / roles e.g. energy manager? Are these job functions internal / external to the company? If external, why do they select external

8. What do you think are some of the main skills required to identify, develop, finance, implement and monitor energy / GHG emission reduction initiatives in the sector?
   Probe: This should be for some of the key job functions they list above. Probe for both technical and core skills.

9. What do you think are the main human resource and/or skills challenges the sector faces when identifying, developing, financing, implementing and monitoring energy / GHG emission reduction initiatives?
   Probe why these are challenges?

10. How do you think these human resource and/or skills challenges can be improved?
    Probe why? Probe who should be involved?

Do you have any other comments on this topic?

Thank you for your time!