IChemE ADVANCING CHEMICAL ENGINEERING WORLDWIDE

IChemE Priority Topic

Responsible Production

Food & Drink Special Interest Group Climate Change Action Plan

Introduction Overall problem statement	The Food and Drink Special Interest Group F&D SIG) agrees with the IChemE position on climate change. The SIG acknowledges that the food, drink and agriculture sectors are significant contributors to global greenhouse gas (GHG) emissions. Through its activities and in accordance with IChemE's Position on Climate Change, the SIG will promote initiatives that support the education sectors, research communities and other stakeholders in the goal of achieving the Paris agreement targets of limiting global temperature rise. The F&D SIG members will ensure that all output of the SIG has a core focus on the climate change impacts of any such output, with reference in the assessment to the appropriate UN SDG. The SIG commits to developing both internal (eg SIGs, members groups (MG) and Communities of Practice (CoP))and external partnerships, such as associated professional scientific and engineering institutions, thereby developing multi-disciplinary activities that will be required to address the structural implementation of major climate change policy initiatives. On a regular basis, the SIG intends to provide targeted webinars and seminars highlighting the latest technological innovations and societal insights to allow us to deliver safe, environmentally benign nutrition through the vehicle of responsible production methods. The SIG will strongly promote the application of full life cycle analyses (LCA) using tools such as life cycle assessment (environmental sustainability), life cycle costing (economic sustainability) and social life cycle assessment (social sustainability) for all food and drink production processes, ensuring that all members are educated on how to effectively interpret these tools. The F&D SIG members will review its current key values and principles within three months, to maintain focus upon the identified climate change actions commitments outlined within this position statement.
Specific problem statement	Food matters for every single individual on this planet, and always has. Unfortunately, over the past 50 years the food industry has (d)evolved into primarily a commodity driven, brand valued, cost driven profit model. That same model, based on the premise that one size fits all, no longer applies. The end of the 20th century and the global realisation that nature's resources are finite introduced two new dimensions other than growth and profitability to the food industry, namely, environmental and sustainability concerns. The Ellen MacArthur Foundation has priced these aspects as currently costing £2 for every £1 spent on food *(Ellen MacArthur Foundation, Jan 2019).*

	Given the macro forces at play, such as, global population growth, the shift from rural to urban life, rising lifestyle diseases, and food production's vulnerability to future climate change, the current food production model is simply not sustainable in its current form. A United Nations backed study, published in 2021, states that 34% of global GHG emissions can be attributed to food systems ie the production, processing, and packaging of food *(Crippa, 2021).* A 2019 report from the UK's Food & Drink Federation entitled a recipe for Growth, Prosperity and Sustainability (FDF, 2019), *A Plan for Success* has an opening paragraph that states *"food is a matter of national security and is part of the UK's Critical National Infrastructure*." It goes on to state that a government's first duty is to feed the country, or as summarised by Jay Rayner: "*If you can't feed a country you don't have a country*" *(Rayner, 2017) (Hefft & Higgins, 2021).*
What actions need to be taken to address the issue?	The IChemE F&D SIG are ideally placed to offer integrated plans and a route to the delivery of sustainable food for all. As part of this strategy, F&D SIG will engage with and encourage multi-disciplinary cooperation both within and outside of IChemE. Chemical engineers offer a unique whole of process systems approach to problem solving. F&D engineers and scientists can and do utilise multiple sector technical inputs, when offering solutions to meet the key United Nations Sustainable Development Goals (UN SDGs) seen in Figure 1.

Figure 1: UN SDGs with F&D playing a large part in arguably over half of these (*United Nations, 2021)*

The F&D SIG will build this whole of process systems approach to address the multiple challenges facedby the food industry. For example: Table 1

Table 1. Process Systems Approach suggested by the F&D SIG to address the multiple challenges faced by the FoodIndustry in relation to the UN SDG.

Area of Activity	Contributes Positively to SDG Number
Production waste reduction	2,3,6,12,13.
Land Stewardship	1,2,6,11,12,13,14,15
Environmental Protection, Water Quality, Effluent management, GHG issues	3,13,14,17

Nutrient Value Protection (appropriate preservation)	2,3,12
More sustainable protein process development	1,2,3,
Energy use optimisation in processing and transport	7,9,11,12,13,17
Packaging	2,3,9,12,13,14,15,17
Consumption wastage	3,4,13,15.

The F&D SIG will, through education and collaboration, avoid the risks of the single issue, point in time solutions, offered by many commentators. The practice of many such entities being a “stop doing this now” approach to the problems the food industry faces. The F&D SIG will promote a transitional and yet transformational approach to solving the many and varied problems faced by the food industry as we urgently transition to more sustainable models.

The F&D SIG will endeavour to work with other groups within IChemE to deliver solutions. We see a potential for collaboration to offer a total supply chain approach to climate change problem solving. For example, a full and robust life cycle analysis (LCA) of a food group could be subjected to multi group analysis by the other SIGs to highlight opportunities for positive process changes throughout the supply chain.

Food wastage is significant, and the F&D SIG can offer guidance as to best practices when reviewing the effectiveness of a production supply chain. For example, Central and Southern Asia reports a 20.7% foodwaste loss prior to the retail step, and food waste contributes 8-10% of GHG emissions. The global volume of food wastage is estimated at 1.6 billion tonnes of "primary product equivalents." Total food wastage for the edible part of this amounts to 1.3 billion tonnes. UN Food and Agriculture Organization’s (FAO) new report is the first study to focus on the environmental impacts of food wastage (*Tostivint, 2013).*

It has been identified that there is a definite need to transition protein production methods to more sustainable models. The F&D SIG will support the research and development of alternative non animal protein foods for the future. Robust LCA for plant and other alternative protein substitutes will allow for minimisation of the environmental and climate change impact during production.

Whilst acknowledging the significant impact of animal-based proteins on climate change, we will continue to support these industries in their efforts to reduce impact on climate change and transition their productionmodels to a more sustainable and circular regenerative footprint.

Figure 1.

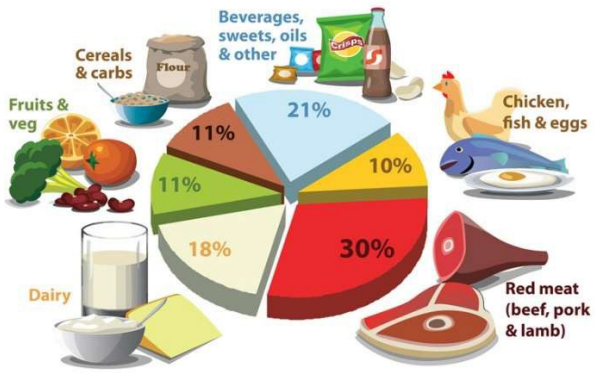

Figure 2.

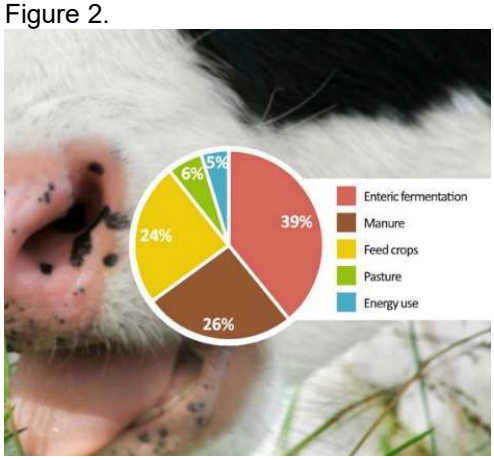

Figure 2: Greenhouse gas emissions from F&D sectors showing red meat and dairy production together account for nearly half of the greenhouse gas emissions associated with US food supply chain (Weber & Matthews,2008). Figure 1 is the GHG emissions from livestock are shown with a large proportion from enteric fermentation (a digestive process unique to ruminant animals eg cattle and goats that releases methane as a by-product) (*Engelhaupt, 2008*).

After canvassing the views of industrialists and academics, the approach to reducing emissions related to the food sector can be split into four main sections (Figure 3), similar to the approach described by Lillford and Hermansson *(Lillford & Hermansson, 2021).*

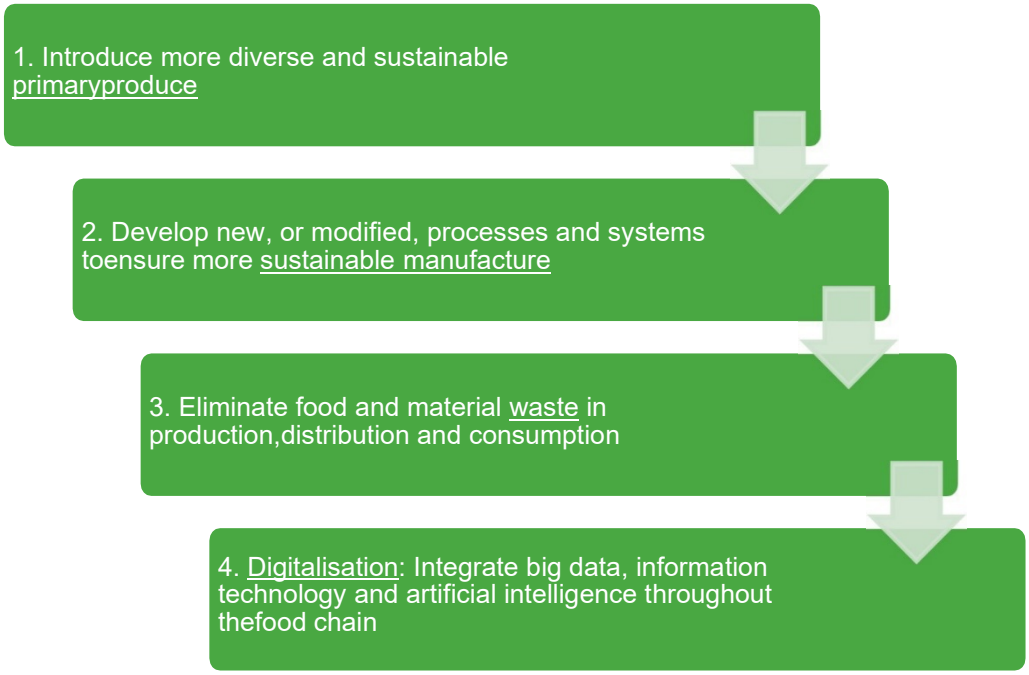

Figure 3: From Farm to Fork: The steps that should be considered to reduce emissions.

The details of the feedback on the work areas (Figure 3) are explicitly listed below:

Introduce more diverse and sustainable primary produce to:

- produce optimal functional properties during production of new raw materials;
- produce an understanding of biological materials and the need to minimise waste of input materials;
- develop basic on farm food preservation systems;

- understand and control the behaviour of raw materials and ingredients in the unit operations of conversion to foods, relating their materials science to the kinetics of conversion;
- improve the measurement sciences for a better control of the final product quality including structure, material properties, sensory perception and nutritional quality;
- develop new protein sources to reduce current reliance on farm and dairy protein, (agriculture is24% of global GHG emissions) (Weber & Matthews, 2008). eg plant based, micro-organisms, insects, cell cultures and then developing new production and process capabilities to produce these at scale;
- develop urban/town centre, renewal; vertical farming and sustainable robotic green housing; local jobs and access to fresh produce demonstrate and support the role of chemical and process engineers in scaling down processes to assist preservation at point of harvest;
- selected small scale preservation technologies that are cost and energy effective will go a long way to solving some of these issues. This will allow small companies and collectives to better prepare food for transport etc.

Develop new or modified processes and systems to ensure more sustainable manufacture to:

- explore the relative merits of centralised versus distributed manufacture for sustainability; for example, by scaling down existing processes for local applications without loss of operational efficiency;
- promote the harmonisation of metrics of sustainability measurement, of product and process, from primary production to end of life through aligned LCA;
- increase focus on climate change in HAZOP or similar studies;
- full and complete lifecycle analysis of equipment and total process;
- increase the use of energy reduction techniques in food processing such as pinch analysis;
- encourage more detailed monitoring of process plants in terms of energy / waste. What gets measured, gets done! Schemes to fit energy monitoring site-wide and process specific devices that make this easy to do, quick to install, etc;
- use alternative energy sources;
- provide clear, simple messages to members on the new and emerging techniques specifically from the engineering perspective.

Methods to achieve the goals listed above:

- further develop precision engineering to reduce and recycle water and heat across all the unit operations of conversion, cleaning, and preservation;
- develop conversion processes which cause minimal damage to reactive micronutrients;
- develop low temperature conversion via enzymic and fermentative processes;
- develop high pressure low temperature processes;
- develop new process concepts driven by functionalities of new raw materials;
- improve drying and rehydration processes to minimise product and ingredient weight indistribution, while maintaining function and performance;
- plasma and ionic technology for natural food preservation;
- increase the use of heat pump technology for industrial heating applications in the food processing sectors;
- develop high temperature heat pump technology for the food industry;
- convert older water removal evaporation and drying technologies to higher efficiency systems. For example, steam driven evaporation being converted to electrical mechanical vapour recompression units.

Eliminate food and material waste in production, distribution, and consumption to:

- improve storage stability of primary produce, to cope with inefficient transport and downstream use; by developing low energy drying, chill and frozen distribution using solar energy and other forms of sustainable power;

- develop rapid sensors of primary product condition and safety, eating quality and nutrient status of finished products;
- restructure the ingredients and food assembly industries to add value to all side streams;
- engage with packaging producers, allowing reduced levels of petrochemical materials in products,and development of novel forms (recyclable, biobased materials etc.). Currently there is some engagement, however, pre-competitive collaboration should be encouraged;
- use renewable energy to power the distribution in the supply chain;
- find alternative values in food waste, where practical.

Digitalisation

Integrate big data, information technology and artificial intelligencethroughout the food chain to:

- use multivariate data and machine learning to construct self-consistent models for material/process interactions in food manufacture;
- provide validated data and develop secure methods to link information flows between primary production, conversion, distribution, and consumption, thereby enhancing traceability, standardising safety, and reducing costs and waste;
- reduce the need for physical trials via simulating trials through modelling and simulation capabilities;
- provide resources to support smart technology deployment smart instruments predictive control and advanced control strategies for the food sector. Exemplars and case studies should be shared. (Perhaps the Knowledge Hub is an ideal repository for this content);
- promote easy to use pinch technologies, digital twins and new approaches being developed by universities, governments, and researchers.

It is evident from the above that there are many areas in F&D processing and therefore the recommendations are plenty. In many food industries there are legacy issues which stem from the development of the sector. There is still an artisanal approach to manufacturing in many sectors. ‘Cheese manufacturing is an art not a science’. There is a need to recognise that food products are extremely complex composite materials molecular entities. An integration of food engineering and science knowledge into all aspects of the production of food is necessary. Cross disciplinary cooperation is very important and is to be strongly encouraged.

Government support

We recommend:

- government backed pathways to cleaner technologies that include transitional fuels (eg LPG and natural gas) and transitional blue / green chemical engineering technologies, that would provide certainty for industry investment. The government support should continue until the economics are feasible;
- government investment support for transitional fuels should be considered but not if investment impedes the overall path to 2050 goals;
- to encourage schemes to deploy energy monitoring not just site wide but process specific.Supporting the development and promotion of devices that are quick to install making this monitoring easy to undertake;
- the individual governments need to do more to co-ordinate food manufacturers and their inputs.

Suggested policy changes

- tax incentives to existing industry to increase food research spend. A focus on more multi-disciplined, combined industrial & academic research initiatives/grants for further food productionrelated research is recommended;
- more support and investment are suggested as being required to overcome hurdles and speed uptransitions. Current global policies do not understand or fully reflect the complexities within the wider food industry;
- raising the profile of chemical and food engineering contributions to food. Emphasise to students,academic administrators, and funding bodies within government, that the climate change challenges will not be met without qualified and well trained engineers, in the specific issues of food production processing and distribution at both global and local scales.

Ways of working changes

Considerations:

- there is a strong feeling that IChemE could work with other professional engineering institutions, such as food science and technology institutes; food engineering institutes and the biological sciences sector, to deliver a more effective and informed platform for the F&D SIG. The F&D SIG will promote dialogue both with internal SIG groups and external like minded stakeholders.

Education: university and before

Feedback suggests we consider the following:

- whilst the focus of IChemE must be at the level of our membership, understanding the background of our members is important, they are a product of the overall education system as it currently exists. There is a view that a total system review is warranted if we are to be effective at the tertiary and tertiary plus level which is represented by our members;
- food and its production/consumption should be part of the education curriculum starting at primary, leading through secondary and finally to tertiary levels. Training can be embedded in subjects related to science/geography (primary education) to sustainability/design projects etc (tertiary education).

The suggested system changes are:

- at primary school level, understanding basic food nutrition, how food is produced and how one's natural biology adapts to protein, carbohydrates, and fats;
- at secondary school level, reintroduce food science as a required subject. Teach and explore the present unsustainability of the current food system. Highlight basic research, how it can be improved. The WhyNotChemEng initiative should support with resources;
- at tertiary level support food engineering and food science programmes at trade and technical levels. Degree and masters' programmes at university level.

Chemical engineering accreditation:

- consider as part of the accreditation process that universities appoint a sustainability champion(with CEng) in their chemical engineering program. This could, if considered appropriate, be viewed as mandatory. The champion will be tasked to ensure the related learning outcomes are covered in this aspect and provide relevant training to staff/students;

- F&D is a large industry and students need to be aware of the real life projects and challenges in the industry. As such, it is recommended to have a mandatory F&D project within the curriculum.

Training provision of:

- training & tools for how to calculate CO_2 impact and estimate other impacts to climate change in food production and processing;
- training on the understanding of the differences between the short and long lived GHGs. These differences are vital when understanding food production systems impacts;
- delivering through training a better understanding among engineers of hygiene and microbiological hazards within the food processing industry is recommended;
- provide "holistic whole of process education" for engineers where energy, water, food interconnectivity, is a key part of the training. Develop an understanding of hygiene and microbiological hazards within the food industry;
- global policies and technical advisories on energy conservation in processing may not be easily implemented in many food processes. Separating 'dirty' (ie raw materials) from 'clean' (ie the product) needs to be considered. A chemical engineer in the food industry needs to fully understand this.

Tertiary Offerings:

- incorporate more food engineering into tertiary education. As an example, 46 third-level institutions in the UK offer food science and technology courses. There are just three UK universities offering food engineering programmes. We support the development of more food engineering specific Chemical Engineering degrees both in the UK and internationally;
- food (process) engineering professionals have driven beneficial change in the food industry for more than two millennia. More recent developments in food science allow us to ''know why'' and''what'' is needed. The F&D SIG supports the development of the educational infrastructure as a method of nurturing the correct skillset required to implement "the how" - thereby achieving the required beneficial change (Hefft & Higgins, 2021);
- review the academic output internationally to see if the same discrepancy exists. Some tertiary institutions offer degrees in Food and Biochemical Engineering which in many aspects is predominantly Chemical Engineering.

Attracting the 'right sort' of people to the profession

Developing "thought leaders":

- we need to encourage an increased emphasis on attracting students into food science, food engineering and related areas (undergraduate, graduate and apprentices) if we are to develop "thought leaders."

Upskilling the food supply chain:

- there is a shortage of staff entering the private sector with appropriate qualifications to maintain even the existing requirements of businesses. The majority of food industries do not need staff with research experience, instead a broad base of sciences and business disciplines are required. IChemE can offer support in delivering tailored courses to the supply chain of non-chemical engineers;
- 50% of F&B companies (£100-500 million turnover) state that it is extremely difficult to recruit engineers. The other 50% say it is difficult to recruit engineers *(Hefft & Higgins, 2021).*

	Education Continuing Professional Development (CPD) Opportunities: ■ it is considered that there are significant opportunities for IChemE to deliver training and CPD opportunities in the food, nutrition, and beverage sector; ■ food and engineering science for non-engineers, food scientists and technologists,microbiologists etc; ■ energy cycles, heat and mass balances for the non-food engineer, etc; ■ food and its production and processing in the context of climate change; ■ engage chemical engineering student chapters to appoint student ambassador to disseminate importance/awareness of climate change issues; ■ the new generations of food process engineers must be provided with a wider and more rounded understanding of farming and the land-based food production sector as both communities are highly interdependent; ■ in addition to primary education and training in chemical engineering, IChemE could offer CPD courses introducing the complexity of handling biological soft materials were necessary; ■ provide an academic transitional gateway to food engineering for chemical engineers wishing to transfer from “sunset” sectors of our profession; ■ provision of simple toolkits to engineers as to how energy reduction techniques can be deployed on an industry by industry sector. **Education Senior Management and Chief Executive Officers** ■ an effective communication strategy with senior management can lead to initiatives being driven down from the top, enabling engineers and non-engineers alike at all levels within organisations to deliver informed and robust solutions; ■ there is a recommendation that we provide input at senior levels within organisations. To educate the management about the need for change within the industry to meet the various goals of the UN SDG and the more common Environmental Social Governance (ESG) goals of business; ■ if we are able to, educate senior executives in the benefits of chemical engineering science in enabling their goals to meet the various targets required by net zero 2050 and their leaders, we will effect positive change; ■ perhaps we need to develop a paper with cooperation from the wider SIG community similar to the one developed by the Safety Centre (SC) aimed at boards and directors targeting health andsafety outcomes. “What chemical engineers can do to help you meet your ESG and UN SDG goals.”
What skills, training gap orfacilitation requirements need to be addressed?	The matter of public and engineer education is lacking in breadth. We need to make widely available to all disciplines the simple energy water food metrics necessary to allow for balanced and effective production systems to be understood and developed. An excellent publication by David MacKay of Cambridge University, *Sustainable Energy without the Hot Air,* is a very high-level paper, but delivers a simple analysis of energy in food, as well as many other climate change energy analyses. It clarifies in a simple manner the interconnectivity of many aspects of food production. This book provides a useful introductory educational tool for both F&D profession, CPD, academia and other stakeholders. Collating the useful information from the cited report, alongside other inputs, summarises how skills and training gaps can be addressed, and the support required to reduce GHG emissions by educating at all schooling and business levels is presented below.

What actions should the SIG and its members take to support delivery of the above actions?

The actions for the Food & Drink Group, IChemE as a whole, and external partners or stakeholders have been split up into short, medium, and long term to provide a clearer action plan:

- short-term action achievable within the next year;
- medium-term action achievable within the next 1-5 years;
- long-term action achievable in the next 10 years plus.

Table 2. Actions required by F&D SIG to support delivery of above action plan.

Action	Short-term	Medium-term	Long-term
Utilise emails and appropriate social media, such as LinkedIn, to share the information such as outreach to include the posting of articles on climate change on our website page.	✓		
Add Climate change action as a regular agenda item for discussion at F&D SIG committee meetings.	✓		
F&D Committee can form a small group responsible for stewardship of our goals and activities dedicated to climate change actions and activities.	✓		
Appoint a committee member to assist on 'WhynotChemEng' publications.	✓		
Potentially beneficial cross sector technology transfers should be sought out and advised through IChemE channels to the wider food industry community. Note: will need to constantly be updated as technology advances.	✓		✓
Develop training materials for climate change. As a community we can assemble a training document that will enable our members to be educated on climate change matters. Note: can be completed in the short-term but should be maintained and updated throughout the long-term as more information/facts on climate *change is released.*	✓		✓
Other SIGs to be considered for collaboration: Water SIG, Sustainability SIG, Clean Energy SIG, Biochemical engineering SIG, Palm oil processing SIG, Environment SIG, and Energy CoP (IChemE to provide us with their contacts). By sharing outlines and draft documents together, outlining our vision and goals we could request input and contribution to such goals. *Note: should maintain collaborations in future as goals are updated.*	✓		✓

		Develop the webinar programme to include a topic and/or a physical event in the future specifically focussing on climate change issues. For such events we will invite and encourage collaboration with other SIGs and other professional bodies.		✓		
		Provide advice to IChemE on food matters with the intention of sharing this information with the government and other organisations, as required.		✓		
		Encouraging others to challenge unsustainable behaviours, setting an example both individually and through group activities). Enable a non-confrontational approach to challenging of decisions which impact upon climate change. Ensure members have the required scientific and economic facts to support this challenge. For example, there are very often capital cost challenges in capital projects (often driven primarily to ensure lowest cost solution delivery). There should also be climate change challenges embedded in the capital projects gating processes. Long term, especially with the advent of Environment Societal Governance (ESG) metrics for Boards, this should lead to a positive cultural change.		✓		
		Promote available training courses and encourage participation. Training can be a very important part to achieving the cultural shift mentioned above. There are two aspects needing consideration, the first being how to raise challenges generally and the second being more climate change specific. (There is an excellent short course offered by The Carbon Literacy Project which addresses both the scientific and ESG issues). There may be other courses on climate communication which could be appropriate, and these should be sought out for promotion and dissemination within the education and CPD Sectors.		✓		
		We acknowledge that consumers need continuous information and education about healthy sustainable diets and how to reduce wastage. The need for engineering sciences in the processing and production of raw materials, ingredients, finished products; and their safe preservation and use needs to be communicated to society in general. IChemE F&D SIG should support such initiatives in providing such information.		✓		

	Engagement with other groups such as SIGs, regional members groups, and/or external PEI stakeholders (who and how to be determined); is now under way with other professional organisations involved with food, but could also be expanded to include primary and secondary school teaching in order to encourage interest in the industry, better understanding of food from farm to fork and one's own individual biology and food consumption. Note: engagement can be achieved within the next 5 years but may require longer to ensure these teachings are incorporated into the curriculum.		✓	

What actions will you encourage others to take?

Table 3. Actions required by IChemE and External Stakeholders to support delivery of above action plan.

Action	Short-term	Medium-term	Long-term
Be prepared to provide advice to governments and other organisations on food matter.		✓	
Develop a food specific set of guidelines that is at a more granular level that the current overarching IChemE policy statement.	✓		
Improve external communication and outreach and the awareness and interest in food engineering should be introduced in schools.		✓	
The challenges of food science and technology need to be articulated both from the science and engineering community and also from business in order to attract good students that can foresee a challenging and rewarding career. IChemE to highlight this in 'WhynotChemEng' type publications.		✓	
More recognition within IChemE that chemical engineering in the food sector can make a significant positive contribution to many of the UN SDGs, especially SDG 1 and 12 (Figure 1).	✓		
Recognition that the production of food and nutritional products needs will and needs to impact every area of IChemE policy advice. Energy, water, waste, oil and gas, and chemicals are an important part of the food pyramid. Reference the Food Water Energy Nexus previously promoted. We need to build on this.		✓	
IChemE can provide more training and knowledge on this topic. Provide access to articles on climate change and constantly		✓	

	inform on new developments related to this area.			
	More feature articles on food and climate change in *The Chemical Engineer* magazine perhaps even on a regular basis.	✓		
	Encourage research into new technologies and processes in the food production processing area and advertise any new discoveries within that sector.	✓		
	Industries to be encouraged to share more widely their efforts and goals in regard to climate change.		✓	
	Collaborative R&D between universities and industry / research institutions in the food and agriculture sector needs to be significantly increased to levels way above those currently being invested. (NB Israel invests 5% of its GDP in R&D): ■ Suggest a gap analysis is required to identify shortcomings in the funding for the areas in section 1 (Figure 3).			✓

Next steps	The next actions for the Food & Drink Group, IChemE as a whole and external partners or stakeholders havebeen split up into short, medium, and long term to provide a clearer action plan and you can find these in Table 2 above.

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Frequently Used Acronyms

GHG	Greenhouse Gas
SIG	Special Interest Group
MG	Members Groups
CoP	Community of Practice
LCA	Life Cycle Analysis (or Assessment)
SDG	Sustainable Development Goals
FAO	Food and Agriculture Organisation (UN body)

	CESIG Clean Energy Special Interest Group BESIG Biochemical Engineering Special Interest Group POPSIG Palm Oil Producers Special Interest Group HAZOP Hazard and Operability Study LPG Liquified Petroleum Gas PEI Professional Engineering Institution ESG Environmental Social Governance. SC Safety Centre **Contributions collated by David Platts, Laura Malhi, Emma McNulty.** For the initial consultation phase the authors invited parties to contribute, responses were received from Peter Lillford*, Seamus Higgins*, Jacus Kruger, Emma McLeod, Rafaella Sammouti, Hii Ching Lik, Janis Swan, Charlie Wedd **Significant contributions which shaped the report.* **Steps taken to write, and peer review this paper** ■ in April 2021 the Learned Society within IChemE highlighted that they wanted to generate climate change papers from all the subject interest groups, or industrial sectors,along with this call came a suggested template to help with generating input from members; ■ during the following months David Platts and Laura Malhi approached the Food & Drink(F&D) SIG committee for input based on the main headings in this paper and a few additional Fellows of IChemE (those who input have been named above); ■ the feedback was collated into the following document, and the context fleshed out alittle more; **Once the document was assembled it was peer reviewed by:** ■ two academics in the F&D industry working outside of chemical engineering; ■ F&D SIG members (three members responded with detailed feedback); ■ following incorporation of member feedback, the final document was then sent to theLSC for acceptance. Note: Any opinions are those of the authors and do not necessarily represent those of IChemE.