



## PROJECT SUMMARY

### **'Practices of meat consumption and cold storage in Australian households: Consumer fridge behaviour and waste reduction of red meat'**

#### KEY POINTS

In order to understand how and why consumers are using their fridges and freezers to store meat and how this impacts how much meat they waste, this project has

- produced updated baseline temperature data of household refrigerators for use by industry.
- provided an evidence base on consumer practices involving meat consumption, storage, and waste in connection with meat waste and refrigerator use in homes.

#### THE CHALLENGE

This project has addressed a research gap in knowledge on Australian consumers' fridge use and shopping, storage, and disposal of red meat and how food wastage could potentially be reduced. To address the multi-faceted nature of this wicked problem, we have used a mixed methods approach by monitoring household refrigerators to measure the internal temperature of refrigerators in Australian households and conducted interviews and ethnography to understand meat waste related practices such as shopping, cooking and storing practices.

#### THE OPPORTUNITY

The opportunity provided by this project includes benefits to various stakeholders, primarily retailers and appliance and meat producers to intervene in and introduce practices that shape consumer practices and reduce meat waste.

- Retailers and fridge manufacturers will benefit from the evidence base of consumer practices, regarding specials, bulk buying and meat storage.
- Industry practices may be shaped through the creation of greater certainty about shelf life, thereby decreasing the marking down discard of products in store.
- Consumers may have greater surety that the product they are consuming is still fresh and regularly affordable, reducing wastage and contributing to health and wellbeing.

#### OUR RESEARCH

The research involved real-time temperature (and other parameter) monitoring of refrigerators in Australian households, combined with semi-structured interviews and fridge rummages with householders to understand how they buy, store, consume, and dispose of meat. This approach enabled the temperature data to be contextualised and interpreted in a household context. The chosen methods were selected to be as efficient and non-intrusive as possible with the minimum sample sizes targeted to create meaningful and robust data.

The interviews took place over two seasonal periods—autumn/winter 2022 and spring/summer 2022/23—to understand any differences in red meat consumption, use and wastage across different times of the year. This approach captured various practices and activities related to meat in Australian households.

Adult members of households with children were recruited for the qualitative part of the research. This household type is the most common household structure in Australia according to ABS 2021 census data, and previous research has shown that households with children may contribute more to food waste.

The refrigerator monitoring also took place during two seasons—winter 2022 and summer 2022-2023. The performance monitoring involved placing data loggers in discrete places in household fridges for at least one



week. A variety of households, from single person households to families with children, were recruited.

The main target audiences for this report are the Fight Food Waste CRC (FFWCRC), Meat and Livestock Australia (MLA,) refrigerator manufacturers, large supermarket retailers, packaging companies, online meal and grocery companies and policy makers. The use of mixed quantitative and qualitative methods ensures that stakeholders can benefit from contextualised technical and social science results. The mixed qualitative and quantitative methods included:

- semi-structured interviews with 20 households in winter and 16 households in summer to capture how meat and other food items were stored, consumed, and became waste. The interviews were accompanied by a rapid ethnography, or fridge rummage, which provided an opportunity for exploring how householders' fridges were organized. In this pilot project we were not seeking saturation as it was designed to be exploratory than exhaustive.
- real-time monitoring of 36 refrigerators over winter and 17 refrigerators over summer using data loggers. This method also required participants to complete a written form about their main fridge. The data were analysed to identify correlations between parameters and behaviours that can affect food waste.
- photographs of the fridges, either through online screenshots during interview, or taken and sent by participants.

## OUTCOMES

The research led to many interesting findings that revealed the complex and nuanced relationships our participants practices have with food and refrigerators.

1. Householders find saving food and meat from waste challenging but experiment with novel and established ways to save food, especially regarding saving meat from going into landfill.
2. Freezers are used to save meat from expiring on the date provided on the packaging. This practice is sometimes used deliberately to buy meat close to the expiry date, thus saving money through specials.
3. Quality of meat is regarded by some householders as reduced by freezing, and may lead to binning, or freezing meat is avoided completely.
4. Managing leftovers from cooked meals and deli meat (cold cuts) is most challenging for householders.
5. Householders evoked cultural patterns and values in talking about food waste. Cultural practices and previous life experiences play an important role in how food and red meat gets wasted, or food waste is avoided.
6. Many householders were unaware of temperature variations in their fridges and tended not to blame the fridge temperature when meat or food was discarded.
7. However, many participants noted the design of the fridge, such as deep, narrow shelves, prevented them from having a clear vision of their fridge, leading to forgetting some stored food items.
8. The increase in prices of all essential commodities at the time of data generation had made many householders thrifty and more conscious about food waste. However, as this a short-term study, no strong conclusions can be drawn from this.
9. Householders acquired knowledge about how long to store food in the fridge and how to save food from waste in various ways, including on the packaging, from the internet and by lived experience.
10. Many householders were constrained from buying a new or larger fridge by the available space in the kitchen, or in the house, which they believed they required so that:
  - they could store more food
  - have a 'fancy' fridge (for example, with a TV or smart fridge, or with a French door), and
  - reduce trips to shops.
11. Date labels were used in many ways during shopping: as an indication of freshness, to ascertain how long an item could be stored for, and if near expiry (and on special) buying it to save



money. Some experimented and used their senses to bypass date labels.

12. Packaging was used in many ways: some participants acknowledged its capacity to keep food fresh, some discarded it immediately after getting home for better stacking and storage results, and some used it for obtaining information about the product.
13. For quite a few fridges and freezers, temperatures were different to the setpoints, and mean temperatures were outside of the optimal range.
14. Many households had multiple refrigerator units, each having a different purpose
15. The mean age of refrigerator units examined was approaching 10 years. This illustrates that improvements that rely on households acquiring new refrigerator units (with special technology) would be insufficient because they are limited by the long delay of householders replacing current units.
16. The refrigerators with damaged door seals were older than the average refrigerator indicates a need for multi-faceted appliance maintenance procedures and knowledge.

## IMPACT

This project has contributed to the following key impact areas:

- **Food waste reduced:** This project has contributed knowledge in achieving the overall Food Waste CRC 2030 industry goal of reducing consumer waste of red meat by 50%. If half of the food wasted by households requires refrigeration (1.25 MT) there is a potential to reduce waste by a minimum of 10% (125,000T) (Arcadis 2019). For the meat sector (Meat, Poultry, Smallgoods) the waste is reported to be 471 tonnes, there is a potential to reduce by 50% (230 tonnes) resulting in 2,474 tonnes CO<sub>2</sub>-eq saving (Arcadis 2019). Note that waste reduction will be dependent on the adoption of the data from this project by retailers, and regulators.
- **Industry profitability:** Any potential reductions of meat waste that will be achieved will lead to greater profitability for retailers and brand

owners due to more certainty on shelf life and most likely longer time on the shelf. This means that there will be fewer markdowns on shelf and reduced amount of product discarded in store. It has been estimated to return \$16.3 million for industry in the domestic market (Kaur et al. 2018).

- **Greenhouse gas emission savings:** For the meat sector (meat, poultry, smallgoods) the waste is reported to be 471 tonnes (Arcadis 2019). There is a potential to reduce waste by 50% (230 tonnes) resulting in 2,474 tonnes CO<sub>2</sub>-eq saving (Arcadis 2019). This saving is probably an underestimate because it excludes retail, transport, household refrigeration, and waste disposal; and the additional processing for the smallgoods.
- **Improved retail and production practices for consumers:** Consumers will also have greater surety that the product they are consuming is still fresh, reducing wastage, possibly reducing excess fridge and freezer usage and contributing to health and wellbeing.

## NEXT STEPS

Waste minimisation is complex, and studies and strategies so far have focussed largely on developing new technologies and businesses rather than attempting to change producer and consumer practices. Furthermore, binaries of separating production from consumption miss the central role and entanglements of daily lives with livestock farming, agriculture, industrial production, waste services and materials, and the implications of change in these sectors. This is a complex issue and further research is required to deeply examine the critical aspects of meat waste and fridge use highlighted by this research.

Our study has highlighted how practices (household, industry, and policy) can change only when the social, material, technological, and cultural configurations align. For example, the dependence on and use of freezers for saving money and preventing meat from going waste leads to subsequent issues, such as buying multiple fridge/freezers, reduced quality of meat, and doubling up of packaging. Thus, societal change, such as minimising meat waste would benefit from a larger scale and multi-sited intervention rather



than mere householder behaviour changes and reflexive actions based on choice and information. Furthermore, future research could investigate how diversity in families and schedules may align with different fridge designs to make better recommendations. More research is required into retailer practices, especially of specials and bulk discounts to evaluate how it may shape meat and other food waste

Recommendations include:

- There needs to be capability provided to householders, in the form of material support and knowledge and competencies to monitor the condition and life of perishable food, adjust the setpoint accordingly and check seals etc.
- Food Standards Australia New Zealand (FSANZ), manufacturers, and retailers should better communicate the optimal fridge and freezer temperatures and different models for optimum food shelf life; and manufacturers could (re)consider more-robust, more-precise temperature control functions and new alert functions.

### Peer review statement

All reports and publications from this project were peer-reviewed, including this final report. We appreciate the time and expertise of the reviewers in improving and building the outputs into high-quality publications.

### Funding partners

We would like to acknowledge our partners Meat and Livestock Australia and the Fight Food Waste Cooperative Research Centre, who commissioned the research summarised in this paper. We would also like to thank Tive inc and CRNRstone and various individuals who participated in the research by sharing their time, knowledge, and expertise. The work has been supported by the Fight Food Waste Cooperative Research Centre whose activities are funded by the Australian Government's Cooperative Research Centre Program. The final report's FFW CRC publication number is FFW CRC Publication 2023\_40.

### PROJECT TEAM

Bhavna Middha (Project Leader) (RMIT University)

Bhavna is an environmental sociologist and a social practice theorist. Her main research area is sustainable consumption, which she has investigated through topics such as food, energy and waste.

Focusing on spatialities and just transitions, Bhavna's work has explored and advanced the practice perspective in sustainable consumption. A strong focus of her work has been on qualitative research methods, where digital ethnography has been an important aspect of the empirical work undertaken. Bhavna is currently the Research Fellow in the ARC industrial training and research hub for Transformation of Reclaimed Waste Resources to Engineered Materials and Solutions for a Circular Economy (TREMS). As part of the hub, she is researching the social and policy dimensions of waste minimisation and management. Bhavna's doctoral research examined the eating spaces of an inner urban university and how relationships between eating practices of students and these spaces is negotiated for sustainable outcomes.

Peter Stasinopoulos (RMIT University)

Dr Peter Stasinopoulos is a Senior Lecturer in the School of Engineering, RMIT University. His expertise is in systems modelling and optimisation. He applies the approaches and modelling tools of systems dynamics, life cycle assessment, and whole-system design to products and processes in the transport, manufacturing, and energy sectors such that selected sustainability impacts (especially resource productivity and emissions) are optimised.

Simon Lockrey (RMIT University and Fight Food Waste CRC)

Associate Professor Simon Lockrey from RMIT School of Design is the Reduce Program Leader in the AU\$121 million Fight Food Waste CRC and sits on the board of the International Sustainable Development Research Society. His research domains are design innovation, resource efficiency, food waste reduction, sustainability strategy, and the circular economy. As a result, he has generated millions of dollars of 'industry facing' research, creating global impact through policy change, commercial outcomes, media coverage, and garnering thousands of citations.

Cecily Maller (RMIT University)



Associate Professor Cecily Maller co-leads the People and Environment Program in the Centre for Urban Research, RMIT University. She has over 70 peer-reviewed publications and from 2018-2023 was Lead Editor for the journal, *People and Nature*. Cecily has conducted interdisciplinary social science research with a range of government and industry partners for more than twenty years, including the Department of Agriculture, Fisheries and Forestry, VicHealth, Parks Victoria, Melbourne Water, and the Planning Institute of Australia.

Nooshin Torabi (RMIT University)

Dr Nooshin Torabi is an interdisciplinary social scientist and lecturer in the Sustainability and Urban Planning discipline, at RMIT University. She has been involved in various sustainability-focused research projects with multi stakeholders' engagement. Her research and teaching focus is on environmental policy and governance, sustainable consumption, energy justice, and transformative climate change responses.

Seyed Mojib Zahraee (RMIT University)

Dr Seyed Mojib Zahraee is a research assistant at RMIT School of Engineering. His research domains are sustainable biomass supply chain, supply chain management, sustainable renewable energy value chain, transportation and logistics, sustainability, optimizing operations, and lean manufacturing. Seyed has published over 60 research papers in multidisciplinary fields with more than 2000 citations. Additionally, he has reviewed more than 250 papers for reputational journals and conferences.

Nirajan Shiwakoti (RMIT University)

Associate Professor Nirajan Shiwakoti, based at RMIT School of Engineering, is a leading expert in Sustainable Transport, particularly in transport users' behaviour (human factors). He is ranked among the world's top 2% of scientists in Logistics and Transportation. With extensive funding, awards, and fellowships from global institutions, his research influences policy and advances sustainable mobility worldwide.

Cherese Sonkkila (RMIT University)

Cherese Sonkkila is from the RMIT College of Design and Social Context. Her research domains span socio-ecology, food waste, environmental psychology, and the circular economy.

## PROJECT WEBPAGE

[Consumer Fridge Behaviour and Waste Reduction of Red Meat](#)



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REDUCE - TRANSFORM - ENGAGE



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Science and Resources

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