

## REFRESH Interim Results

### The REFRESH Project: Resource Efficient Food and dRink for the Entire Supply cHain

REFRESH is an EU research project taking action against food waste. 26 partners from 12 European countries and China work towards reducing food waste at the retail and consumer level and reducing food losses along production and supply chains. Specifically, the project aims to:

- Develop strategic agreements to reduce food waste with governments, business and local stakeholders in five pilot countries: Spain, Germany, Hungary, the Netherlands and China. Within pilots, the participating stakeholders will test new approaches to reduce food waste.
- Build a pan-european evidence base exploring and explaining the factors influencing current 'sub-optimal' consumer and business behaviour and practice, in order to support effective and targeted interventions.
- Formulate EU policy recommendations and support national implementation of food waste policy frameworks.
- Provide better estimations of the environmental impacts of food waste reduction.
- Design and develop technological innovations to improve valorisation of food waste, e.g. from food processing.

The REFRESH team can build on the results and experience of the FUSIONS project ("Food Use for Social Innovation by Optimising Waste Prevention Strategies"). REFRESH runs from 2015 to June 2019. Since its beginning, REFRESH has established 4 voluntary Frameworks for Action in pilot countries, put on a multi-stakeholder conference and a number of policy workshops, published 32 project result publications, and organised a Food Waste Solution Contest.

This document provides information on selected results of REFRESH and the work undertaken in the project until March 2018.

**A full list of the results from the project is available on the REFRESH website: [eu-refresh.org/results](http://eu-refresh.org/results)**

#### Brochure

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**E-Mail:** [info@eu-refresh.org](mailto:info@eu-refresh.org)

**Website:** [www.eu-refresh.org](http://www.eu-refresh.org)

**Twitter:** [@EUrefresh](https://twitter.com/EUrefresh)

All project results can be found on the REFRESH website:  
<http://eu-refresh.org/results>

#### Project Coordinator:

**Toine Timmermans**  
Wageningen University and Research  
[toine.timmermans@wur.nl](mailto:toine.timmermans@wur.nl)

#### Communication Partner:

**Stephanie Wunder**  
Ecologic Institute  
[stephanie.wunder@ecologic.eu](mailto:stephanie.wunder@ecologic.eu)

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## Interim Project Results

### Understanding Consumer Behaviour and Household Relationships with Food and Food Waste

Key new insights are that various household practices determine the amount of household food waste: households that buy less on impulse, have a good overview of the food that is in stock, cook precisely, and use leftovers, report less food waste. Moreover, consumers' motivation, their abilities (skills and knowledge) and the opportunities provided to them influence household food waste.

In particular, compared to households with more food waste, consumers in households with less food waste:

- believe that others waste little, and have more negative thoughts and feelings about food waste
- find having enough and tasty food in the household less important
- are more skilled in accurately planning how much food their household needs, cooking creatively with (leftover) foods, and knowing how to prolong the shelf life of products
- encounter fewer unexpected events that mix up their planning
- feel that they have access to good quality products, sold in right quantities

Surprisingly, the extent to which consumers are aware of the consequences of food waste does not seem to influence the amount of household food waste. Based on these insights, attempts to influence household food waste that focus solely on increasing consumer awareness would not have the intended effect. Rather, promising strategies to reduce consumer food waste should aim to change the social norm (i.e., convince people that it is normal to not waste), to strengthen consumers' skills and knowledge, as well as to improve the accessibility to good supply and to help consumers reduce the chance and impact of unforeseen events on their household food management.

These results are based on a large scale survey in Germany, Hungary, Spain and the Netherlands. In this survey, we examined the extent to which the potential factors that we uncovered in prior REFRESH studies actually determine household food waste. Details about the survey and its results can be found in the [report about quantified consumer insights on food waste](#).

The survey builds upon results from the first part of the project, where an overview was developed of all factors that may influence household food waste. This was based on prior research as well as focus group interviews throughout four European countries (see [report on national, qualitative insights on household and catering food waste](#)). In addition to this, [various methods to measure household food waste were compared](#) to develop the [REFRESH best practice assessment of household food waste](#).

In a different survey, also across the four European countries, various formats of on-pack guidance information have been examined. Different formulations and formats of date labelling, freezing advice, as well as storage advice were compared. Results show high potential for storage advice on oranges, and freezing guidance for chicken, and will be published mid-2018 on the REFRESH website.

**Upcoming results:** we will examine how consumers evaluate apps aimed at food waste reduction, and how consumers respond to waste valorisation options. Moreover, we will translate the findings into policy recommendations.

## National Pilot Working Platforms in Hungary, Germany, the Netherlands, Spain, and China

A main ambition of the REFRESH project is to develop an adaptable 'Framework for Action' (FA) model that promotes collaboration along the whole food and drink value chain to address food waste at a national level.

The four "Pilot Working Platforms" or 'steering groups', established through REFRESH in Hungary, Germany, the Netherlands and Spain in have continued to meet regularly. All have furthered their engagement by implementing specific actions to support the Frameworks for Action. A number of agreed pilot projects are now underway in each country, covering topics such as Measurement, Employee Engagement, Redistribution, Event Catering, Packaging and Surplus Food products. However members are also using the support of REFRESH to identify new and innovative ways to address food waste within their own operations.

A process evaluation has taken place reviewing FA initiation and development in each country, which has provided a number of valuable insights into the establishment and management of the FA. The findings will inform the development of a Blueprint, which will be a guide to support other countries opting to take a voluntary agreement approach to tackling food waste. The Blueprint will provide step by step advice to interested countries, drawing on previous research and backed by the experiences of the four REFRESH pilots.

Replication of the FA approach is accelerating in China, where key players have been identified; China Chain store and Franchise Association (CCFA), China Household Electric Appliance Research Institute (CHEARI) and IVL Swedish Environmental Research Institute China have all shared their intention to sign a Framework Agreement based on EU model prior to an official launch event in June 2018.

REFRESH launched an online knowledge sharing site in October 2017 in collaboration with the EU Platform on Food Losses and Food Waste (FLW). The '**Community of Experts**' (CoE) provides an interactive space where users can share and learn from their own experiences, with relevant tools and resources to support them; [www.refreshcoe.eu](http://www.refreshcoe.eu). As of April 2018, the CoE hosted **137** resources and saw **422** average monthly site visits.

**Upcoming results:** The next steps in the project are the evaluation of pilot projects and the FA approach, and the development and testing of the Blueprint to replicate this in other Members States. Further developments are also planned for the CoE, such as an interactive "Ask the Experts" forum, which will enhance the user experience and expand the reach of the site. For more information about the Frameworks and supporting pilot projects, see [eu-refresh.org/national-platforms](http://eu-refresh.org/national-platforms)

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## Food Waste Policy - Recommendations

REFRESH will provide evidence-based policy recommendations to improve the policy framework for preventing, reducing, reusing and valorising food loss and waste.

Food waste innovators and experts were brought together to discuss success factors and barriers for food waste reduction initiatives in a first workshop organised in May 2017 in Berlin.. The role of policy frameworks at regional, national, EU was explored in discussions of success factors and barriers for food waste reduction for retailers, entrepreneurs, and social innovators.

Drawing on the conclusions of this first workshop, REFRESH provided a screening of the most relevant policy topics to address to reduce food waste (waste and resource policy, food safety and hygiene, bioenergy, agriculture and fisheries, date labelling, etc.). REFRESH identified key policy areas to investigate further and develop policy recommendations by reviewing EU policy tools and legislations, explaining their relevance and evaluating their effect on food waste generation.

During a second workshop, held in Brussels in November 2017, stakeholders discussed what aspects of these key policy areas were the most relevant to reduce food waste. Participants developed suggestions for short and long-term policy strategies during interactive working sessions. The results of the workshop were integrated into the final version of the report.

A comparative analysis of two case studies, Unfair Trading Practices and Voluntary Agreements across EU countries, then illustrated how interacting policies can enhance the sustainability of food systems.

Through this research, input from the workshops, along with the findings from the policy overview and the comparative analysis, four policy areas were identified as focus areas for the remainder of the REFRESH project. These policy areas are Unfair Trading Practices, Voluntary Agreements, Animal Feed and Consumer Behaviour.

**Upcoming results:** Through policy briefs on each of the identified areas, REFRESH will define best practices and give insight on their application in EU countries. Throughout 2018-2019, a series of four events specific to these policy areas will be organised to bring stakeholders together to discuss policy options to reduce food waste. The first one, held in June 2018, will present Voluntary Agreements as a policy instrument for more sustainable food systems on the Member State level.

The following working groups will focus on technical and policy measures to use food surplus as animal feed, and on consumer behaviour-based recommendations to design more effective policy interventions, respectively. A final event will present the conclusions derived from all policy workshops as well as synthesize policy implications from the research conducted within REFRESH. These findings will help to define action plans by providing recommendations for specific policy changes and identifying the actors who can influence policy development.

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### Behavioural Economic Approaches

Using behavioural economics approaches, REFRESH aims at providing new information on consumer and business behaviours. Studying the behavioural dynamics of consumers and businesses can help design better policy and market interventions to prevent and reduce food waste.

The work conducted in the first three years of the project led to the identification and analysis of the socio-economic conditions and driving factors that influence businesses' and consumers' choices in the creation and/or reduction of food waste. These are based on a [model framework for applying behavioural economic approaches](#) to the study of food waste using Agent-Based Models (ABM) and Bayesian Networks (BN).

The report [Consumers behavioural economic interrelationships](#) and typologies found that the size of the household, the age of its head individual and their level of education are identified as significant determinants of the amount of food waste. There is, however, high variation across countries.

REFRESH has identified a set of behavioural typologies and interrelationships that influence firms' adoption of innovations in the report [Socio-economic implications of food waste: Business behavioural typologies and interrelationships](#), while economic factors were identified in the report [Socio-economic implications of food waste: Economics of innovation](#). The ultimate reason for innovating is related to economic factors such as improving firm performance, productivity and international competitiveness. Therefore, costs and risks are key drivers of technological and organisational innovation. However, the behavior of every single business is influenced by its idiosyncratic characteristics, its structural and managerial features, and the environment where they operate, so that sharing information and inter-firm coordination may generate uncertain outcomes.

The paper [The use of systems models to identify food waste drivers](#) found that consumer food waste is influenced by country, age, student status, and belief that the family wastes too much, and suggests how policy interventions can be designed to target these drivers.

**Upcoming results:** By means of an integrated ABM-BN model, REFRESH will analyse business behaviours and their modifications over time, and test the findings within the four REFRESH pilot countries to identify conditions and impacts of food waste-related innovation. REFRESH will test policy interventions in models to develop food waste reduction scenarios and a roadmap.

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### Environmental and Life Cycle Costing Dimensions of Food Waste

REFRESH will provide recommendations for evaluating the environmental impact (Life Cycle Accounting, LCA), as well as life cycle costs (LCC), of prevention, valorisation and waste management options for food waste.

The report *Generic Strategy LCA and LCC* provides guidance to practitioners and policymakers on how to apply Life Cycle Assessment (LCA) and Life Cycle Costs (LCC) for studies that specifically explore questions on handling side flows from the food supply chain.

**Upcoming results** The LCA and LCC methodological recommendations developed early in REFRESH are now applied in practice in four case studies aiming to provide answers to the following questions:

- What would be the environmental and cost impacts in a life cycle perspective of preventing losses and waste in peach & nectarine supply chains?
- What would be the environmental and economic costs and benefits of replacing conventional pig feed with heat-treated catering waste, compared to the current use of this waste stream? Provided rigorous safety standards can be established, is there a strong business case for a new feed processing industry and pig farming approach that uses food waste?
- With regards to the generation of greenhouse gases, what are the synergies and trade-offs of different interventions/market changes relating to waste prevention and valorization options in European tomato production and German meat production?

Previously REFRESH has evaluated the key unavoidable EU food production residues with the *potential* for significant environmental impacts. Now an excel tool is being developed for helping stakeholders (policy makers, researchers, professionals, business, etc.) to gain a general understanding of the dynamics of environmental impacts and life cycle costs for different valorization routes for a selection of these side-flows.

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## Valorisation of Waste Streams and Co-products

The REFRESH project aims to increase the exploitation of unavoidable food chain waste. To do this, it aims to provide support to business stakeholders to identify waste streams that are appropriate to valorize.

REFRESH has evaluated key unavoidable EU food production by-products with the most potential for significant environmental impacts. In the report, *Medium List of Waste Streams Appropriate for Valorisation*, over 290 food production residues were identified, scored and reviewed to produce a list of priority waste streams for further study. Over 20 different existing valorisation approaches have now been turned into indicative models with inventories of process energy inputs, outputs and product yields. These feed into the development of an LCA tool "Forklift", to be published in mid-2018.

REFRESH is developing technical guidance on the potential for processing catering waste to allow it to be used as a safe and commercially acceptable pig feed once again.

REFRESH partner Bactevo have identified, genetically characterised and grown specific strains of bacteria that can successfully utilize unavoidable food waste and could be used as chassis organisms to selectively generate specific fine chemicals. This is a key step forward in demonstrating the potential for harvesting bacteria for production of fine chemicals from unavoidable food wastes.

REFRESH has also conducted laboratory research confirming the technical potential of recovering a food grade vegetable fibre by-product for use in further food products and also selecting strains of bacteria that have potential for generating fine chemicals from food waste.

The project is also developing a *Food Waste Compositional Database* that brings together compositional information on the macro-nutrients, micronutrients and bioactive components present in the top food co-product streams in a searchable format. It is being demonstrated at the REFRESH Food Waste Conference 2017.

### Upcoming results:

Inventories from the 20 top valorisation approaches are being used to develop an excel tool – "ForkLift". ForkLift indicates how the overall net cost and greenhouse gas impact differs with various valorisation approaches and scenarios. It is designed to be interactive, introduce users to whole lifecycle thinking and indicate the significant factors that impact the environmental and cost performance of valorisation options.

Future research effort will identify higher value valorisation options for selected cases, and where applicable, assess their scaling potential. This will feed into further analysis on the potential benefits and barriers to existing and new valorisation approaches. Conclusions will feed into REFRESH work formulating overall policy framework recommendations regarding valorisation.

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## REFRESH events: engaging stakeholders across policy, practice and research

The REFRESH Food Waste 2017 Multi-stakeholder Conference connecting champions of food waste reduction and valorization was held in May 2017 in Berlin. REFRESH partners presented the latest results and ongoing work of the REFRESH Project. The conference engaged participants in creative and innovative learning and networking with elements such as an

Innovator Fair, interactive sessions, food waste catering, and art installations. Documentation of the conference including proceedings and presentations are available on the REFRESH website: <http://eu-refresh.org/conference2017>

On May 19th food waste stakeholders met for an interactive Food Waste Innovation Incubator Day in Berlin. The aim of this workshop was to bring food waste innovators and experts together to learn from each other, develop solutions to food waste issues in the food chain, and improve cooperation. It was co-hosted with the German Federal Ministry of Food and Agriculture (BMEL), and was carried out in collaboration with the Food Waste Innovation Network (FoodWIN). Results of the workshop can be found here: <http://eu-refresh.org/food-waste-innovation-incubator-day>.

The REFRESH Policy Workshop "Sowing the seeds for short and long term improved EU policies for food waste" took place on 08. November 2017 in Brussels, back to back with the Meeting of the EU Platform on Food Losses and Food Waste. This workshop presented and discussed preliminary findings on opportunities for improving EU policies relevant to food waste prevention and valorisation and explored short- and long-term strategies with stakeholders. The outcomes, including participants' recommendation to investigate an Integrated EU Food Policy, feed into the project's further policy work. Documentation is available online: <http://eu-refresh.org/sowing-seeds-short-and-long-term-improved-eu-policies-food-waste-refresh-policy-workshop>

The REFRESH final conference will be held in mid-May 2019 in Barcelona. Check the REFRESH website to stay updated on conference announcements: <http://eu-refresh.org/conference2019>

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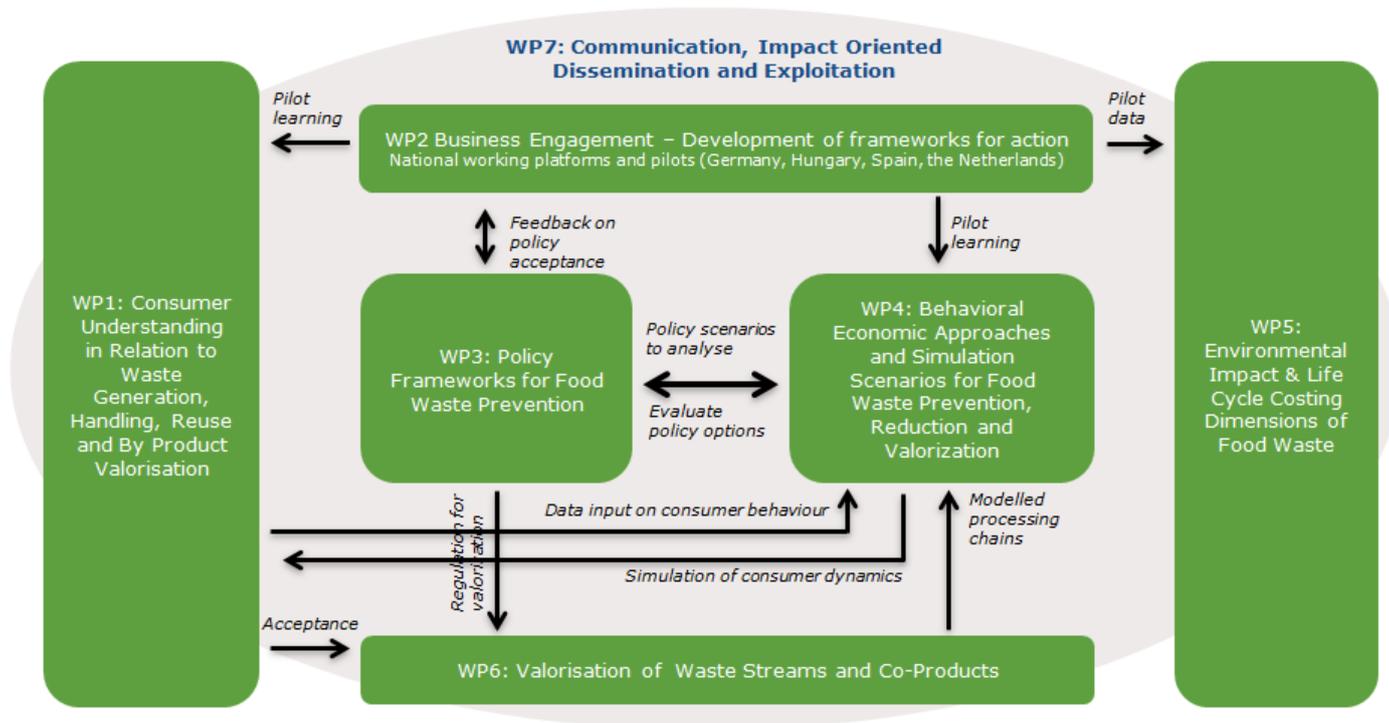
### **REFRESH Food Waste Solution Contest**

In autumn of 2016, the REFRESH project launched the REFRESH Food Waste Solution Contest, calling on food waste innovators to submit their projects and ideas. The objective of the Contest was to bring much-deserved recognition to these ideas and encourage their spread. Contest submissions were made by individuals, organisations, start-ups and large companies.

Wastewatchers (NL) and Transition Surplus Food Project (UK) were selected by the jury of experts, and Zero Waste Aiud (RO) gathered over 17,000 votes to win the Public Award. During the Public Award in February 2017 some 61,000 votes were cast in total for all projects competing in the Contest.

More information about the Contest is available at: [eu-refresh.org/contest](http://eu-refresh.org/contest)

## Project Structure and Responsibilities



**WP1:** Consumer understanding in relation to waste generation, handling, reuse and by-product valorization – Wageningen University & Research (Hans van Trijp & Erica van Herpen)

**WP2:** Business engagement: Frameworks for Action – WRAP (David Rogers & Kate Bygrave)

**WP3:** Policy framework for food waste prevention, recycling, and reuse – Deloitte Development Durable (Manuela Gheoldus)

**WP4:** Behavioural economic approaches and scenarios for food waste prevention, reduction and valorization – University of Bologna (UNIBO) (Matteo Vittuari)

**WP5:** Environmental and life cycle costing dimensions of food waste – RISE Research Institute of Sweden (Karin Ostergren)

**WP6:** Valorisation of waste streams and co-products – Quadram institute (Paul Finglas)

**WP7:** Communication, impact oriented dissemination, and exploitation – Ecologic Institute (Stephanie Wunder)

**WP8:** Project management – Wageningen University & Research (Hilke Bos-Brouwers & Toine Timmermans)

## Project Partners



## About the REFRESH project

REFRESH ("Resource Efficient Food and dRink for the Entire Supply cHain") is an EU funded project taking action against food waste. 26 partners from 12 European countries and China work towards the project's goal to contribute towards Sustainable Development Goal 12.3 of halving per capita food waste at the retail and consumer level and reducing food losses along production and supply chains, reducing waste management costs, and maximizing the value from unavoidable food waste and packaging materials. REFRESH runs from July 2015 until June 2019.