

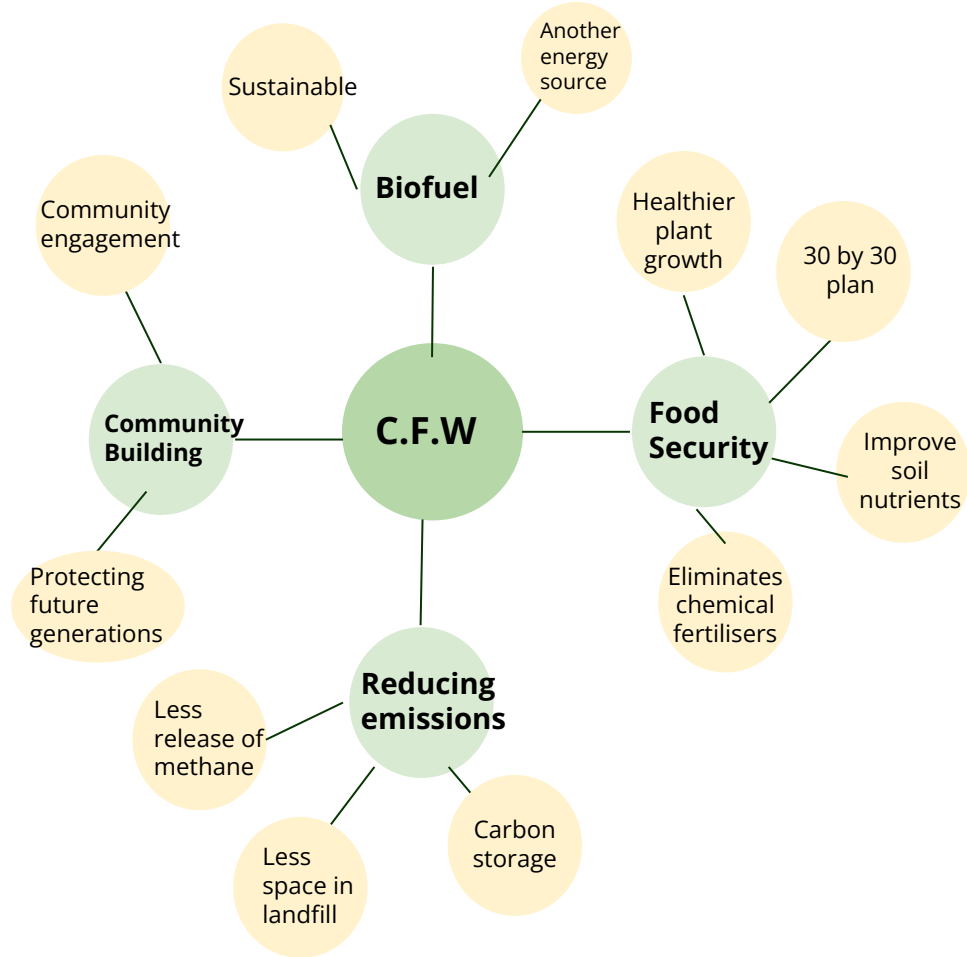
# The Circular Food Web (C.F.W)

By: Sarah, Emily, Jareth & Ashna



# Our Ideation Process

- **Emilee:** Lived in Seoul *inspired by RFID food waste recycling system*
- **Ashna:** Lived in Melbourne, *inspired by city's food composting dedication*
- **Our group:** We are 16 in year 11. Worked on establishing food composting system to help our school garden (**Green Machine Sustainability Club**)



# UNDERSTANDING THE PROBLEM

- Food waste accounts for **12% of the total waste generated in Singapore**
- Upward Trend:** Total amount of food waste generated in 2021 was 817,000 tonnes (*increase of 23% from 2020*)

2017 study by NEA found out that food waste accounted for about **half of the waste disposed of by each household a day**.

Avoidable food waste was equivalent to each household **throwing away a 2.5 kg bag of rice every week**.

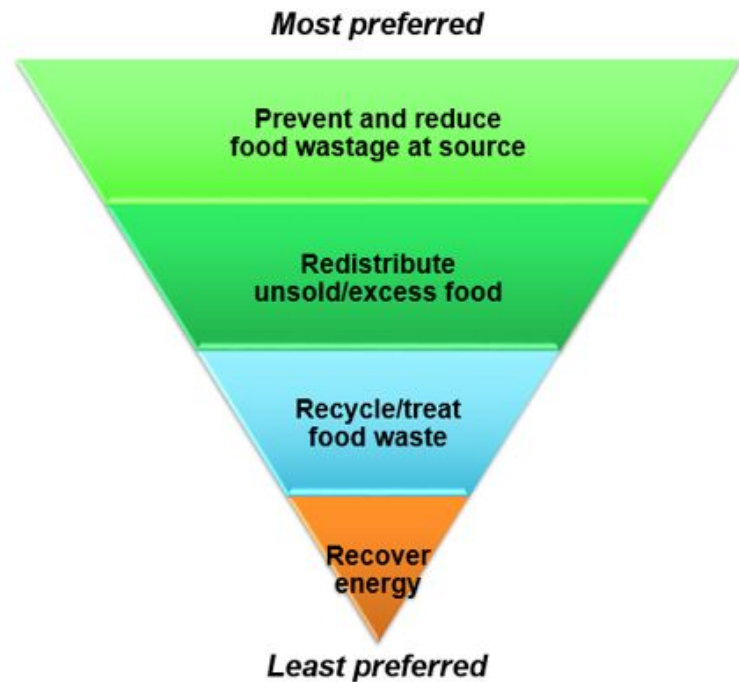


# Existing Solutions

- **Waste minimisation guidebooks:** *E.g Love Your Food Handy Guide*
- Redistributing **unused food to food banks**
- **On-site composting** for industries
- Tuas Nexus: Integrated Waste Management Facility (IWMF)
  - Plans to process **400 tonnes per day of source-segregated food waste**
  - Completion by **2025**
  - **Biogas energy transfer** between transport facilities (TWRP to IWMF)

## Issue:

- **Composting system too detached**
- **Needs to be properly connected nationwide**



*NEA 4 step approach to reducing food waste*

# Intro Our Circular Food Web Idea



## #1 Collection

- **Limits of food waste** per household/company
- Limiting Food Waste Incentives

### Composting process

Food waste can be utilised in order to create **high quality compost** used to fertilise the soil of rooftop gardens

### Animal Feed / Fish Pellets

Treated food waste can be reshaped and used as **cheap feed** in order to continue the circular food web.

### Biofuel Processes

Food wastes can be utilised as a resource for the **production of biodiesel and bioethanol** (aka fuel)



## #2 Transport

Food waste is transported to IWMFS sponsored by the government

## #3 Processing

Food Waste is processed into **3 substeps- compost, biofuel or animal feed**

# Research Inspiration



e.g. *Scortum barcoo*

*Oreochromis niloticus*

*Epinephelus lanceolatus* x  
*E. fuscoguttatus*

Fish products

Fish feed pellets



Food waste based  
fish feed pellets



Commercial fish  
feed pellets

Alternative ingredients

Conventional  
ingredients

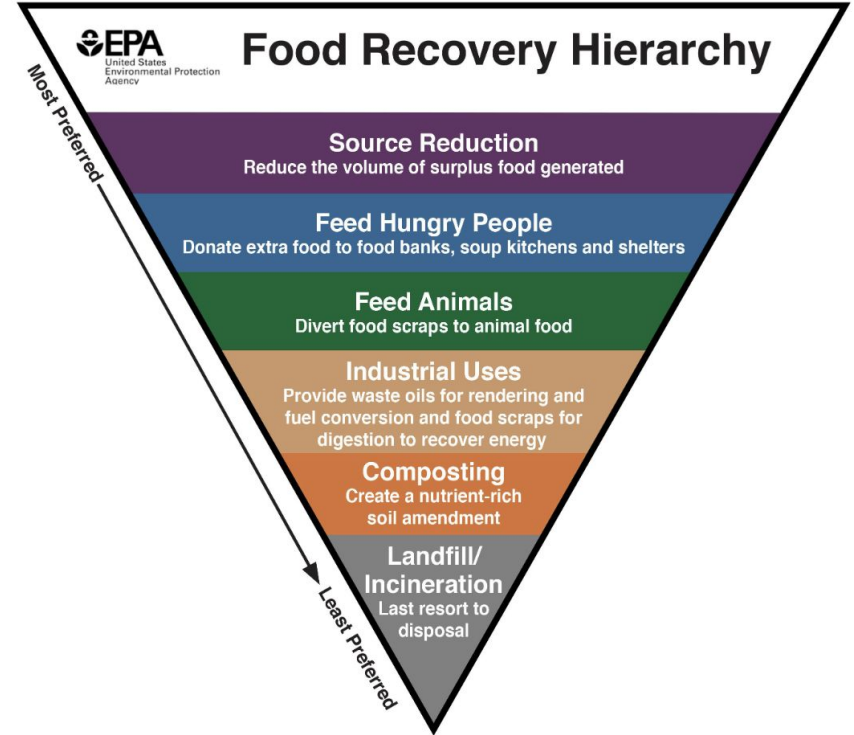
Food waste

Fish waste

Okara

Soybean  
meal

Trash fish



# Breakdown of Our Plan

Future Scope: Master plan for 15 years in advance

Estimated Investment: \$55 million SGD





# Collection Process

## Bin Case Studies



**Melbourne Smart Bins**, sends signal to waste facility and auto-locks when full



**Seoul Smart Bins**- RFID chips to track data, implement tax charges/fines

## New Buildings + Old Buildings Food Waste Collection

- *New Buildings*: design for **food-waste only chute**
- Installation of **smart bins** in HDBs, Condos & independent housing
- Need supply of **biodegradable bags**
- Chute/bin **opens by access card**
  - **App** can be connected to card
  - Unlocking **incentives** such as **vouchers/coupons**
  - Avg. household size 3.15
  - Point system per week
    - 2.0 kg earns 10 points
    - 1.5 kg earns 20 points
    - 1.0 kg earns 25 points
    - Exceed limit: no points
    - 100 points = \$10 voucher

## Bin Technology

- **Weighing technology**
- **Sorting technology** - to ensure food waste is only disposed





# Transportation

## Truck Technology

- New trucks need to be designed specifically for food compost retrieval
  - **Leak-proof seams**
  - **Mixing & shredding** of compost for space inside
  - **Smaller vehicles**
  - **Automatic power wash**
  - Arm mechanics to **attach to bins**



## Pick-up schedule

- Bins will auto-lock and alert waste treatment facility when **full**
- Pick up schedule will **not** be daily
- **AI systems to map out designated & efficient** routes for garbage engineer drivers



## Hygienic, Anti-Vermin & Biohazard management

- Bins & trucks to incorporate leak proof seams
- **Proper AI to ensure bin is emptied in timely manner** (bin inbuilt timer)
- **Power wash system inside garbage truck & smart bin**



# Processing

## *Integrated Waste Management System (IWMS): Compost treated at IWMS, Tuas Nexus*

### Food Composting

- Use in **urban farming**
- Approved **permits** for HDBs, condos, schools & private residences
- Assist in **plant growth/success to support 30 by 30 plan**
- Reduce SG dependency on **food importations**

### Biofuel Process

- Biofuel derived will **assist Tuas Water Reclamation Plant (TWRP)**
- Biofuel can be introduced into **grid**
- Will **diversify energy sources**
- Will **need plant** allow for biofuel to connect to grid

### Farming Usage

- Use for **animal feed**
- Use for **fish pellets**
- Animal feed: requires **milling & processing plant**
- Improves **soil quality**
- **Reduce water** needed for agriculture

### Industrial Symbiosis

- Area for market growth in **agriculture fertiliser**
- Growth in **biofuel/ biodiesel sector**
- Prompt **development in tech.** which operates using biofuel
- Biofuel tech market: projected to grow to **\$59.4 billion by 2030 (currently at 6 billion)**

# Education / Awareness - Sociocultural Implementation

## Bold Advertising Campaigns

Bright Marketing to be used to inform masses as well as to spark change within individuals / groups.

## Education and Programs

Education in schools on repercussions of food waste as well as informative social programs.

NEA 2019 Consumer Survey on

## Food Wastage

Attitudes towards food waste



8 in 10 are bothered when uneaten food is thrown away

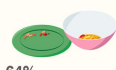


8 in 10 are aware of the environmental impact of food wastage

Actions to reduce food wastage



71% try to use leftover ingredients in the fridge (up from 58% in 2015)



64% have no leftovers when eating out (up from 59% in 2015)



6 in 10 would cater for exact or fewer number of expected guests, instead of catering for more guests than expected (59% in 2019, up from 48% in 2015)



56% take away unfinished food when dining out (up from 44% in 2015)



32% are open to buying fruits/veg with slight imperfections (up from 23% in 2015)



38% are open to buying discounted expiring food (up from 18% in 2015)



43% prepare shopping lists before grocery shopping (up from 39% in 2015)

Top motivating factors



93% If I can help my family save money



92% To protect the environment



8 in 10 wanted more information on how to waste less food

Tips on wasting less food

- Make a shopping list and stick to it!
- Opt for less rice or noodles when catering.
- Cook a use-it-up meal for leftover food.
- Get more tips from our handy guide: [cgs.gov.sg/programmes/food-waste-reduction-programme](https://cgs.gov.sg/programmes/food-waste-reduction-programme)

For more information, please visit [www.nea.gov.sg](http://www.nea.gov.sg).

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**Thank You for  
Your Kind  
attention!**