



Surplus food as animal feed

Professor Tomoyuki Kawashima, University of Miyazaki, Japan
Dr Jennifer Davis, RISE
Dr Karen Luyckx, Feedback



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Heat-treated surplus food for non-ruminants



Part 1: **The Japanese experience**

Please write down your main question on how the EU can apply the Japanese experience



Part 2: **Short group discussion**

Each table to prioritise a question they wish to get an answer on from Tomo, Jennifer or Karen



Part 3: **Environmental and economic costs and benefits**

Part 4: **Safety in European context and EU policy framework, Consumer acceptance**



Part 1: The Japanese Experience

Professor Tomoyuki Kawashima,

Department of Animal and Grassland Sciences,
University of Miyazaki, Japan

新発売
ポーク あんしん、健康、しかもデリシヤス。

1 乳成分調飼料で
すくすく健康に
育った豚肉。

2 たとえば、
しゃぶしゃぶしても
おまひアツが
出ない。

3 豚身に、健康に有用な
オレイン酸が
多く含まれている。

「優とん」は、
小田急グループのエコ事業に
よって生まれた、安心の商品です。
豚を健康に育てるための乳成分調飼料をつくっています。
食生活質を含まない、豚を安全に育てるための飼料です。

小田急グループの食品リサイクル事業

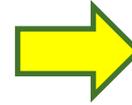
詳しくは www.odakyu-ox.net/eco/

お問い合わせ先… Odakyu OX
「優とん」をお店で… 小田急百貨店
「優とん」をメニューで…

*Ecopork:
Safe,
healthy
and
delicious*

One-way society based on mass production, mass consumption and mass disposal

Challenge
for 21st century



Recycling-based Society

The Basic Law for Establishing the Recycling-based Society (2000)

Waste Management and Public Cleansing Law

Securing restriction of the generation of wastes and appropriate recycling and disposal of wastes.

Law for Promotion of Effective Utilization of Resources

Promoting restriction of the generation of wastes and reuse and recycling of wastes.

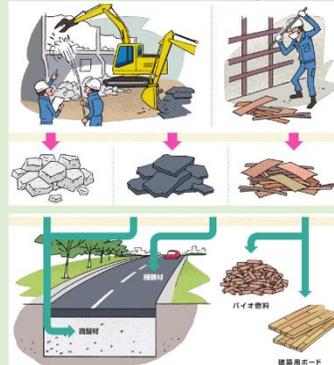
Law on Promoting Green Purchasing

The National Government, etc., takes initiative in promoting procurement of reproduced products, etc.

Electric Household Appliance Recycling Law



Construction Material Recycling



Food Recycling Law



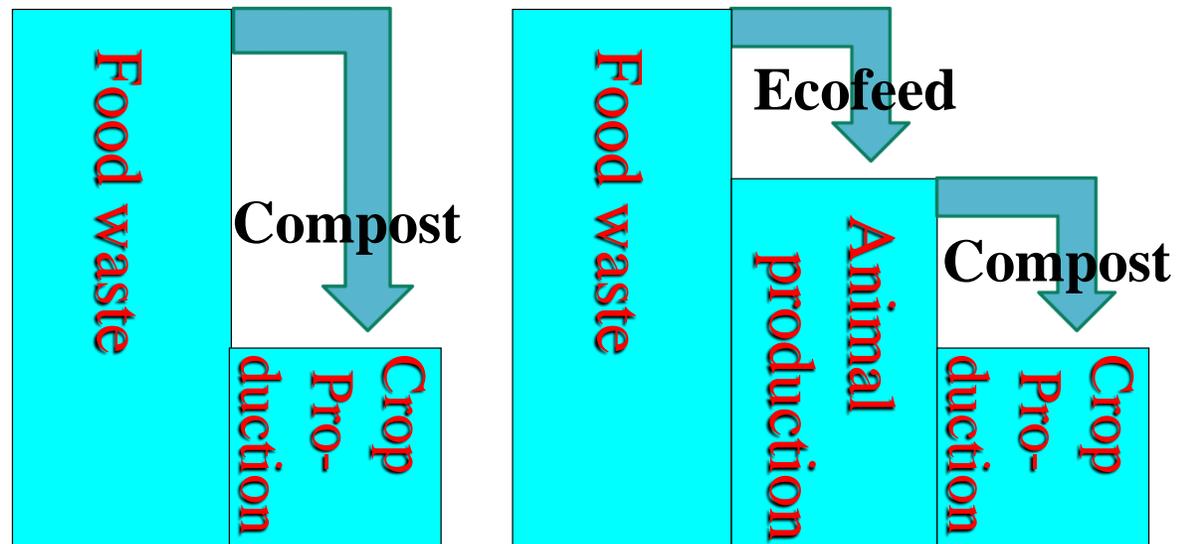
Container and Packaging Recycling Law



Background of Ecofeed

- Self-sufficiencies of food and feed in Japan are 38% and 26%, respectively.
- We import more than 10 million ton of corn for animal feed.
- Food Recycling Law (2001) Compost and feed in the same order
- The law revised (2007). Use as feed is the first priority

Cascade use of food waste





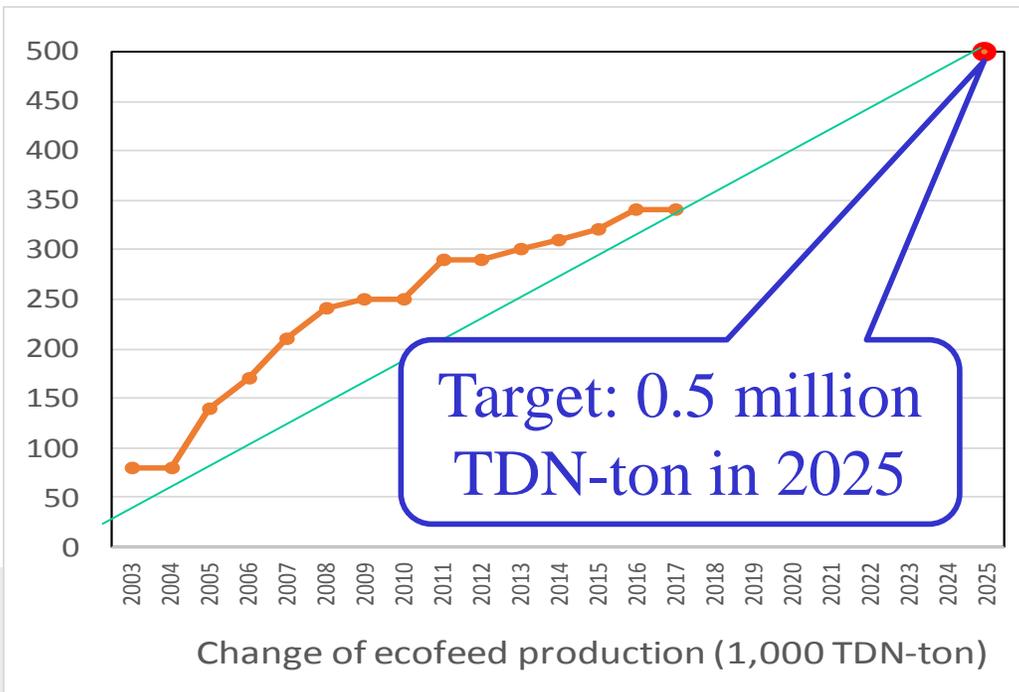
BSE incidence and Amendment of Feed Safety Law (2001)

- No animal materials for ruminants
- Food waste can be fed to swine and poultry with heat treatment
- Explanation by the government
 - The materials are originally for human consumption
 - Little possibility of meat bone meal contamination as supply chain is limited
 - It especially contributes to promotion of public benefits, such as an increase in food self-sufficiency and implementation of recycling society through reduction and reuse of food waste

Comparison between risks derived from the use food waste for animal feed and not using them, from environmental, and food security perspectives

Ecofeed: Ecological and Economical feed

- Feed prepared from food-processing by-products, surplus food, cooking loss, food waste.
- Long history but new practice
- Proper use based on current animal science



- Competition for the resources which can be easily used as eco-feed
- Need for exploitation of new materials for eco-feed and development of new technology

Situation of food waste recycling in 2016

	The amount of food waste generated per year (1000ton)	The amount of recycle use	The amount for animal feed
Food manufacturing industry	16,170	13,090 (81%)	9,970 (76%)
Food wholesaler	270	130 (47%)	40 (30%)
Food retailer	1,270	480 (38%)	210 (43%)
Food service industry	1,990	290 (14%)	60 (21%)
Total	19,700	13,980 (71%)	10,270 (73%)

Statistics and Information Department, Ministry of Agriculture, Forestry

52%



Eco-feed: wide variation of chemical composition

Strategy to produce stable-quality feed

1. Collect resources with less variation
 - Food processing by-product, co-products from factories producing same product
2. Dilute variation by mixing with compound feed or with wheat bran
3. Collect resources from many places
 - Crude Protein 20-25%, EE (fat) 15-20%
4. Separate resources based on their chemical composition, and mix them with their representing value

Sapporo Recycle Center



**Production of fried meal
Waste from schools, hotels,
restaurants etc. in the city
Food waste 68ton/day**

→ **about 14ton feed**



**Use as an ingredient of compound feed
for pig or poultry**

	OM	CP	EE	Carbohydrat
Average	92.2	23.4	9.7	59.1
std	0.9	1.2	1.4	1.8

Chubu Organic Recycle Ltd. <http://www.chubu-yr.co.jp>

21 認証第 6 号



食品循環資源利用率：100%

- Production of pig feed from expired lunch box, vegetables etc. generated from supermarkets, convenience stores etc.
- 36ton of waste → 7ton of feed/day
- Refined fat 4ton/day
- Private brand pork
- Certified ecofeed
- Recycling loop



外観<北側>



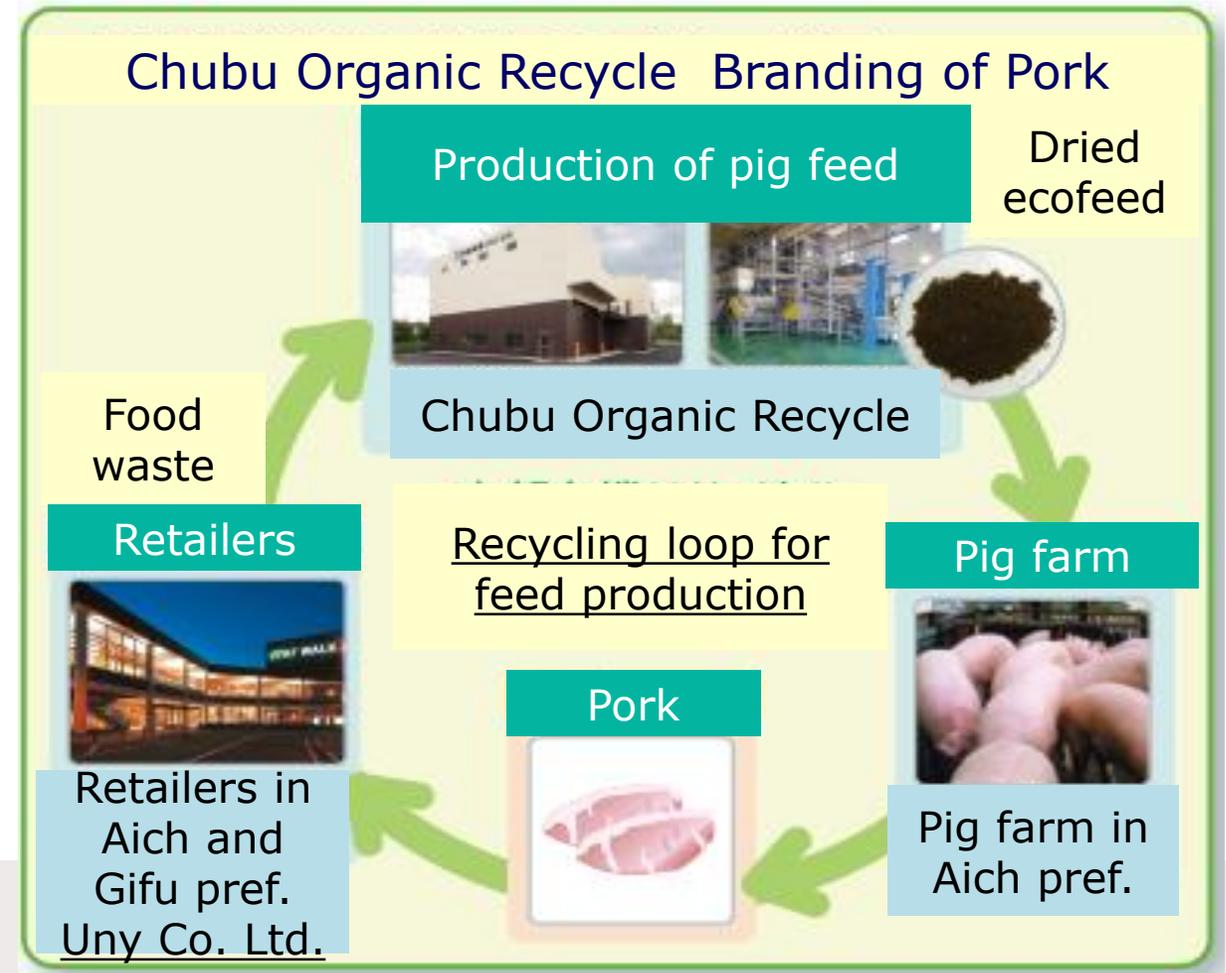
外観<西側>



原料受入室



機械室



Waste measurement system



Separation of waste



Weighing & registration



Labeling



Separate storage

Recycle Loop

Farmers
Agricultural products by using recycled materials (feed and fertilizer)



Retailers

- Management of waste
- Sales of products based on recycling



関係者が一堂に会し、意見交換を実施

Consumer



エコ野菜売場では、生産者の顔を付けて販売



買う・食べる
エコ野菜マーク

Recycling business

- Feed
- Fertilizer

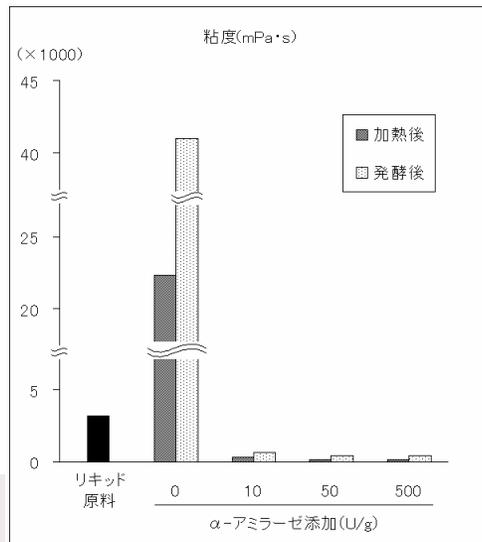
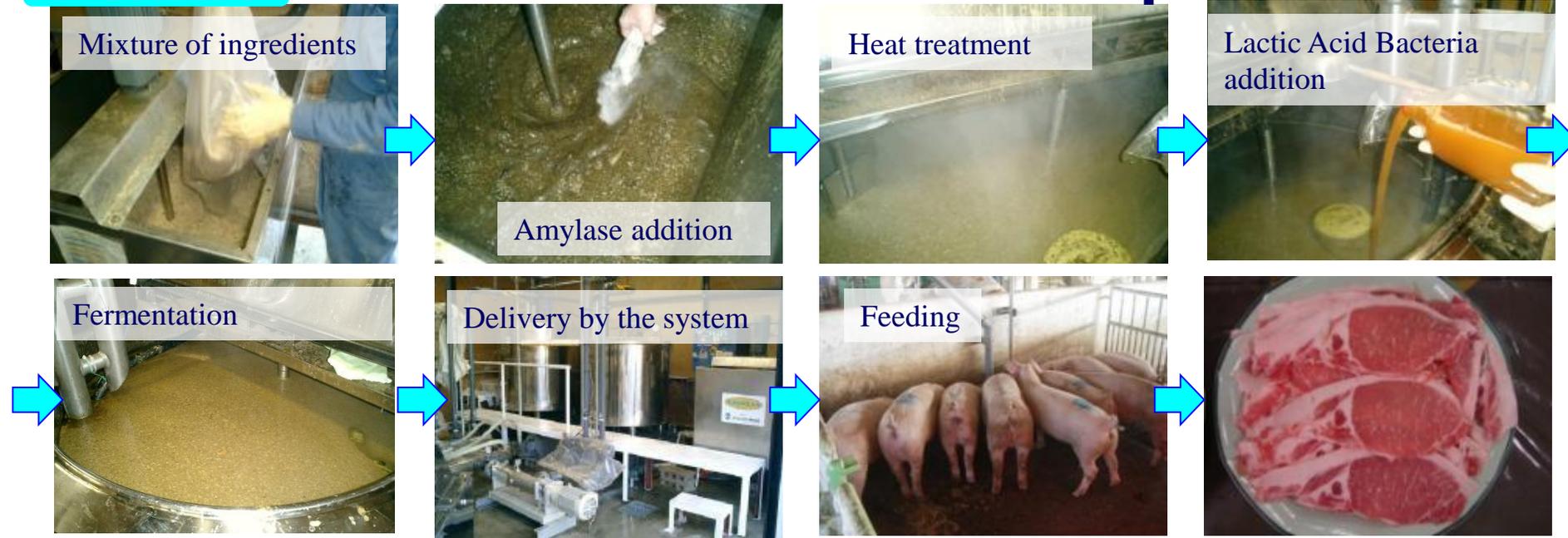


Liquid feeding

- Liquid feeding is a feeding system that delivers feed with water through pipeline, mainly for pigs.
- Advantage of using high moisture by-products for pig feed.
- Improvement of preservation by either organic acid addition or lactic fermentation.

Fermented liquid feeding

Procedure



- Increase in DM
→ DM intake
- Reduction of cost for fuel and transportation

- Reduction of viscosity by amylase addition and delivery through pipeline
- Fermentation by addition of specific lactic acid bacteria (LAB) after heat treatment
- Improvement of intestinal flora and activation of immunity by probiotic LAB

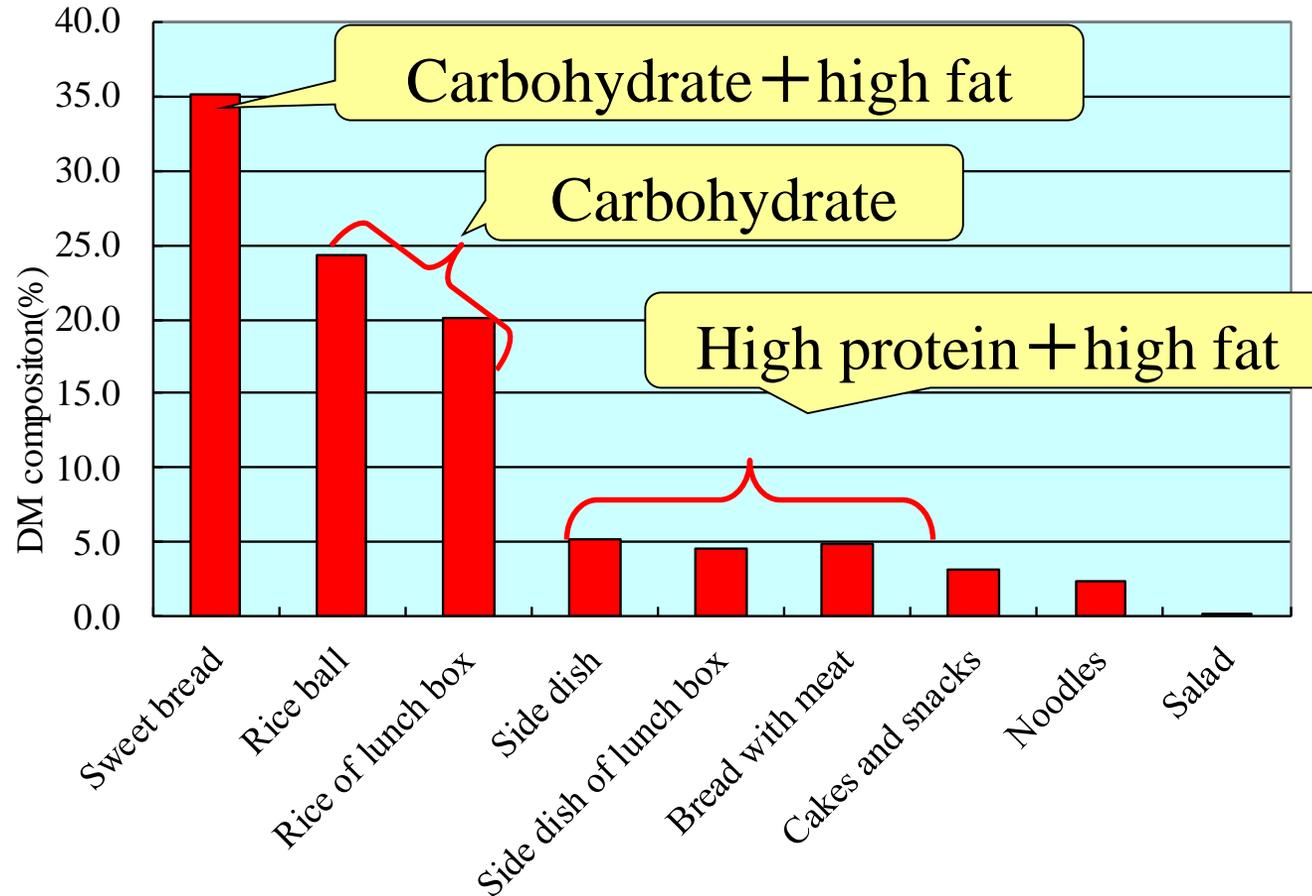
Expired food from convenience store

- 10-15kg of expired food come out from one convenience store per day
- “Mottainai” is a Japanese term conveying a sense of regret concerning waste.



Survey on expired food from convenience store

Survey at a company collecting waste from 900 Seven-Eleven shops in Tokyo, and making compost. Separating items and measure the weight from a track and sampling for proximate analysis.



DM Composition of waste from convenience stores



Fattening Experiment of Finishing Pigs by Fermented Liquid Feed using Expired Foods from Convenience Stores

Composition of fermented liquid feed

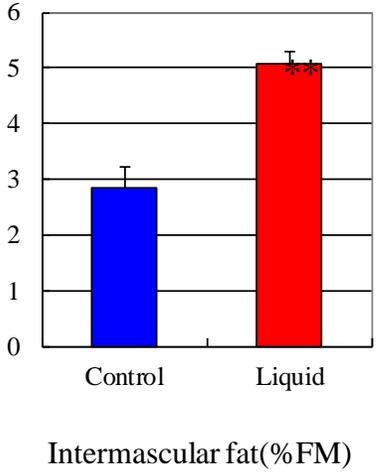
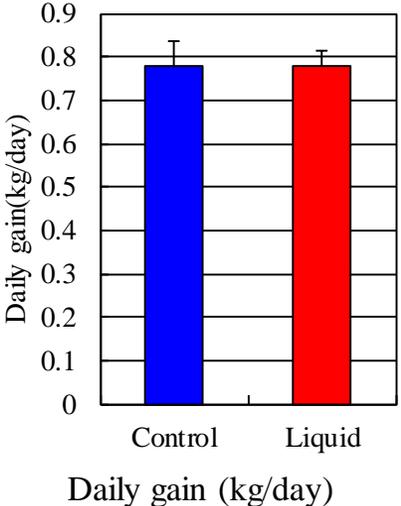
	FM%	DM%
Rice	11.3	19.2
Rice ball	11.3	19.4
Sweet bread	16.9	45.9
Soybean meal	1.6	5.7
Alfalfa meal	2.3	8.4
Calcium phosphate	0.4	1.5
Water	56.3	0.0

Chemical composition of feed

	Control	Fermented liquid
DM(%)	87.8	21.6
Crude protein(% DM)	16.6	16.8
Ether extract(% DM)	2.9	7.5
NDF(% DM)	15.1	8.1
Crude ash(% DM)	5.6	2.4
Lysine(% DM)	0.90	0.51



Production of marbling pork through amino acid control
 Katsumata et al. (2005) Animal Science Journal Vol.76 237-244.



Japan Food Ecology Center (JFEC) <http://www.japan-fec.co.jp/>



Sagamihara, Kanagawa
Capacity : 39ton/day



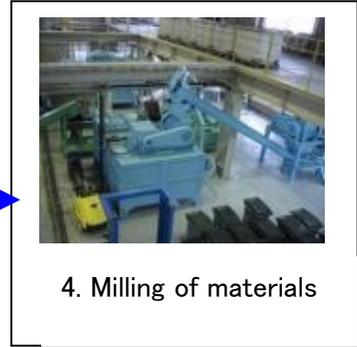
1. Collection of co-products



2. Weighing of container



3. Put into liquid feed preparation system



4. Milling of materials



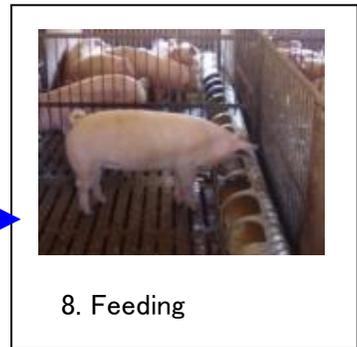
5. Heat treatment



6. Lactic acid fermentation



7. Delivery of liquid feed by a tank truck



8. Feeding

新発売 ポーク

あんしん、健康、しかもデリシヤス。

Safe, healthy and delicious

① 乳酸発酵飲料で、すくすく健康に育った豚肉。

② 食べ、しゃぶしゃぶしてもおまけアツが出ない。

③ 豚身に、健康に有用なオレイン酸が多く含まれている。

「優とん」は、小田急グループのエコ事業によって生まれた、安心の商品です。豚を健康に育てるための乳酸発酵飲料をつくっている。有害物質を含まない、豚を安全に育てるための飼料です。

小田急グループの畜産リサイクル事業

詳しくは www.odakyu-ox.net/eco/

お求めは... Odakyu OX 「優とん」をお魚巻で... 小田急百貨店 「優とん」をメニューで...

Ecofeed formulation program <http://nilgs.naro.affrc.go.jp/>

Chemical composition of food waste varies very much. But the variation can be minimized by a proper separation. We can formulate high quality ecofeed to meet the requirement of pigs by using food waste after properly separated. This is a feed formulation program to support preparing high quality ecofeed.

Requirement calculation sheet

Table 1 Data input		
Body weight	75	kg
Daily gain	0.85	kg/day
No. of pigs	30	head

Feed calculation sheet

Feed No.	Name of Feed	Amount FM kg	DM %	DM amount kg	DM ratio %DM	TDN kg
88	Rice	30.00	40.0	12.01	16.7	11.26
73	Bread crumbs and stale bread (D)	20.00	89.2	17.84	24.8	17.60
108	Vegetable	50.00	7.4	3.69	5.1	2.50
92	Japanese noodle (boiled)	25.00	33.3	8.33	11.6	7.46
61	Milk	70.00	12.3	8.61	12.0	10.92
35	Wheat bran	4.00	86.8	3.47	4.8	2.34
52	Soybean curd residue (Wet)	10.00	22.5	2.25	3.1	1.59
115	Barley tee residue (Dry)	20.00	94.1	10.00	13.9	7.00
82	Alfalfa meal (Dehydrate)	5.00	90.7	4.54	6.3	1.92
83	Dicalcium phosphate	1.00	96.0	0.96	1.3	0.00
87	Water	100.00	0.0			0.00
67	Lysine hydrochloride	0.15	98.5	0.15	0.2	0.14
1	Corn		85.5			0.00
1	Corn		85.5			0.00
1	Corn		85.5			0.00
1	Corn		85.5			0.00
	Amount	335.15		71.85		62.73
	Conent(%DM)			21.4		87.3
	Sufficiency, %			101.4		103.0

Feed table

Feed tables							
Nutrient contents are expressed on fresh matter basis.							
	DM %	CP %	EE %	TDN %	Ca %	Lysine %	
Co-products							
88	Rice	40.0	2.661	0.352	37.54	0	0.084
89	Rice cooked with various ingredients	57.8	2.671	0.468	51.77	0.01	
90	Fried rice	54.3	3.836	2.838	50.46	0.02	
91	Rice ball	41.7	4.182	1.251	39.21		0.171
92	Japanese noodle (boiled)	33.3	4.52	0.343	29.83	0.02	0.097
93	Chinese noodle	66.1	7.901	0.434	58.11	0.05	0.178
94	Pasta	38.0	6.618	1.138	36.91	0.02	0.106
95	Japanese noodle (Wet)	70.8	6.123	0.149	66.56	0.04	0.198
96	Noodle (Dry)	87.6	9.9	0.482	77.25	0.12	0.245
97	Sidedishe bread	49.2	8.705	13.31	57.47		0.305
98	Cake	83.1	10.03	9.405	84.22	0.05	0.128
99	Potato skin	15.6	1.807	0.164	9.339	0.03	0.08
100	Mashed potato	21.1	1.569	0.041	17.03	0	0.08
101	Fried potato	96.9	7.634	29.34	109.8	0.12	
102	Chocolate	98.7	6.567	39.92	133.8	0.25	
103	Corn frake	97.3	5.821	0.451	86.12	0.05	0.067
104	Cady	98.8	0.435	0.543	94.8	0.07	
105	Sidedishes	25.0	8.444	6.894	25.91		0.372
106	Simmered vegetable	72.9	2.905	1.154	64.1	0.05	
107	Raw material of fried tofu	25.0	14.39	8.026	33.31	0.15	
108	Vegetable	7.4	1.49	0.293	5.005	0.04	0.024
109	Dried vegetable	79.7	15.36	2.429	46.71	0.93	0.255
110	Dried salad	91.3	16.07	22.06	97.17	0.1	0.538
111	Tomato juice	7.5	2.142	0.669	5.691		
112	Greentee residue (Wet)	22.2	6.124	1.245	13.14	0.13	0.347



Part 2: Group discussion

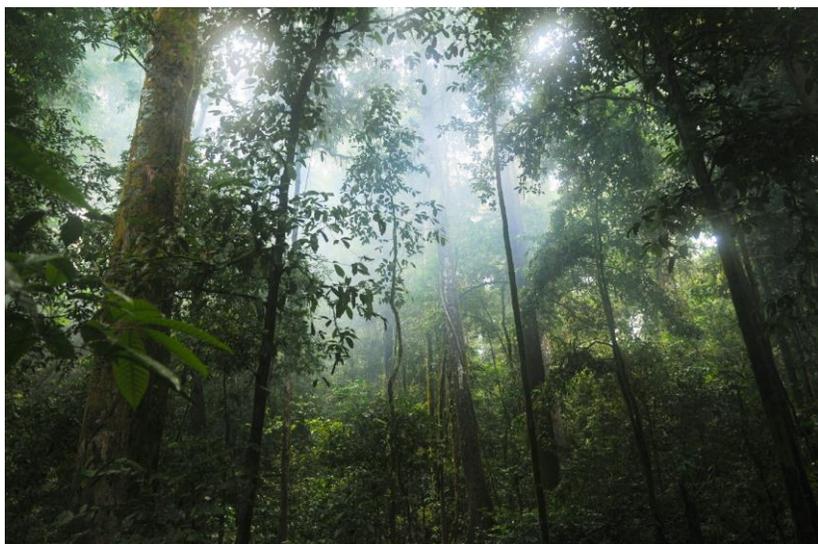


Applying the Japanese experience in the EU:
Please prioritise a question from your table and write it on the card provided



Part 3: Environment and Economy

Jennifer Davis, RISE



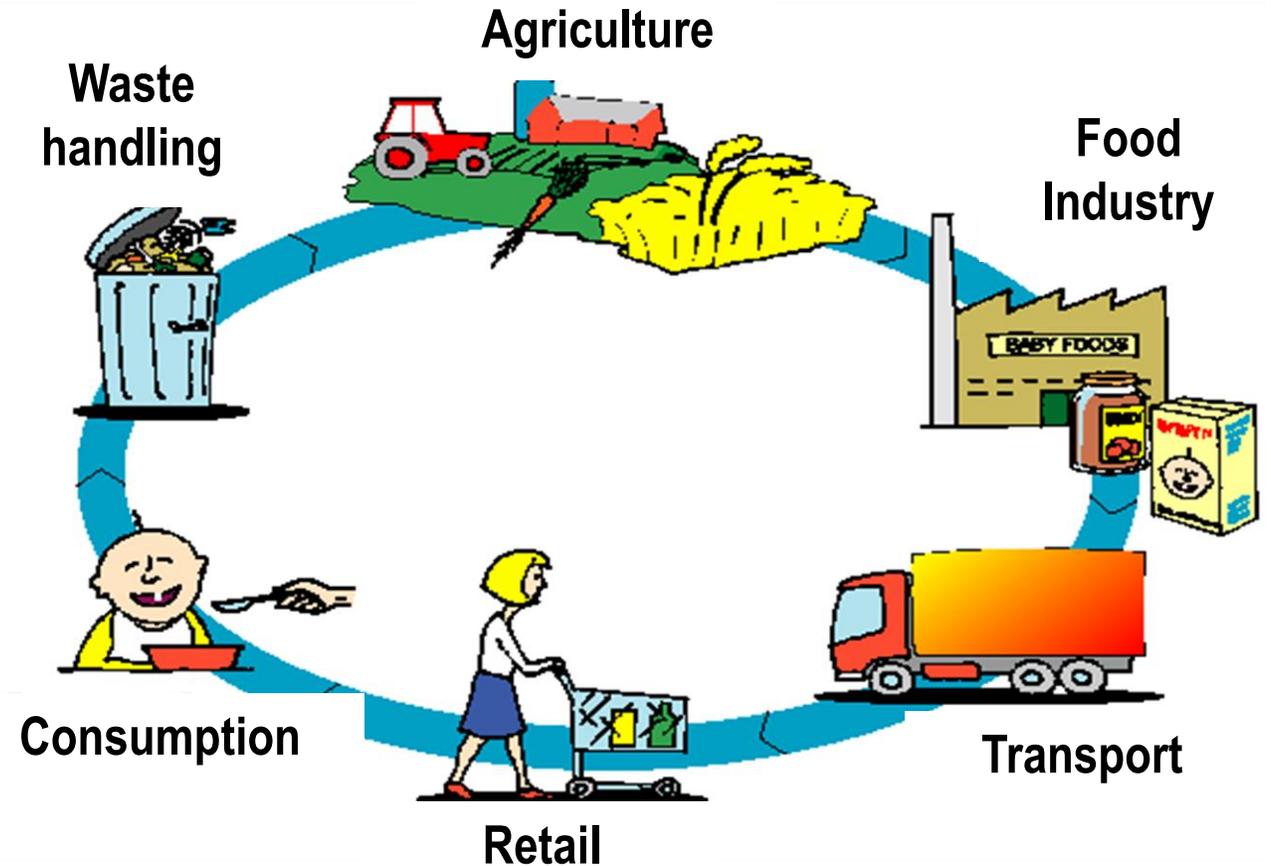


Effect of feeding leftovers to pigs?

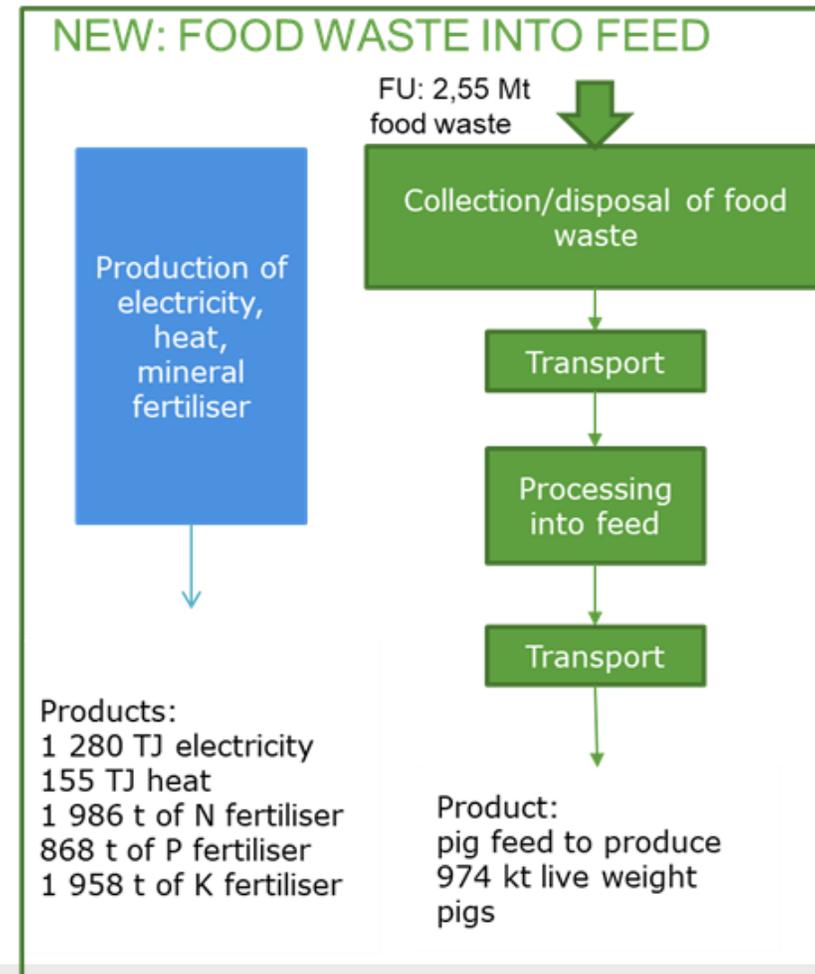
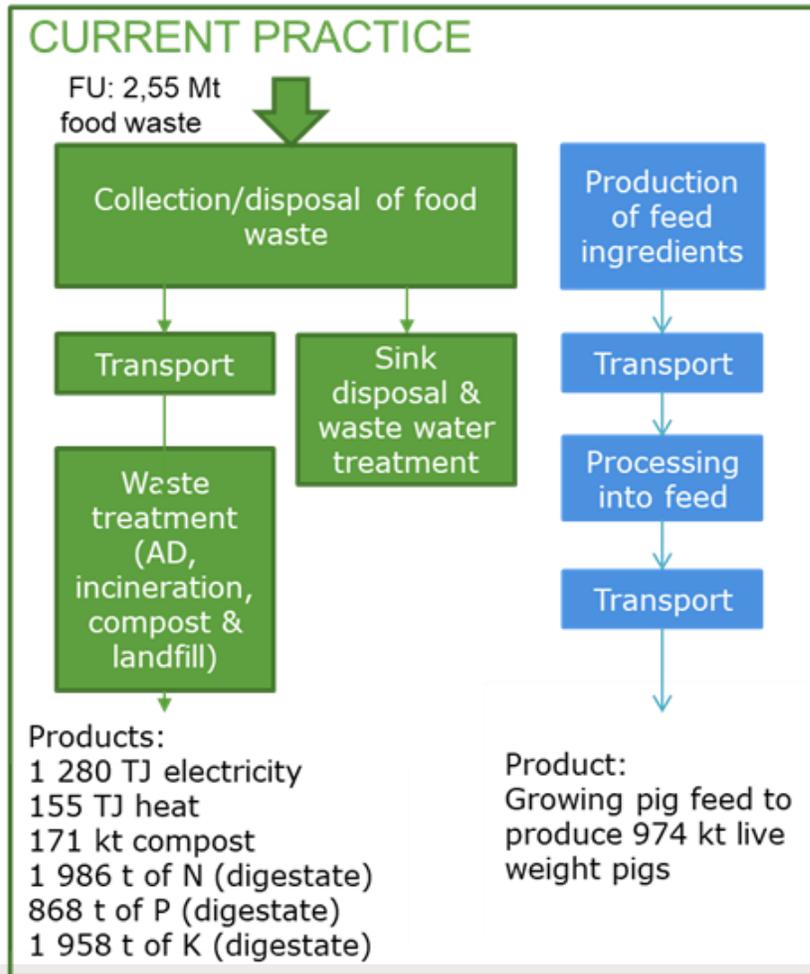
- Explored surplus food from catering, manufacturing and retail in UK and France respectively
- What would the environmental and economic effect be if this surplus food was fed to pigs, instead of current waste treatment?

Life Cycle Assessment and Environmental Life Cycle Costing

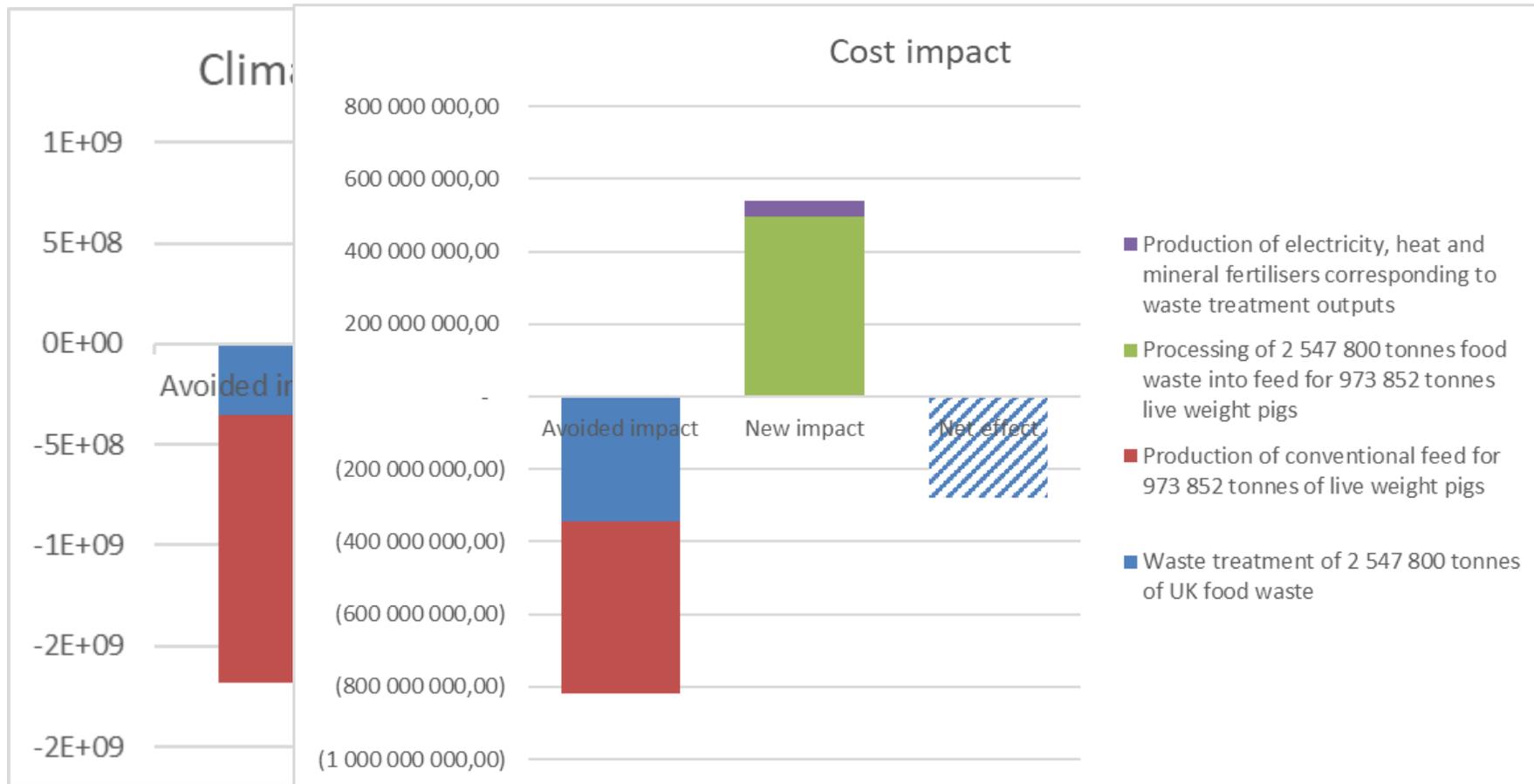
- LCA: environmental impacts from cradle to grave
- E-LCC: all costs (real money flows) associated with the life cycle of a product



Systems compared for UK

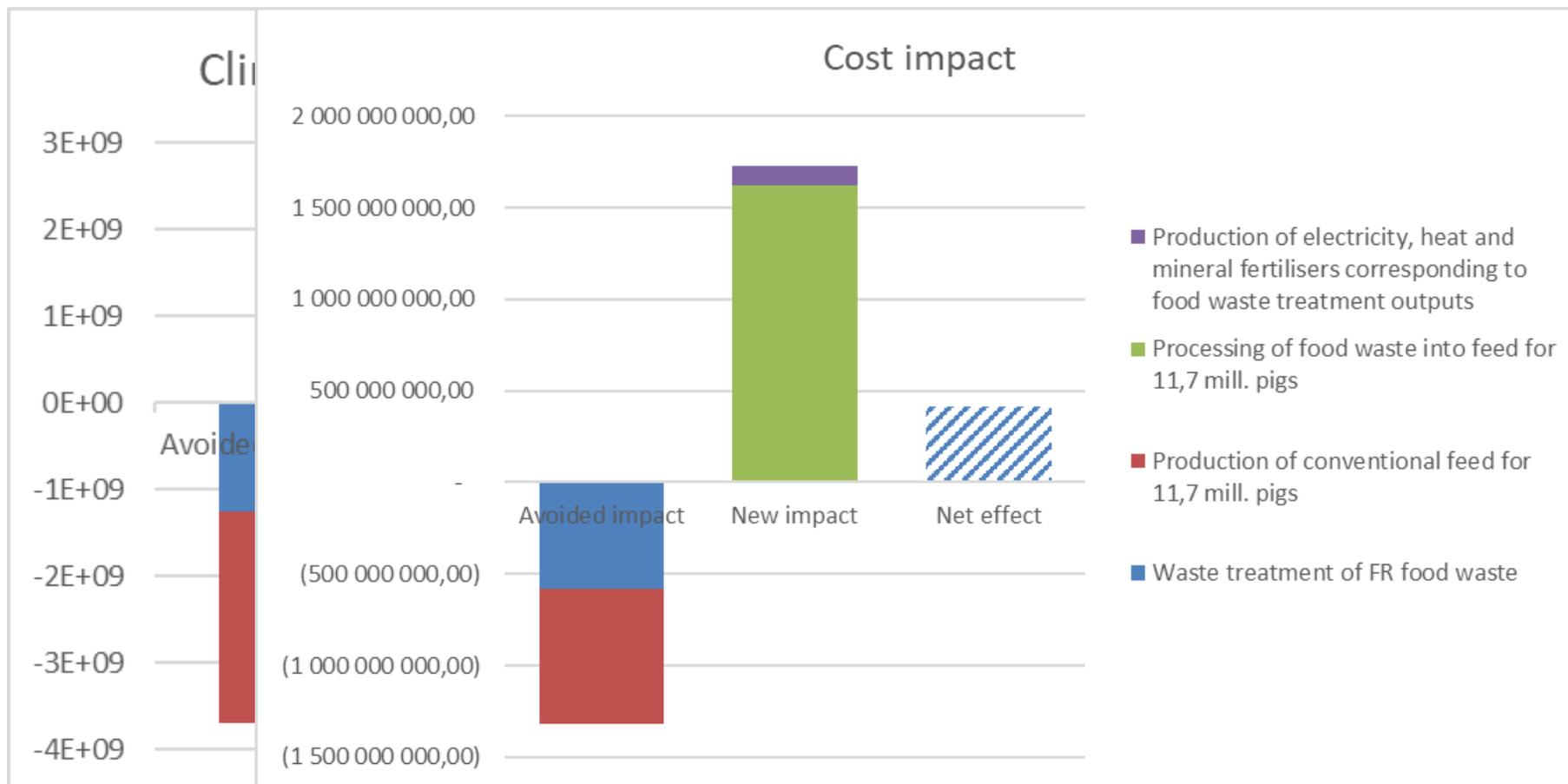


Results – UK



Source: De Menna et al, 2019, 'D5.5 LCA & LCC of food waste case studies, REFRESH report'.

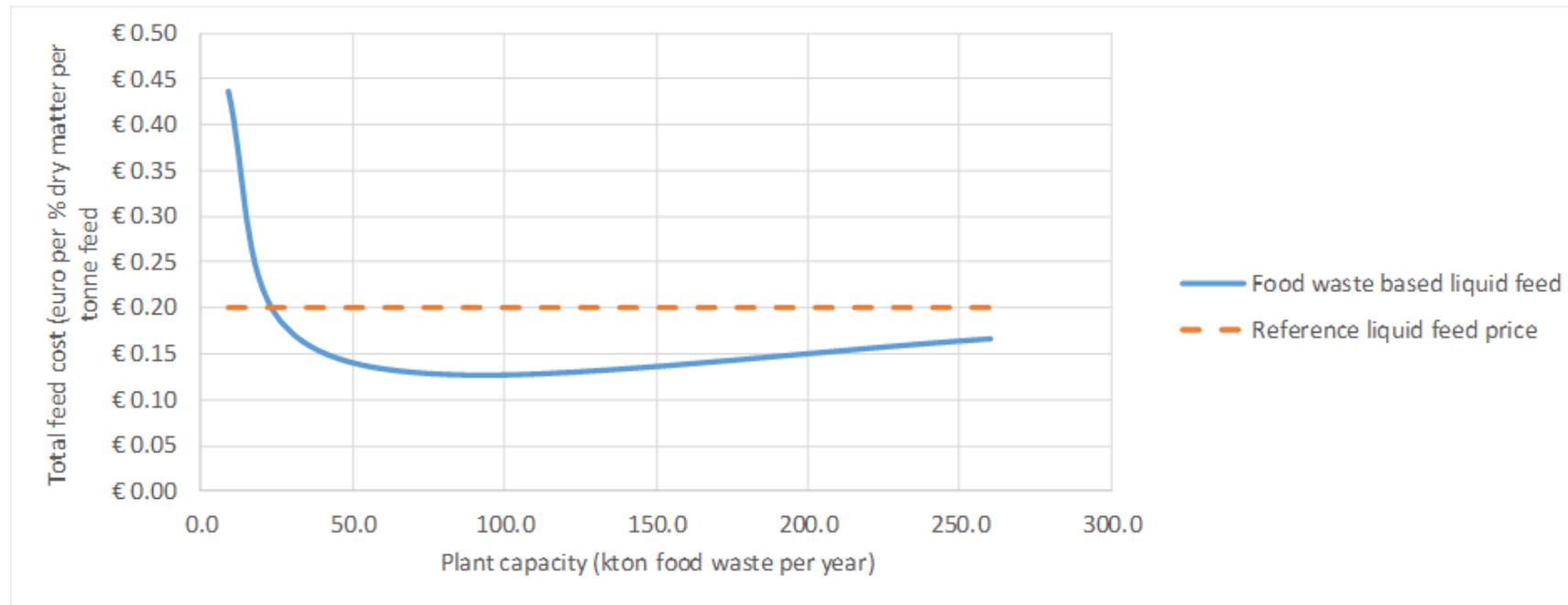
Results – France



Source: De Menna et al, 2019, 'D5.5 LCA & LCC of food waste case studies, REFRESH report'.

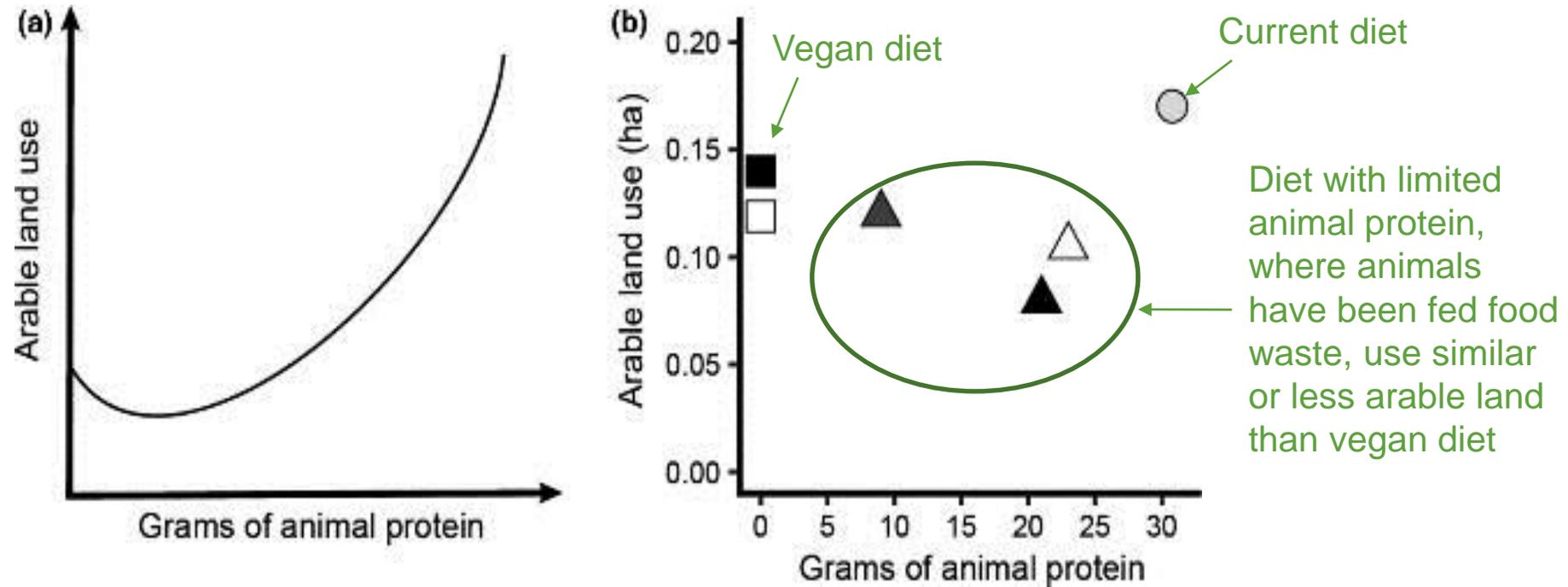
Effect of scale size of processing plant

Most attractive ~100 ktonnes waste processing capacity per year



Source: Luyckx et al, 2019, 'D6.7 Technical guidelines animal feed, REFRESH report'.

Benefit of diet with very small amount of animal protein



Source: Van Zanten et al 2018, 'Defining a Land Boundary for Sustainable Livestock Consumption'. *Global Change Biology* 24 (9): 4185–94.



Environmental and economic potential of surplus food to feed

- Environmental and economic **benefits** of valorising food side flows into pig feed
- This is particularly of interest for countries or regions with **high amounts of side flows and relatively nearby pig farms**
- **Transport distance** plays a role in potential for environmental and cost savings
- Most attractive scenario from an economic perspective:
~100 ktonnes waste processing capacity per year



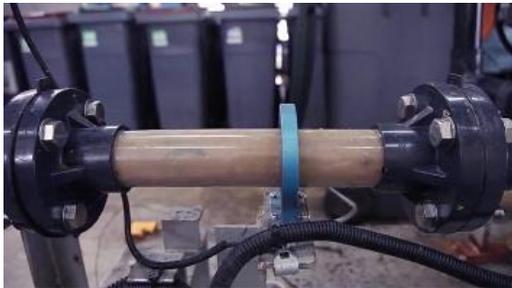
Part 4: Safety, Policy, Consumers

Karen Luyckx,
Feedback





Proposed changes to TSE, animal by-product & feed regulations



- 🥬 **Maintain** feed ban for
 - 🍌 Ruminants
 - 🍌 Untreated / raw surplus food
- 🥬 **Lift** ban on meat-containing, heat-treated surplus food
 - 🍌 Only from licensed facilities
 - 🍌 Only for non-ruminant omnivorous livestock on licensed farms
 - 🍌 Only from retail, manufacturing and commercial catering sources
- 🥬 **No** on-farm treatment
- 🥬 **No** surplus food from
 - 🍌 Households
 - 🍌 International catering, planes, ships, etc

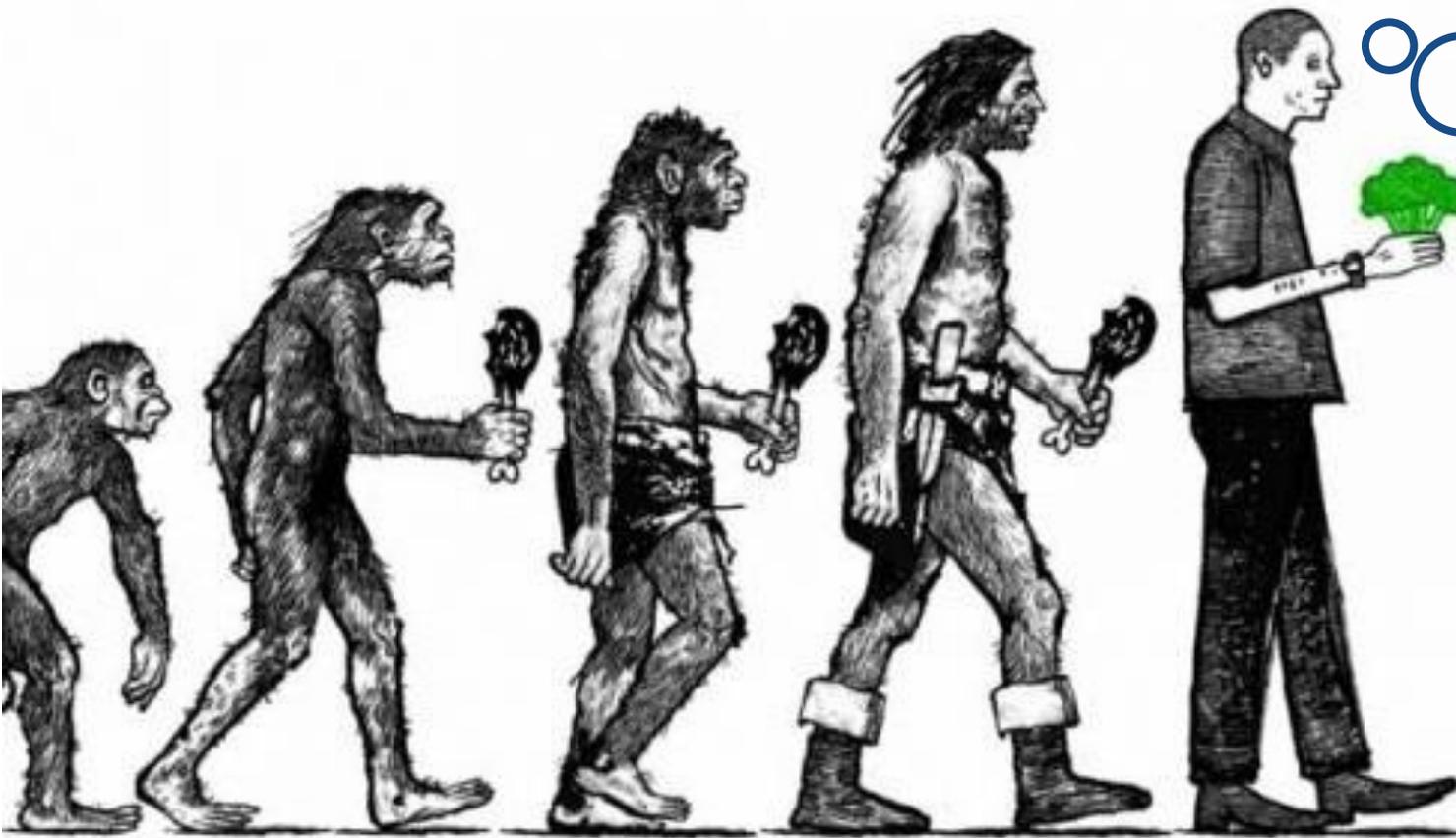


Disease risk management





Consumer acceptance

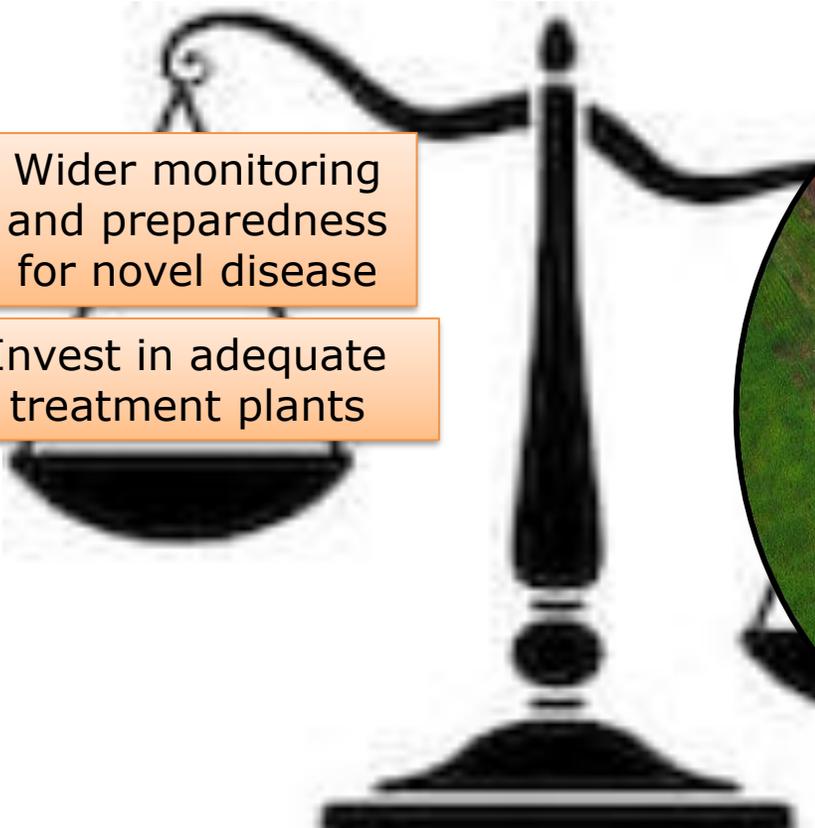


Do I really have
to choose?





Risk Balance



Wider monitoring
and preparedness
for novel disease

Invest in adequate
treatment plants



**IPCC: to stay
within 1.5°C, we
need “rapid and
far-reaching
transitions in **land**,
energy, industry,
buildings, transport
and cities**

Contribute to climate response



Thank you & Questions

Contact

Karen Luyckx, REFRESH Lead on Animal Feed
karen@feedbackglobal.org

Jennifer Davis, REFRESH LCA specialist
Jennifer.davis@ri.se

Tomoyuki Kawashima, Ecofeed Expert
tkawa@cc.miyazaki-u.ac.jp

More information in forthcoming REFRESH reports:

- LCA & LCC of food waste case studies
- Technical guidelines animal feed by Luyckx et al.

