CBIO
AARHUS UNIVERSITY CENTRE FOR CIRCULAR BIOECONOMY

Processing insects for the production of protein

Insects: A new protein source for Europe?

Circular Bioeconomy Days

Aarhus University, Forskningscenter Foulum, Denmark

DIRK SINDERMANN, TJELE, DENMARK, 27TH JUNE 2019

GEA engineering for a better world

GEA – “engineering for a better world”

GEA is one of the largest suppliers of process technology to the food industry and to a wide range of other industries.

17,863
employees (FTEs)

4,605
million revenue (EUR)

The company is listed on the German MDAX stock index (G1A, WKN 660 200) and included in the STOXX® Europe 600 Index.

In addition, the company is listed in selected MSCI Global Sustainability Indexes.

4,751
million order intake (EUR)

The international technology group focuses on process technology, components and sustainable energy solutions for sophisticated production processes in diverse end-user markets.

564
million operating EBITDA (EUR)

12.2
% operating EBITDA margin

1.31
earnings per share (EUR)

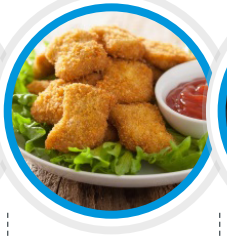
Our applications – in touch with GEA every day

engineering for a better world

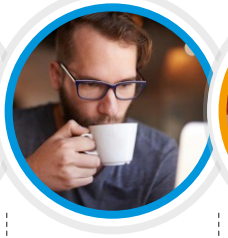
Dairy Farming and Processing

Approx. one quarter of processed milk comes from GEA production systems

Food

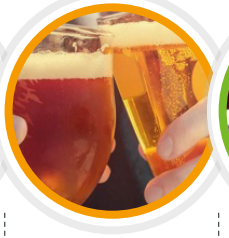


Every third chicken nugget is produced using GEA technology



Approx. every third process line for instant coffee was installed by GEA

Beverages



Approx. every second liter of beer is brewed with the aid of systems and process solutions from GEA

Pharma

Every fourth liter of human blood for making plasma-derived products is processed using GEA equipment

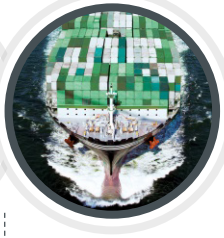
Chemical

More than one third of all polymer producers are using GEA drying technology

Utilities

Each industry we serve utilizes industrial refrigeration technology from GEA

Marine



Every second container ship in the world sails with GEA marine equipment on board

Processing insects for the production of protein

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Image of Insects in Western Cultures

Population development

GEA activities in protein production – today and tomorrow

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Animal proteins

Plant proteins

Alternative proteins

Impacts of conventional protein production

On land

- Water use and pollution
- Land use
- Greenhouse gases
- Feed price volatility
- Soil degradation
- Antibiotic resistance
- Habitat loss

In the ocean

- Overfishing

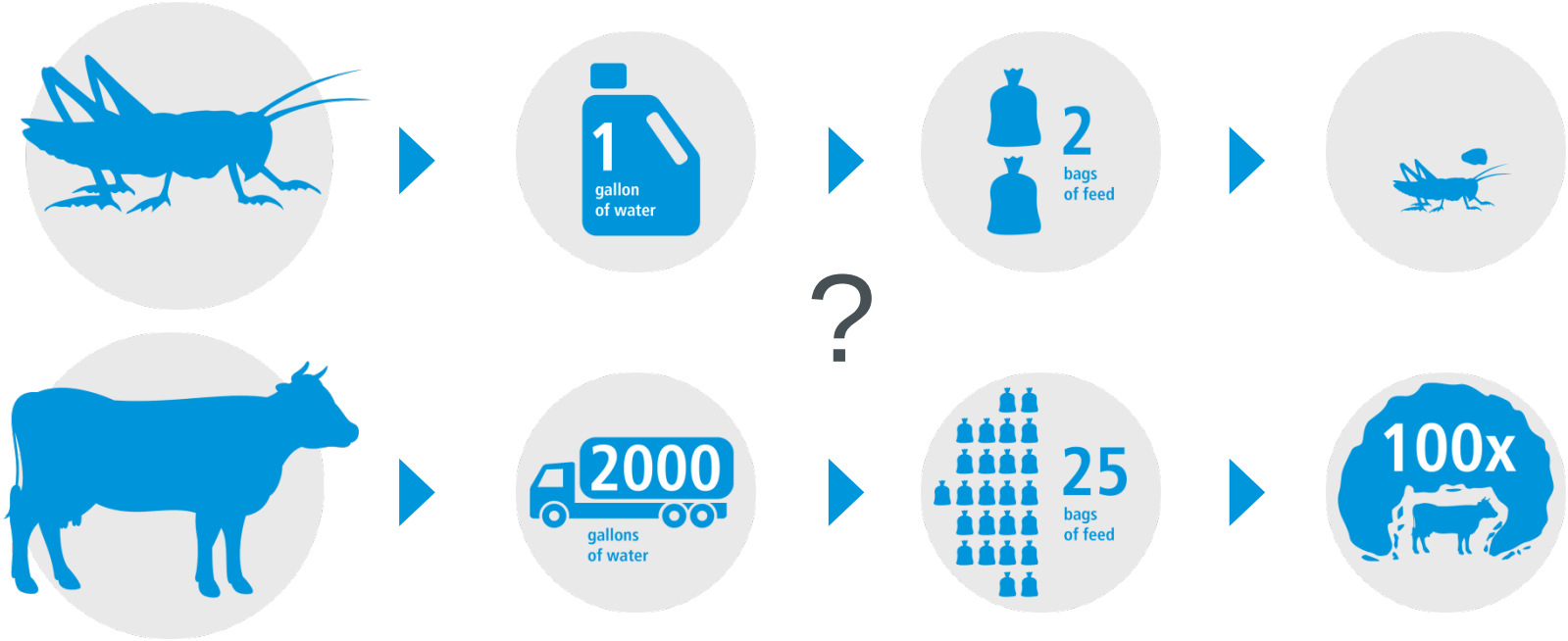
Sustainability of Insects?

1 G = 3.8L / 1P = 0.45 kg

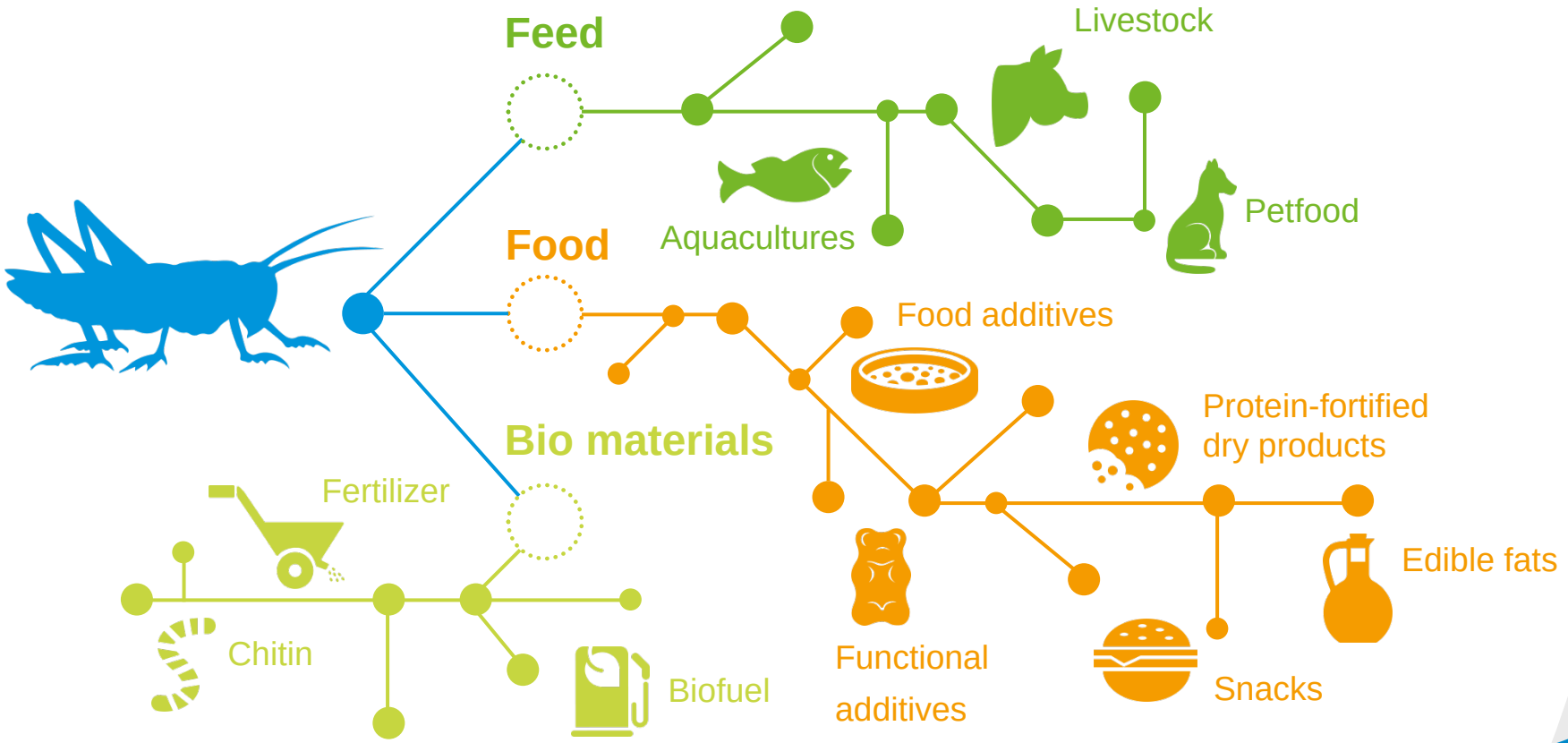
Gallons of water needed to produce **one pound of meat**

Pound of feed needed to produce **one pound of digestible meat**

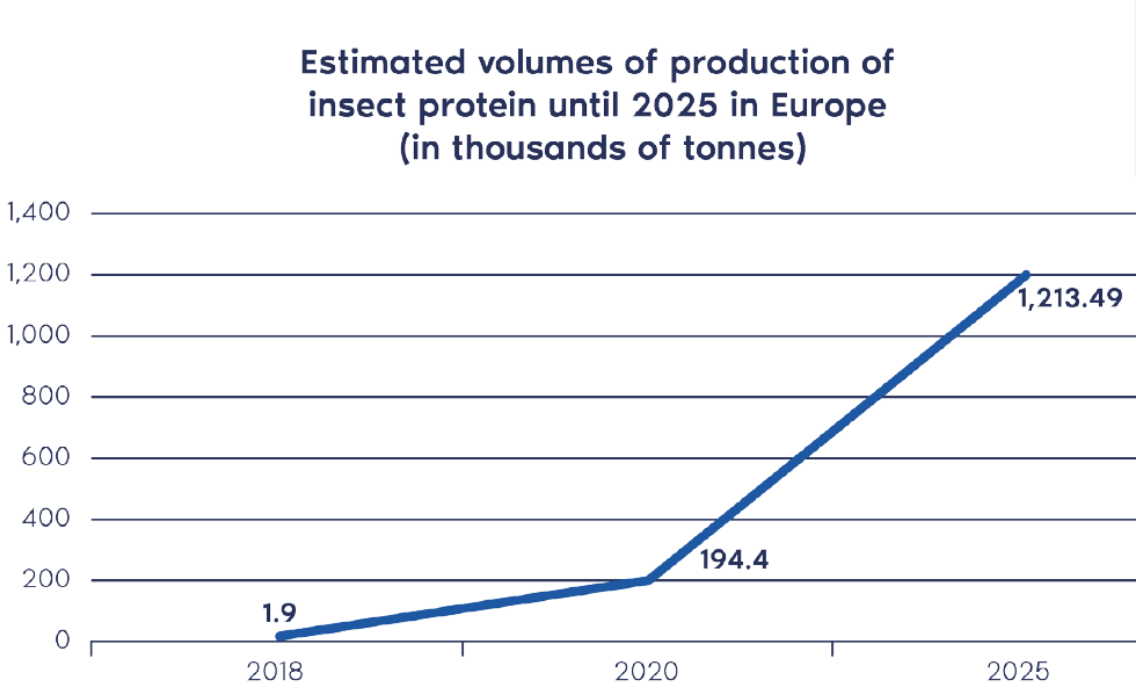
Greenhouse **gas emissions**



Potential for Food, Feed and Bio Materials



Estimated Protein Production from Insects within Europe



Source: IPIFF questionnaire October 2018

Insects for Food: Mealworm Larvae

Lesser Mealworm (Little Beetle)

Alphitobius diaperinus

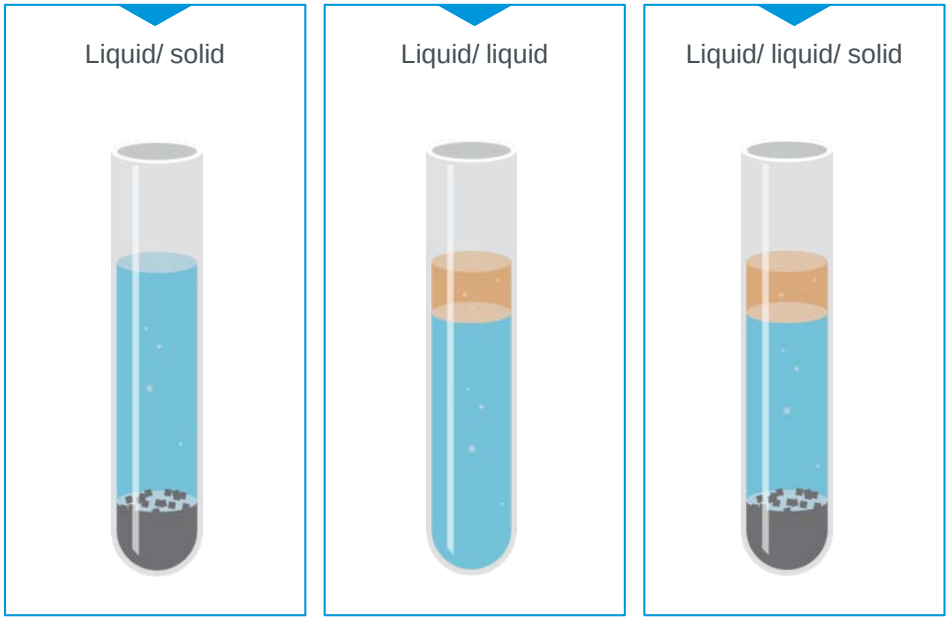
Insects for Food:
Burgers from Mealworm Larvae

Proti-Farm®
The Protein Company

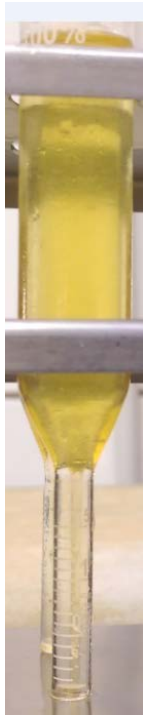
- Co-creation @GEA
- Insect burger
- New: up to 64% insects inside

Fundamental principles of centrifugal separation

Density difference: Separators and decanters can be used for the separation of the following liquid mixtures:



Insects for Food: Recovery of Protein and Fat from Mealworm Larvae



Insects for Feed: Black Soldier Fly Larvae

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Black Soldier Fly (BSF)

Hermetia Illucens

Insects for Feed: EU Perspective

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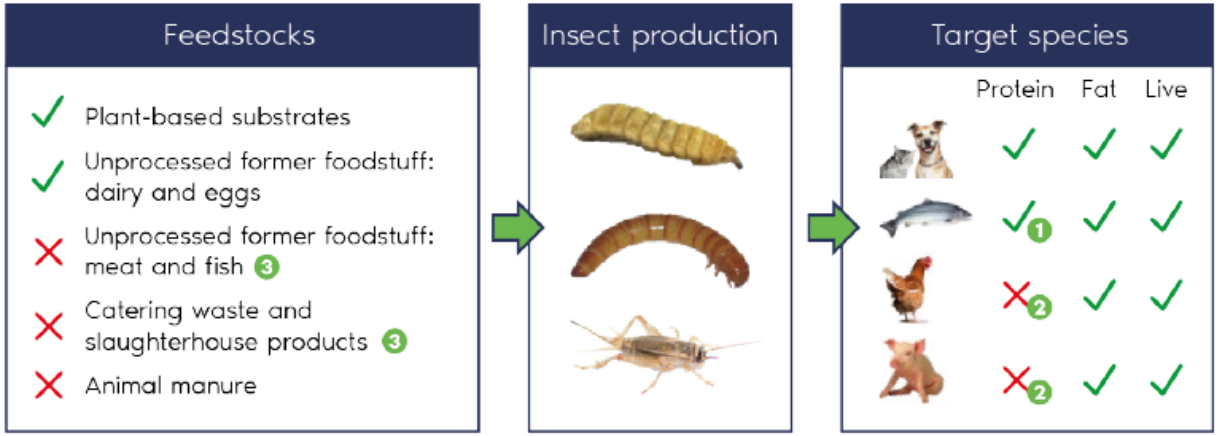
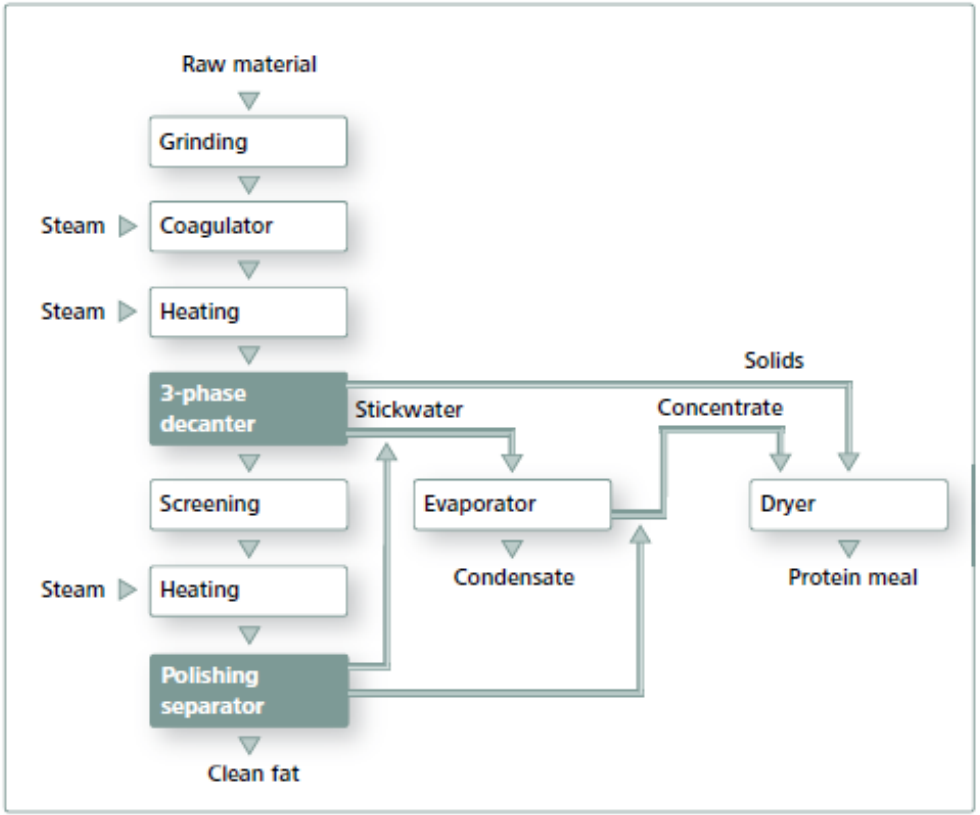
IPIFF roadmap on the use of insects in animal feed

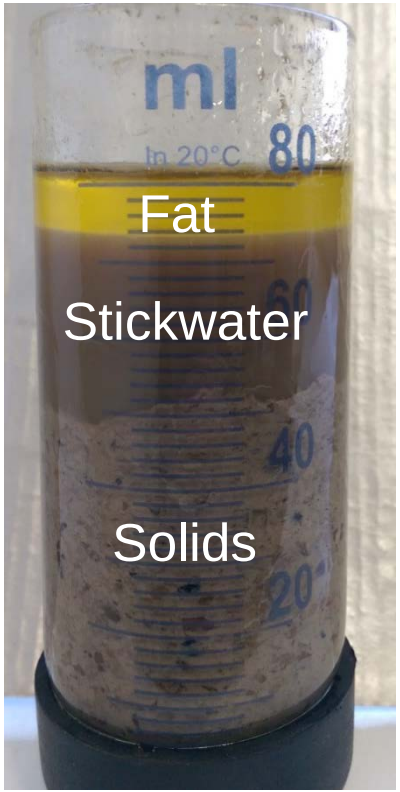


http://ipiff.org/publications-position-papers/

Step	Target	Timeframe
1	Authorise insect proteins for aqua feed use	Target achieved Authorisation effective since 1 July 2017
2	Authorise insect proteins for use in pig and poultry feed	EU discussions may begin end-2018. Approval by Member States possible during the 1st quarter of 2019
3	Authorise 'former foodstuff' and/or catering waste as feed for insects	2020 onwards

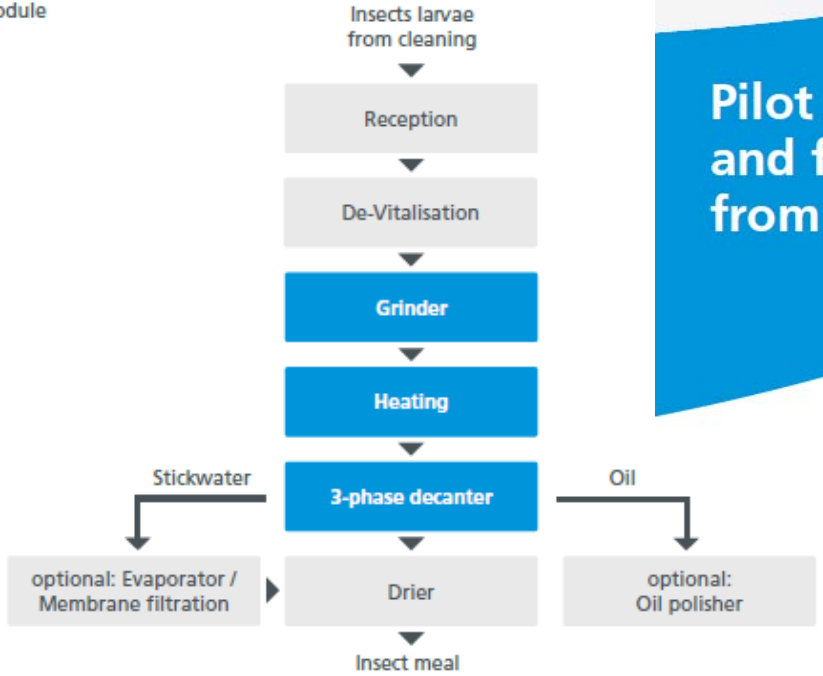
Low Temperature Process
Process for Food and Feed





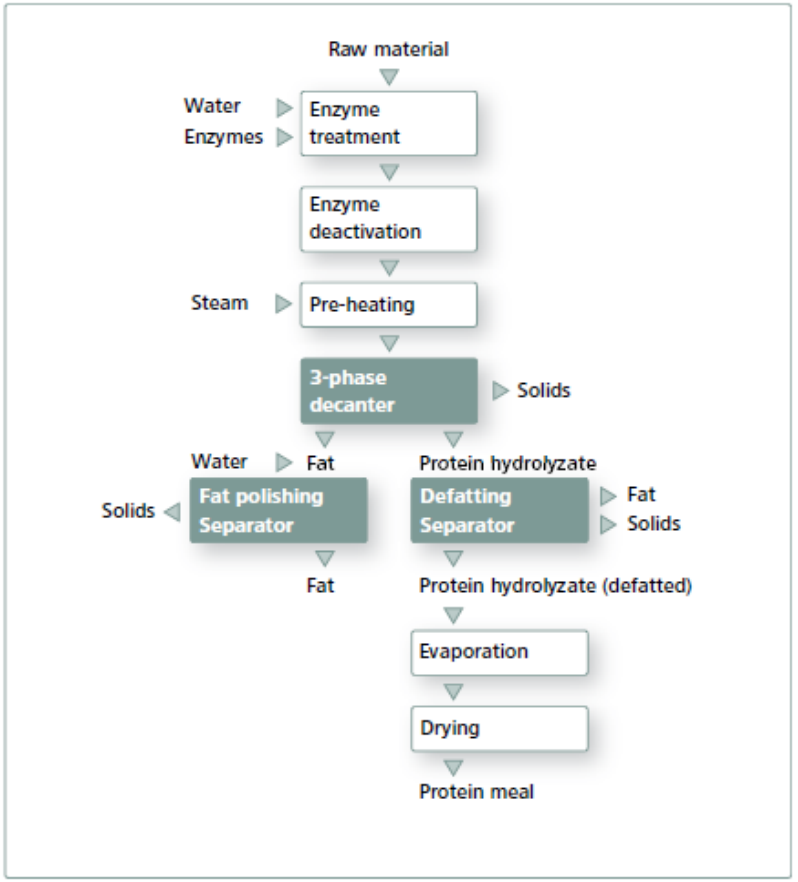
Low Temperature Process
Pilot Plants for Product Development

GEA basic module



Capacity: up to 500 kg/h or 10 t/d

Enzymatic Hydrolysis Process
Process for Food and Feed



Recovery of chitin

as separate phase possible

Pilot plant Haaksbergen, NL

Insects for Feed: Low Temperature Process Devitalisation of Larvae

Insects for Feed: Low Temperature Process Mechanical Separation

Composition	BSF
Dry Substance	28 – 30 %
Fat	9 – 11 %
Protein	10 – 12 %

Insects for Feed: Low Temperature Process Mechanical Separation

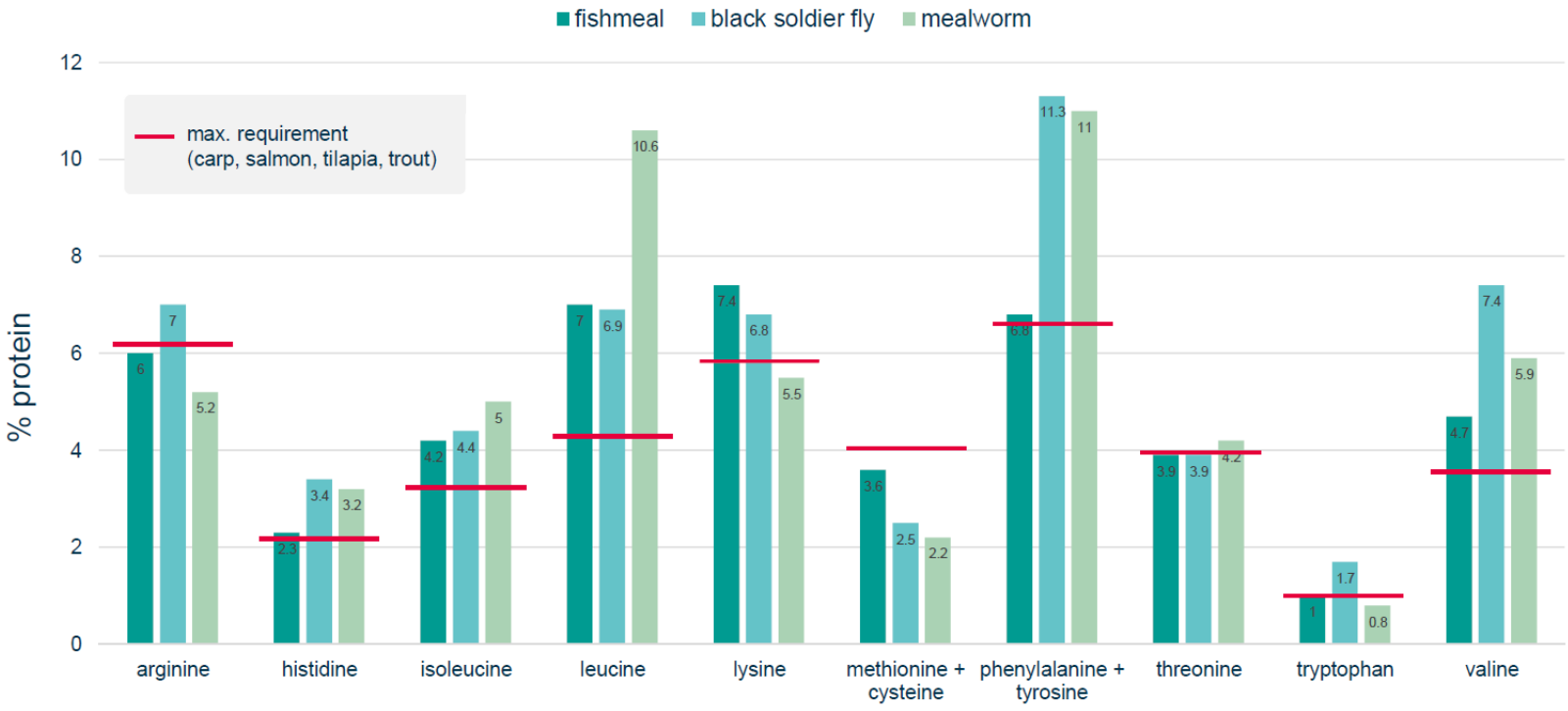
Composition	BSF Meal
Moisture	6 – 10 %
Protein (DM)	54 – 64 %
Fat (DM)	8 – 12 %

Stickwater:

- Can be evaporated and added
- Reducing fat content and increasing protein content

Insects for Feed: BSF Meal

Nutritional value of insect proteins



Source: Bühler, Networking days 2016

Insects for Feed: Low Temperature Process Mechanical Separation

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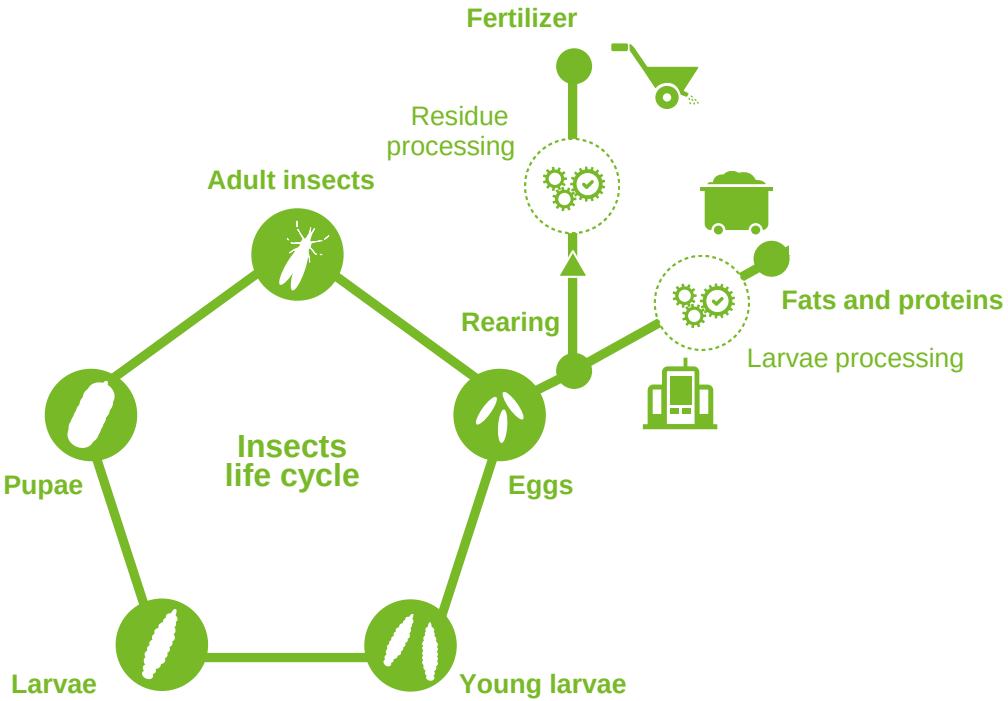
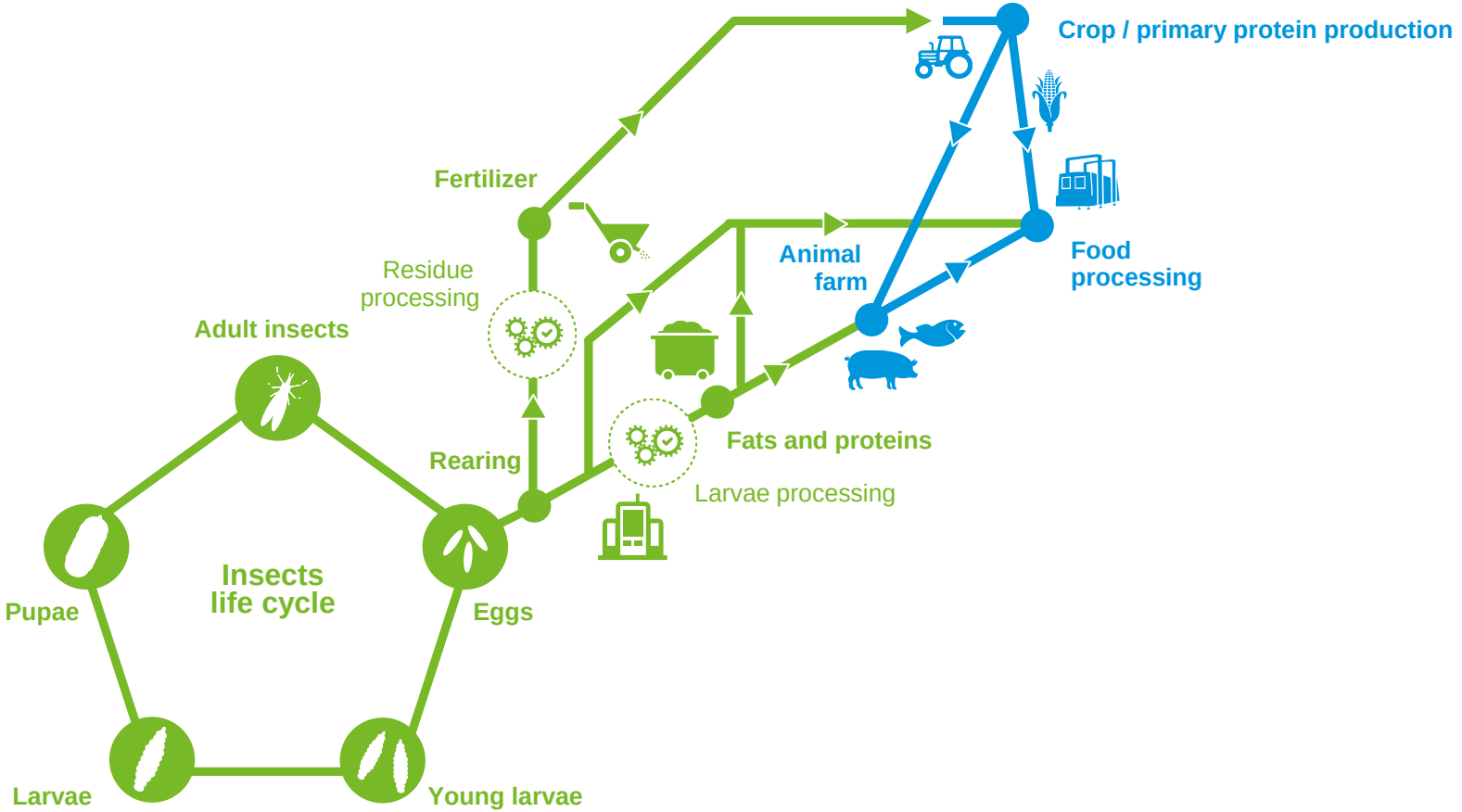
Fat from Black Soldier Fly:

- low in unsaturated fatty acids
- nutty taste and smell

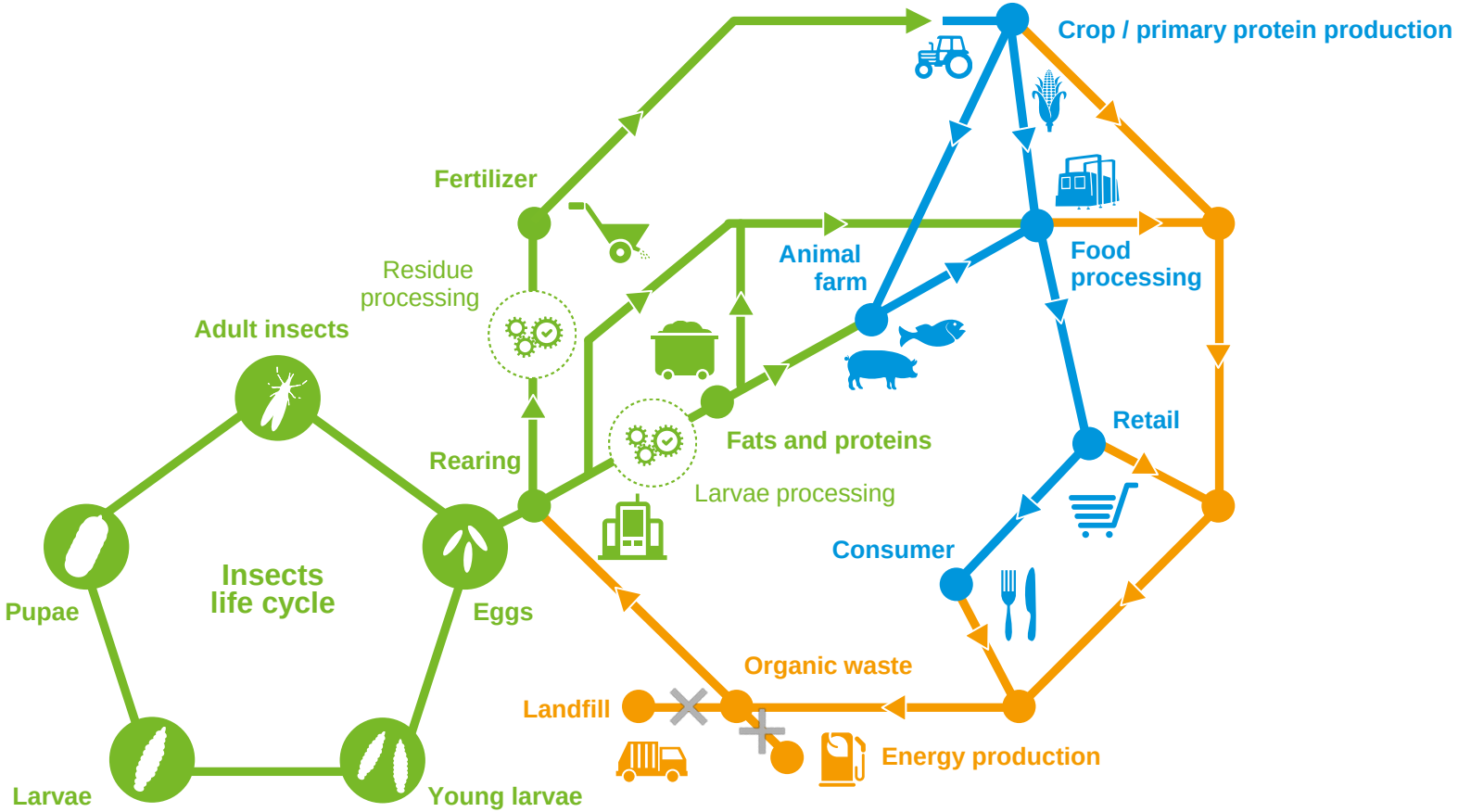
Circular Economy



Circular Economy



Circular Economy



Case Example

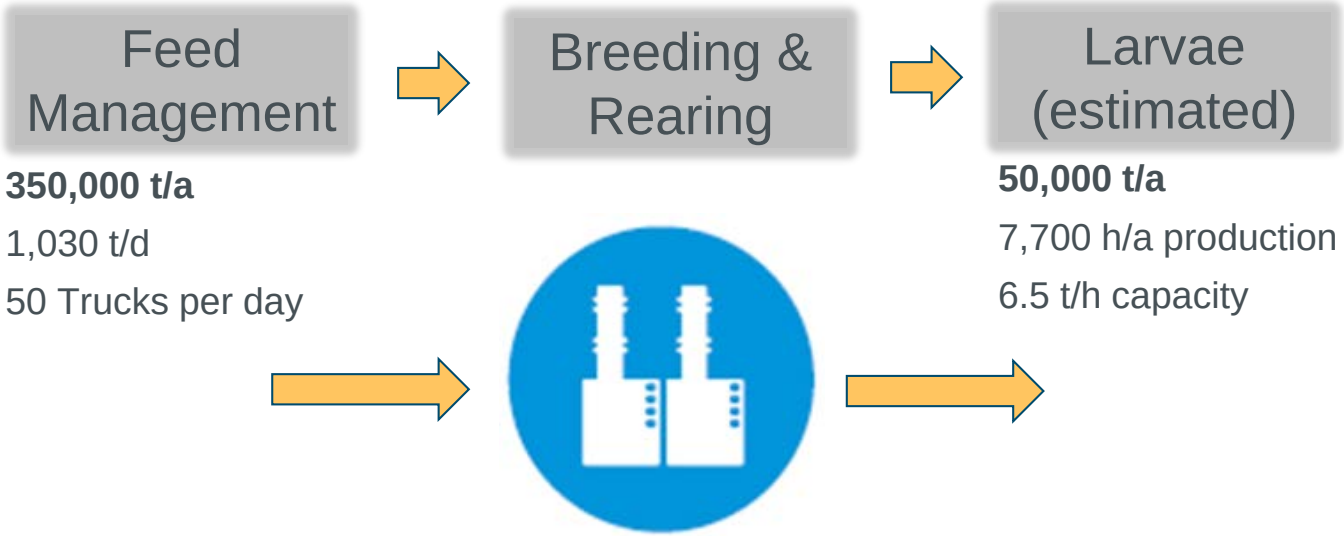
Production 25 – 35 days

365 day/a production

7 kg of (wet) feed for 1 kg larvae

Foot Print of 20,000 m² for 50,000 t larvae /a

Upscaling: Breeding and Rearing Case Example



Upscaling: Processing Case Example

Larvae (estimated) → Processing → Endproducts (estimated)

50,000 t/a

7,700 h/a production

6.5 t/h capacity

1.1 – 1.5 t/h Meal

0.5 – 0.7 t/h Fat

Upscaling Protein Meal and Fat Production Case Example

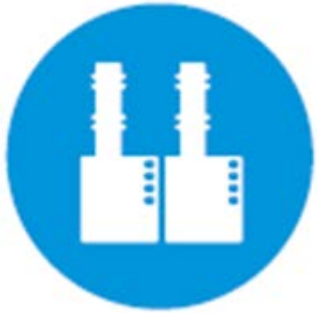
Feed-Management

Breeding & Rearing

Processing

Distribution of Final Products

350,000 t/a
1,030 t/d



8,500– 11,500 t/a
1.1 – 1.5 t/h Meal

3,800 – 5,400 t/a
0.5 – 0.7 t/h Fat

Circular Economy
Future Green Solutions

Future Green Solutions
A business of tomorrow

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Food Waste

Helping to solve the current food waste crisis. Diverting organic food waste from landfill, as use for BSF feed. Current research is investigating other organic wastes for feed.

Black Solider Fly

Black soldier fly (Hermetia illucens) larvae are ferocious feeders that efficiently convert organic waste into high value proteins and oils for use in livestock and aquaculture feeds.

Soil Ameliorants

The resultant larvae castings can then be utilised as high grade soil ameliorants.

Waste Treatment

Currently investigating opportunities for BSF to treat problematic organic wastes.

The University of Western Australia
Achieve International Excellence

FRDC
Fisheries Research & Development Corporation

RIDLEY AgriProducts

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2017 WA Seafood Industry Awards
WINNER
Research, Development & Extension Award

Insect Protein Association of Australia
Proud Member

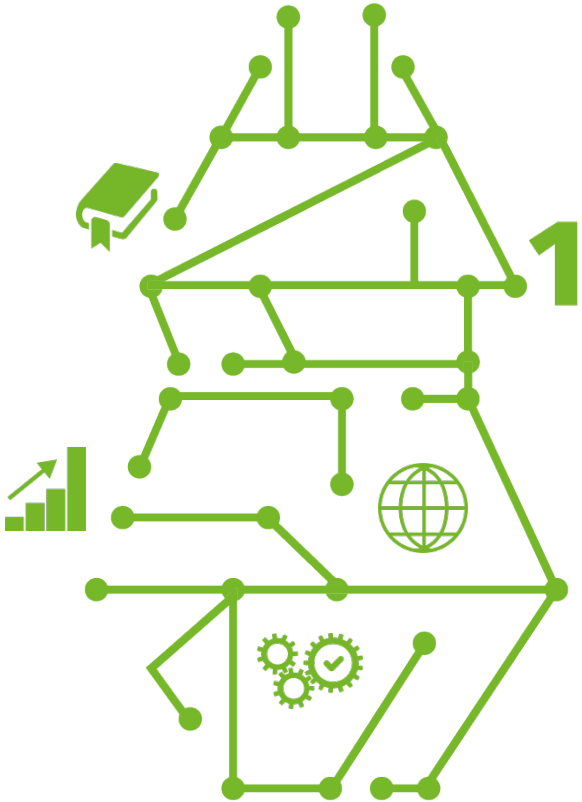
foodfutureWA

Perth NRM

Department of Primary Industries and Regional Development
Government of Western Australia

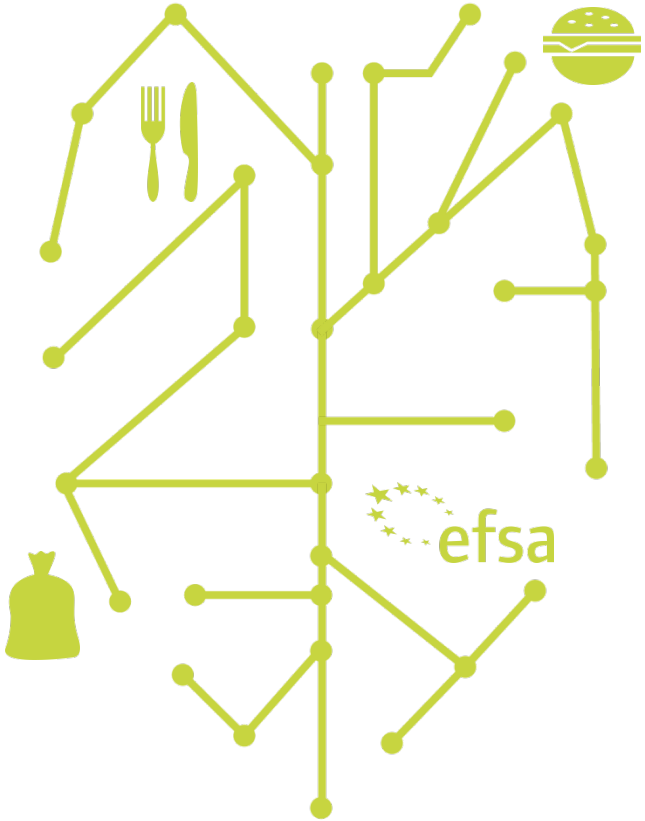
Summary
Application

- Process know-how available
- All process steps can technically be covered
- Not replacing existing protein sources but helping to fill the protein gap sustainably
- Room for further innovations



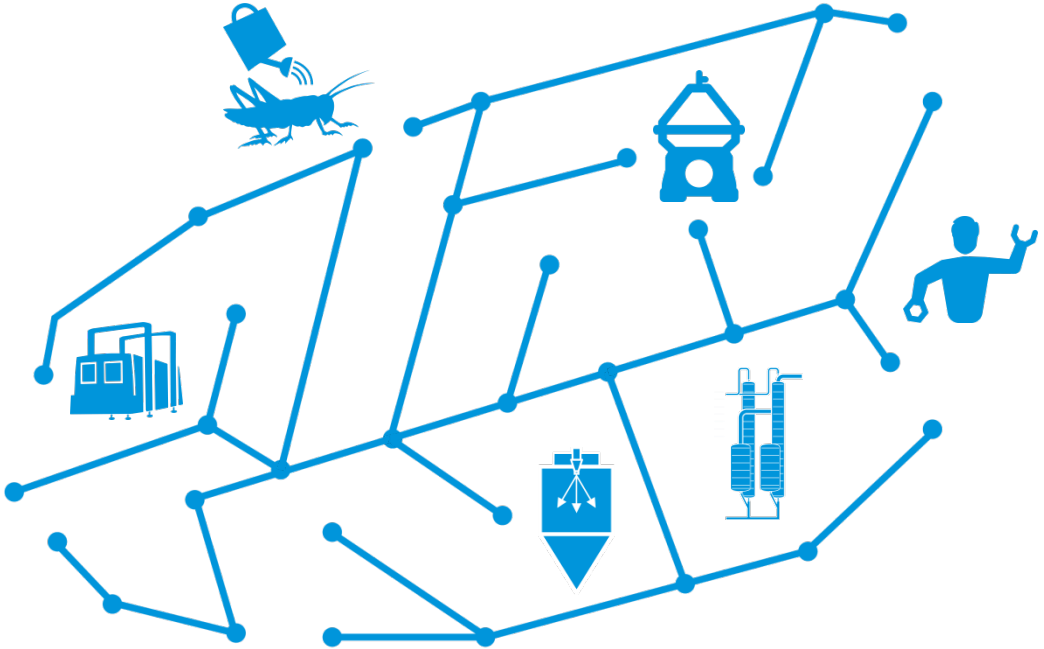
Summary
Region

- In many regions fit for food
- In many regions fit for feed
- Product design helps (for food)
- Movement where restrictions are still in place



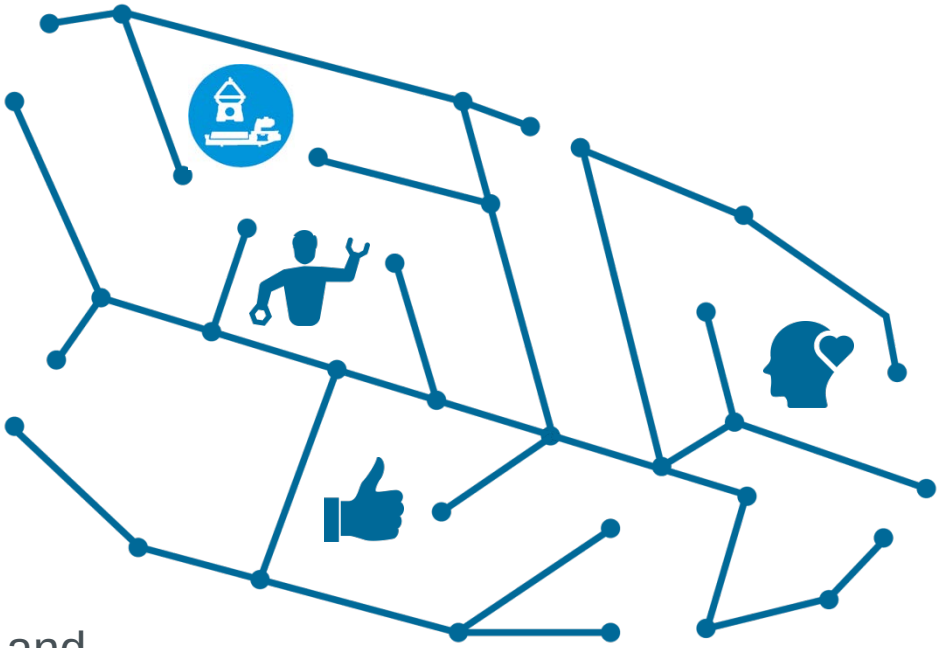
Summary
Technology

- We are ready,
  no new machines
- Opportunities for Farming
  (alliances and co-operations)
- Collecting further
  competence for alternative
  proteins

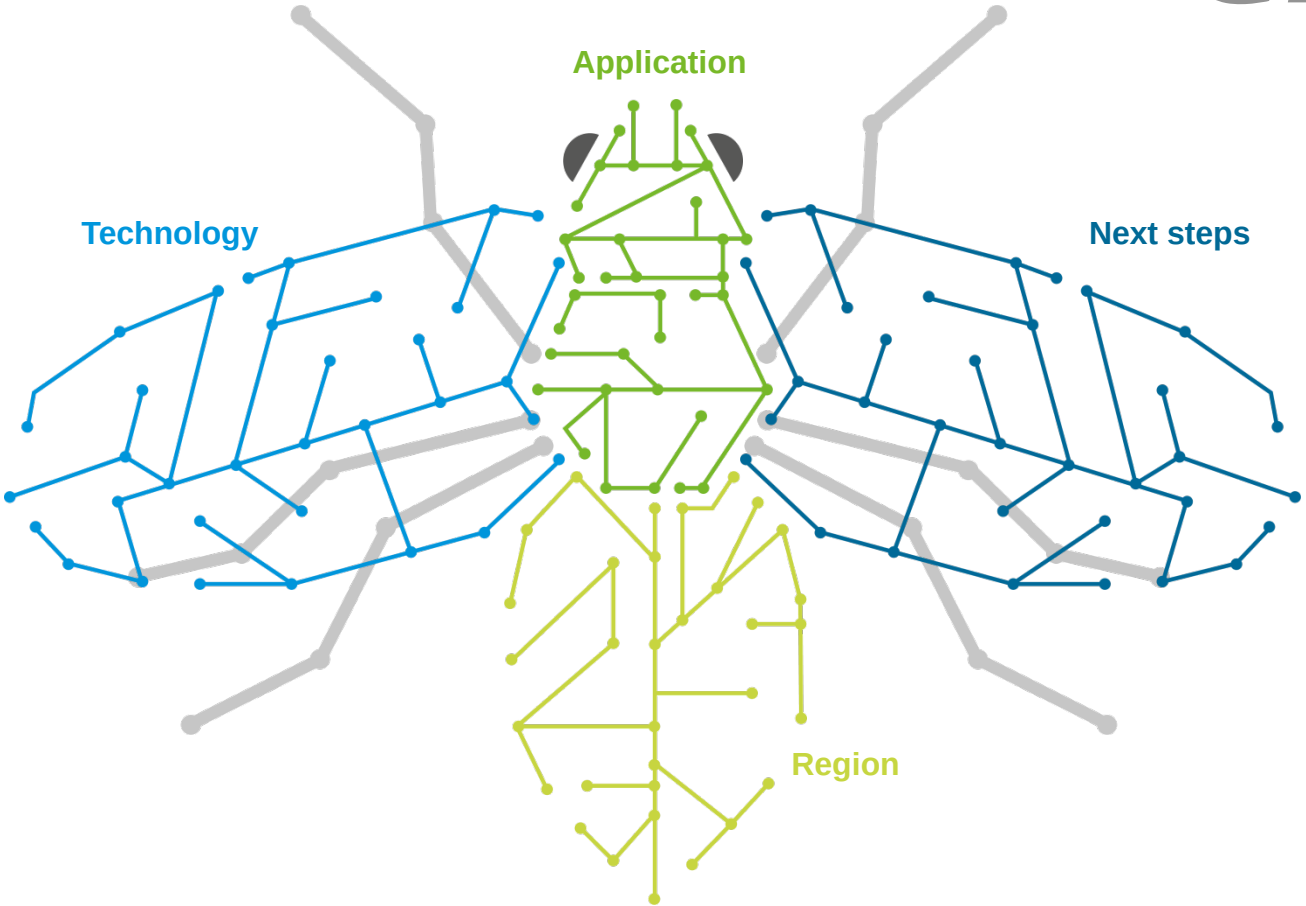


Outlook
Next steps

- Further testing with different raw material, substrates, equipment,…
- Committed regarding alternative proteins without loosing focus on traditional applications
- Co-operating with partners to be able to offer complete solutions
- Open minded regarding new trends and developments



Insects as Alternative Protein Source



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