

Black Soldier Fly Larvae Bioresource

- A Sustainable Waste Management Approach



Kankyo Bert

German Technology • Indian Engineering

About Us

- Design Engineering
- Project Management
- Technology Optimisation
- Turnkey Projects
- Operation & Maintenance
- Training
- Research & Development



Kankyo Bert has three decades of experience in biogas management starting from Concept to commission. Backed by a strong team of experienced professionals it offers pre-engineered and customised biogas solutions for a range of applications.



Our Core Values

Our Vision

Be a leading driver for a commercially viable biogas solutions globally

Our Mission

Our Mission to strive hard to achieve what has not been achieved hitherto and produce the world's best products & services in terms of quality, reliability and performance to serve the domain of biogas and translate our advanced technologies into value for our customers and stakeholders.



Need Of The Hour

Waste management is still a challenge in low income settings

- Organic solid waste is 50-80% of waste mass and is yet hardly recovered and recycled
- Strategies and policies are more and more including aspects of circular economy

Current organic waste recovery/recycling still faces a «value chain» challenge

- Compost typically has limited value and customers are not where the product is
- Biogas often suffers from cheap energy competition
- Char production (or biomass fuel) is promising but limited to dry materials

How else can we create value from waste?

BSFL - The right approach

**Creates
value from
waste**

Good substitute

- Fishmeal
- Soymeal

Why BSFL

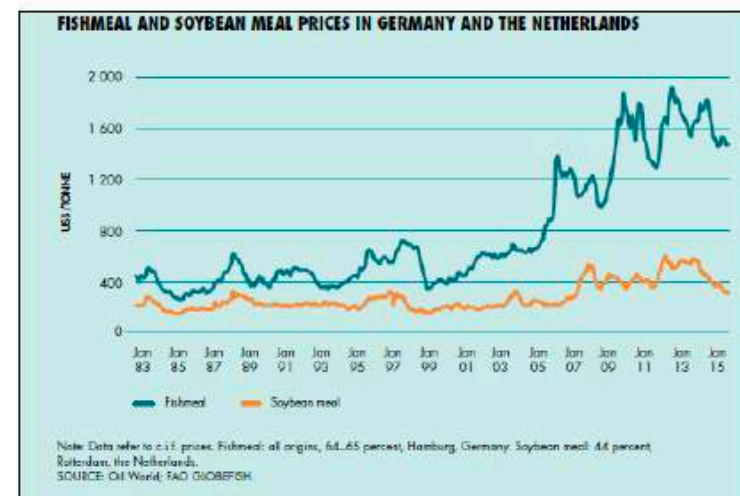
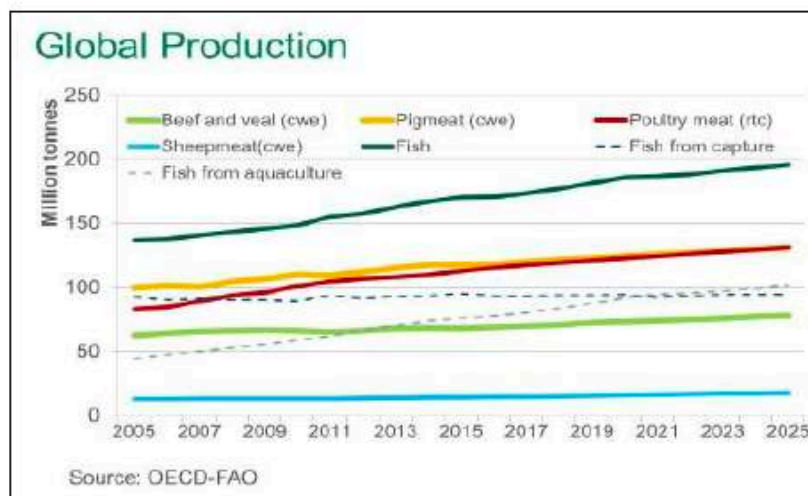
Harvested BSF larvae are versatile

- Whole larvae (fresh or desiccated) can be fed to pets, fish and poultry. Dried larvae can be ground to insect meal and fed to fish and pets.
- Larvae milk (pressed larvae devoid of the chitin part) can be further processed to insect meal or protein.
- The oil component can be separated and used for nutrition, as lubricant, for cosmetics, or for bio-diesel preparation
- Even the left-over can be collected and used as a high-value fertilizer.



The Potential

- Demand for protein rich nutrition is rapidly increasing - driven by world population growth
- Insect protein can play an important part in human and animal nutrition in aquaculture, poultry and pig farming (FAO)
- Insects are traditional fodder animals
- Industrial produced defatted insect protein meal was successfully tested as animal feed
- Water consumption, land demand and required feedstuff quantities for insect farming are generally lower as for intensive animal production of pig, cattle and fish
- Other option: Application in biofuel, biolubricants and biotechnology sector



Global Opportunity

DRIVERS

- Rising Global Meat Demand
- Growing Aquaculture Industry
- Increasing Government Support for the Use of Insect Meal in Livestock Feed

MARKET SEGMENTATION

BY PRODUCT TYPE

- Protein Meal
- Biofertilizers (Frass)
- Whole Dried Larvae
- Larvae Oil
- Others (Live, Larvae, Adult, Cocoon, & Pupa)

BY APPLICATION

- Animal Feed
- Agriculture
- Pet Food
- Others

BY GEOGRAPHY



Asia Pacific : The Largest Share

 CAGR
(2020-2030)

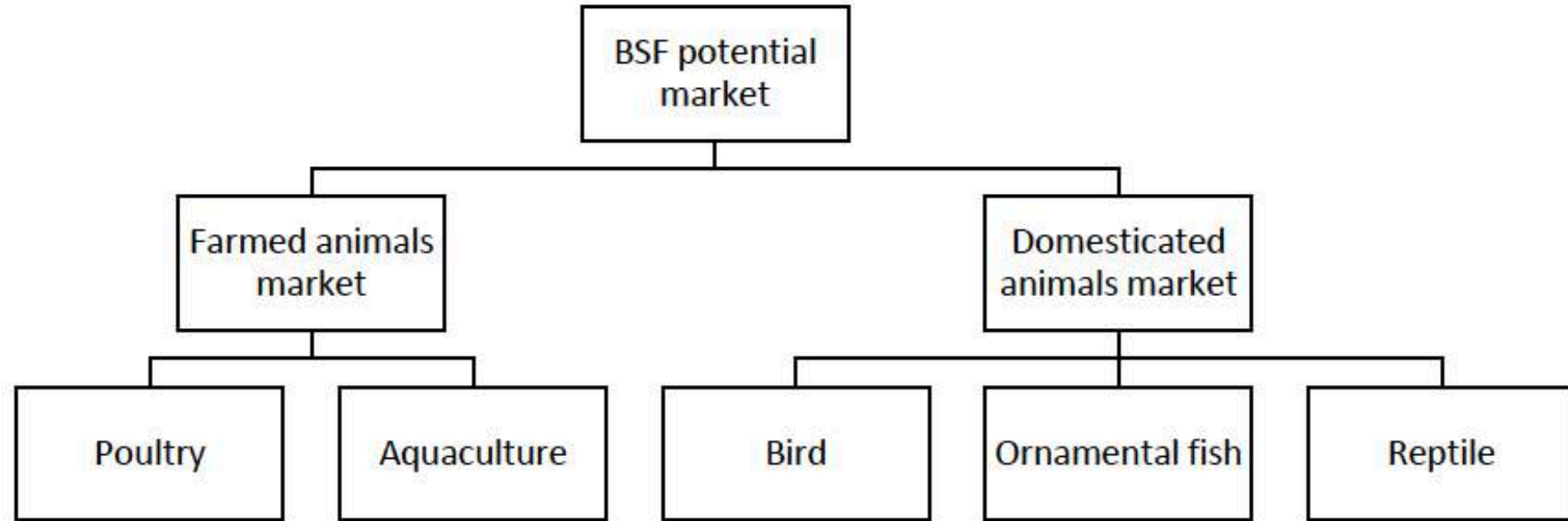
34.7%



Market Size USD

3.4 Billion

Target Segments



Potential Feedstuff

Potential feedstuff for technical product application

- Animal manure
- AD digestion plant digestate
- Organic fraction of municipal solid waste
- Biowaste (source separated organics)
- Restaurant waste and market waste
- Slaughter house waste

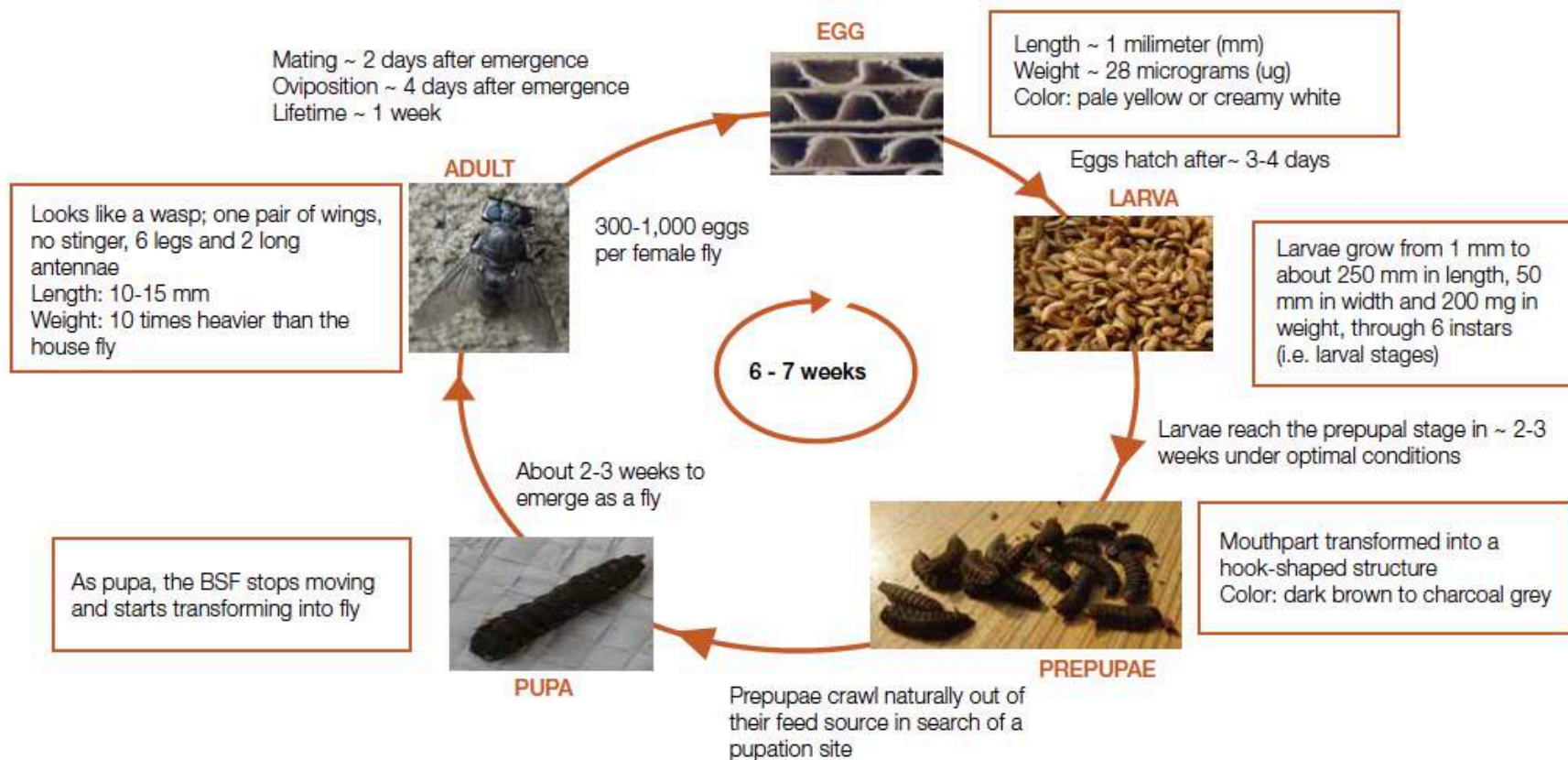


Feedstuff for product application in the feed and food sector

- Residues from ethanol and sugar production
- Residues from vegetable oil and biodiesel production
- Milling by-products
- Crop silage and feed grain
- Aquatic plants
- Brewery residues
- Residues from food Industry



The Life Cycle



Factors Influencing BSFL

Factors influencing the growth performance of the BSFL

Physical

- Moisture content
- pH
- Relative humidity
- Temperature
- Feeding system

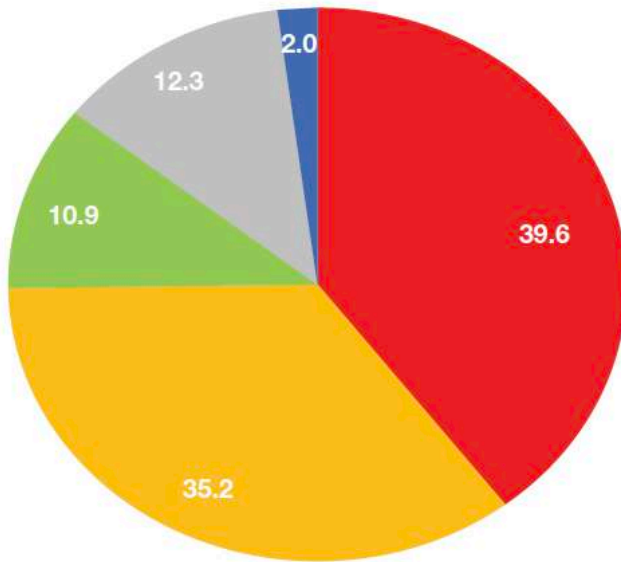
Chemical

- Protein
- Amino acids
- Carbohydrate
- Lipid
- Vitamins
- Minerals

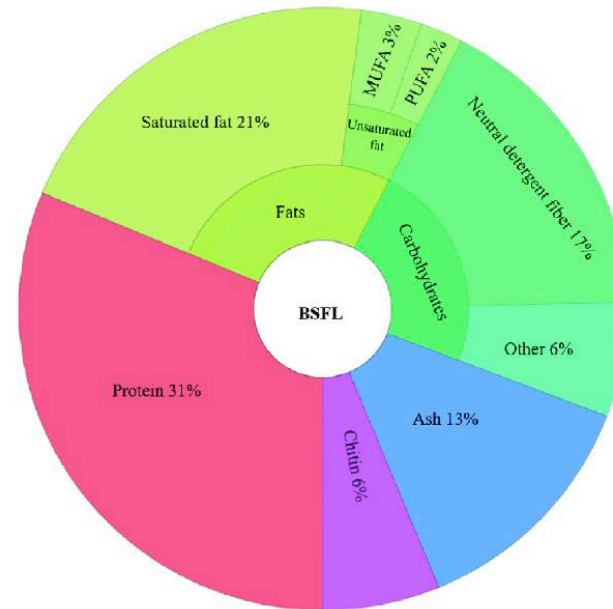
Others

- Heavy metals
- Larval density
- Particle size of substrate
- Light-dark cycle

BSFL Composition



■ Crude protein ■ Lipid ■ Crude fiber ■ Ash ■ Other



Main components	Average value	Minimum value	Maximum value	Standard deviation
Crude protein (% DM)	39.6	35.0	43.6	2.7
Lipid (% DM)	35.2	13.9	49.0	9.5
Crude fiber (% DM)	10.9	7.0	24.4	6.7
Ash (% DM)	12.3	2.7	25.7	6.6
Dry matter of the fresh larva (% WW)	38.6	31.1	44.0	4.8
Chitin (% DM)	6.5	4.5	8.7	1.7
Gross energy (MJ kg ⁻¹ DM)	22.1	-	-	-

BSFL Mineral Composition

Table.3 Mineral composition of BSF larvae

Mineral	Mean value
Calcium	75.6 g/kg
Phosphorus	9.0 g/kg
Potassium	6.9 g/kg
Sodium	1.3 g/kg
Magnesium	3.9 g/kg
Iron	1.37 g/kg
Manganese	246 mg/kg
Zinc	108 mg/kg
Copper	6 mg/kg

(Source: Newton *et al.*, 1977)

Table.1 Comparison of nutritional value of black soldier fly larvae meals vis-à-vis conventional meal

Constituents (% in DM)	BSF Larvae	Fish meal	Soy meal
Crudeprotein	56.9	70.6	51.8
Lipid	26.0	9.9	2.0
Calcium	7.56	4.34	0.39
Phosphorus	0.90	2.79	0.69
Ca:P ratio	8.4	1.56	0.57

(Source: Makkar *et al.*, 2014)

BSFL Truly Sustainable

Simple labor skills

Natural matured technology

Very Low Carbon footprint

Low Investment cost

Non pest insect

Multiple product value

Social acceptance

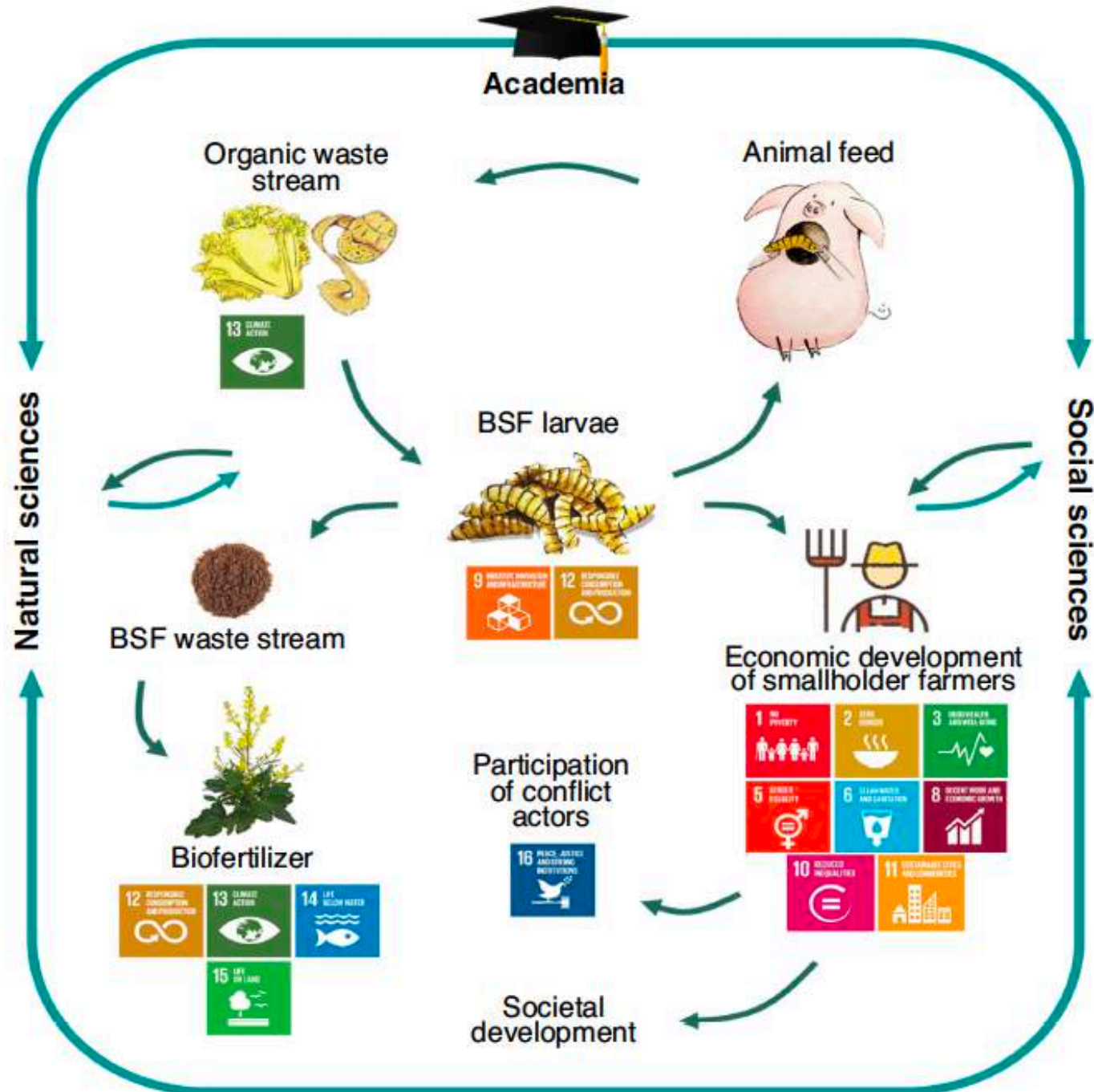
Livelihood

Environment friendly

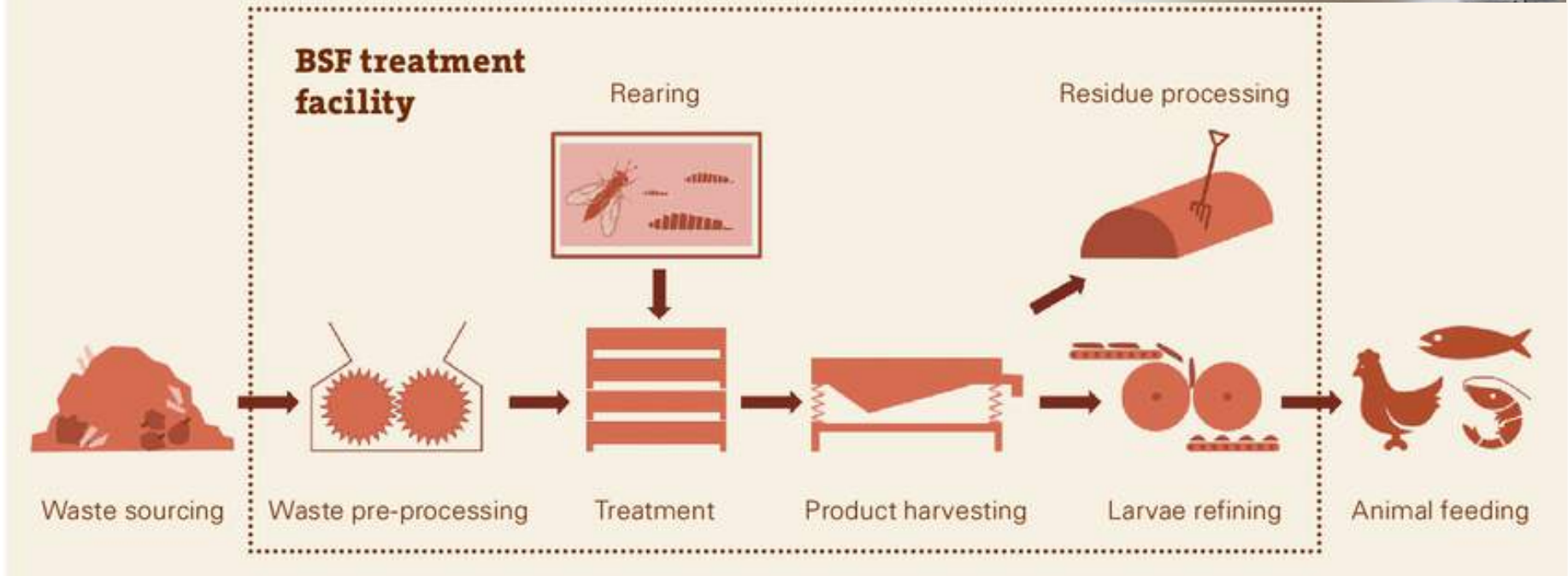
Odourless



BSFL meets SD Goals



BSFL Process Facility



Waste to Value Concept

Waste to Value: Insect bioconversion

Fruit and vegetable wastes are crushed and conditioned to at least 70% moisture.

Insect bioconversion

Larvae and frass are the outputs emerging from the bioconversion process.

1000 kg of waste F&V substrate



Converted by BSFL
14 to 21 days

Yields 50 kg of fresh BSFL
and
140 kg of frass



1000 kg of F&V waste

Moisture content – 800
Protein – 39
Lipids – 28
Total carbohydrates – 175

*All values in kilograms

Nutrition

Upcycling

16 kg of dry BSFL

Protein – 13
Lipids – 15
Total carbohydrates – 6
Chitin – 1

*All values in kilograms

- The waste substrates undergo bioconversion mediated by insects and are further processed to obtain high-value products suitable for various applications.
- Insect meal provides energy, high quality proteins and lipids for animal nutrition.

Industrial applications of lipid, protein, chitin fractions and frass



BSFL Frass



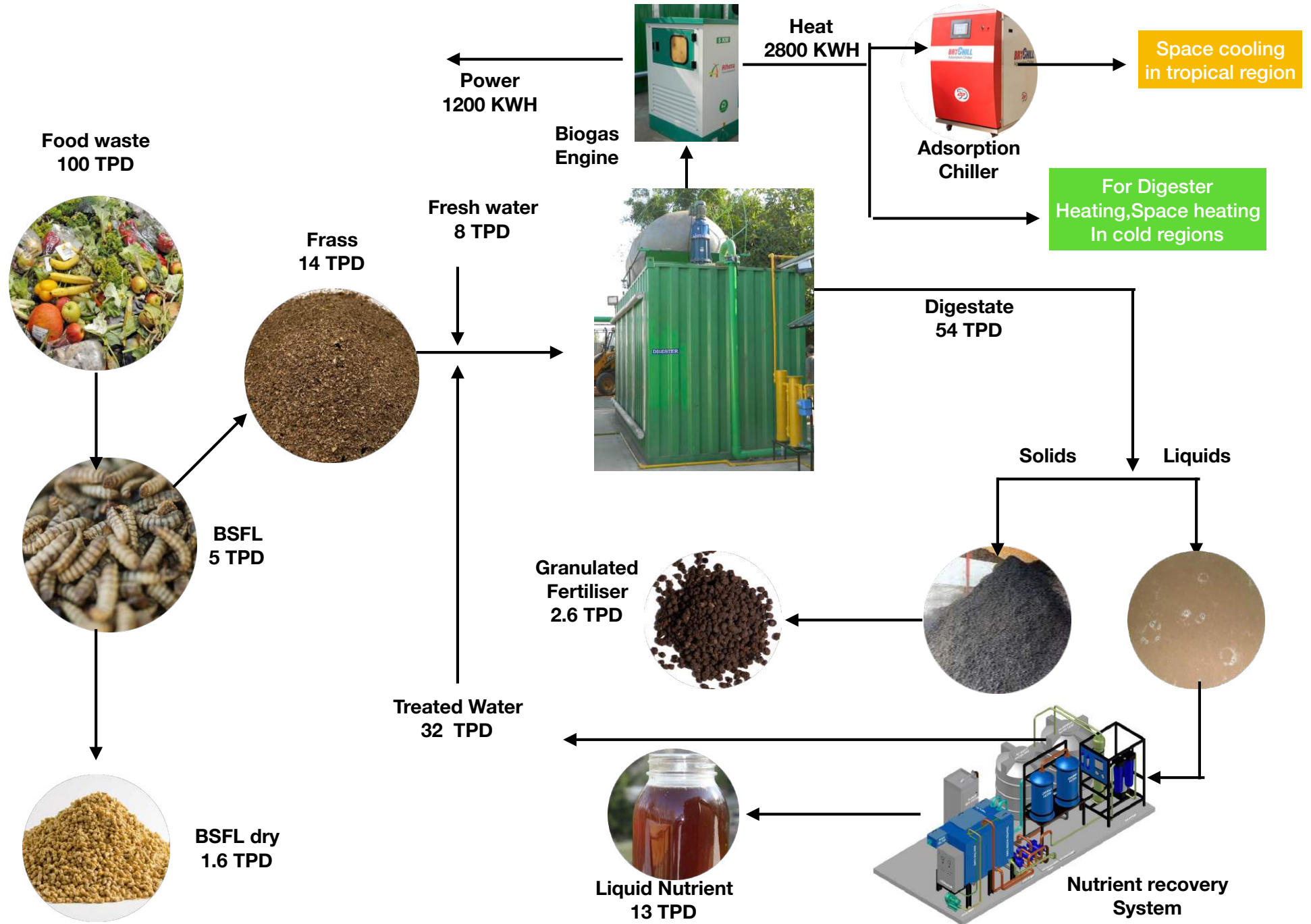
Main Features of BSFL Frass

- ✓ All natural & organic
- ✓ Rich in insect chitin and calcium
- ✓ Water soluble
- ✓ Odourless
- ✓ Pathogen-free
- ✓ Zero chemical additive
- ✓ High in organic matter and nutrients
- ✓ Full of beneficial microorganisms
- ✓ Sustainable and environmentally-friendly

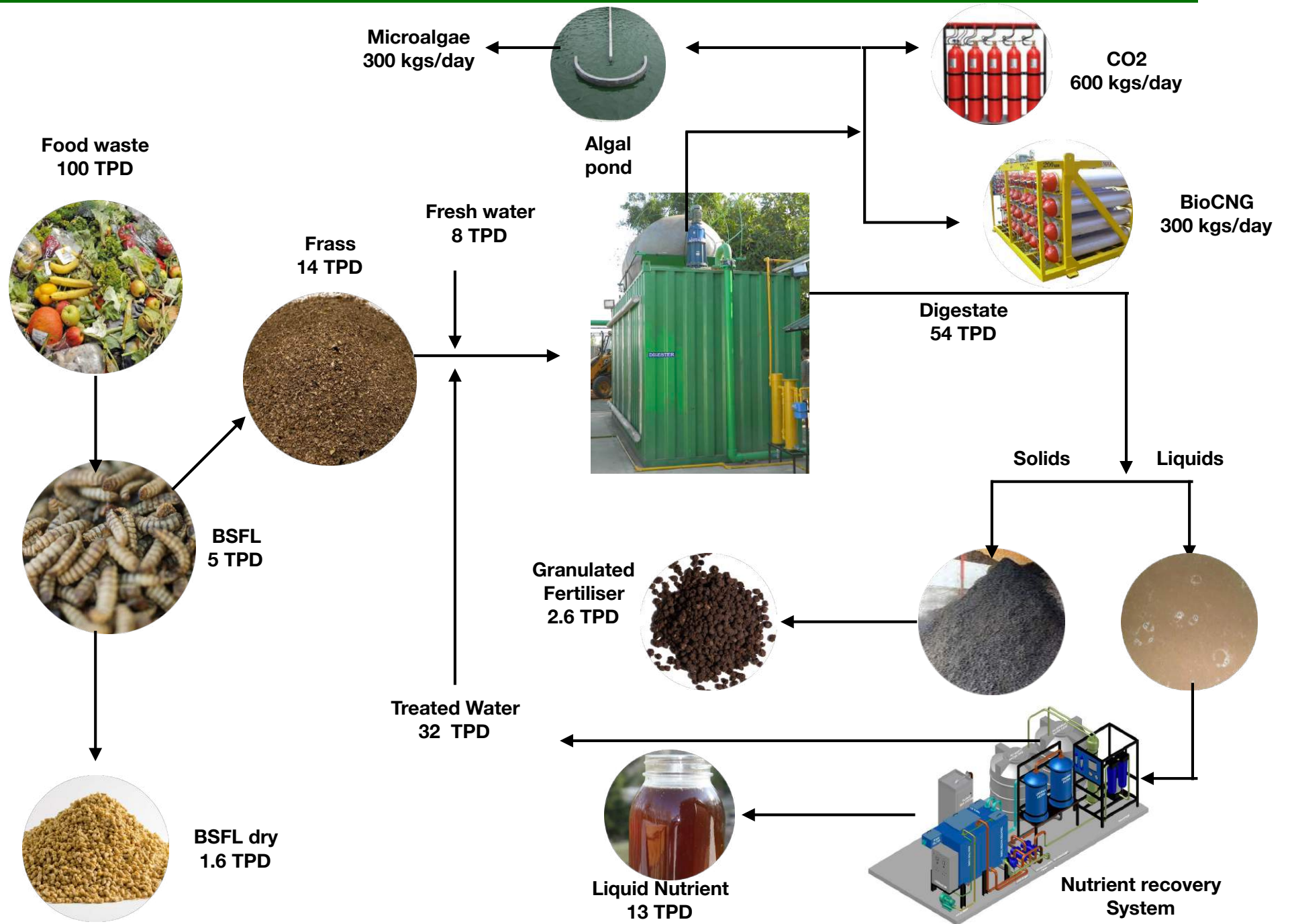
Benefits of BSFL Frass

- ✓ Chitin provides a natural way to protect plants from pests, pathogens and diseases by boosting plant's immune response system
- ✓ Promotes rapid mineralization and faster nutrient release
- ✓ Promotes seed germination and early development
- ✓ Promotes healthy flowering, fruiting and root development
- ✓ Does not attract flies and other insects
- ✓ Can be used in fertigation and hydroponics
- ✓ Beneficial microbes improve overall soil health
- ✓ Helps retain moisture and nutrients in soil
- ✓ Helps maintain soil pH for optimum plant growth
- ✓ Great as soil amendment and conditioner
- ✓ Improvements can be seen as early as 2 weeks to 3 months

Bio-resource Outputs



Bio-resource Outputs



Multiple Resources



Dry BSFL



Frass



Nutrient



Micro-algae



Dry BSFL
Sludge Granules



Pure water



BioCNG



CCHP



CO2

Our R&D Team

ICAR-CIBA New Startup initiative for the production of 'Black Soldier Fly meal (BSF)' as an effective and sustainable fishmeal replacement source



The Specifics

A typical 100 TPD Organic waste to BSFL processing facility requires



12,000 m²



1700 - 2700 KWH



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BSFL the road towards sustainability