Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

How to combine insect farming with a biogas process?

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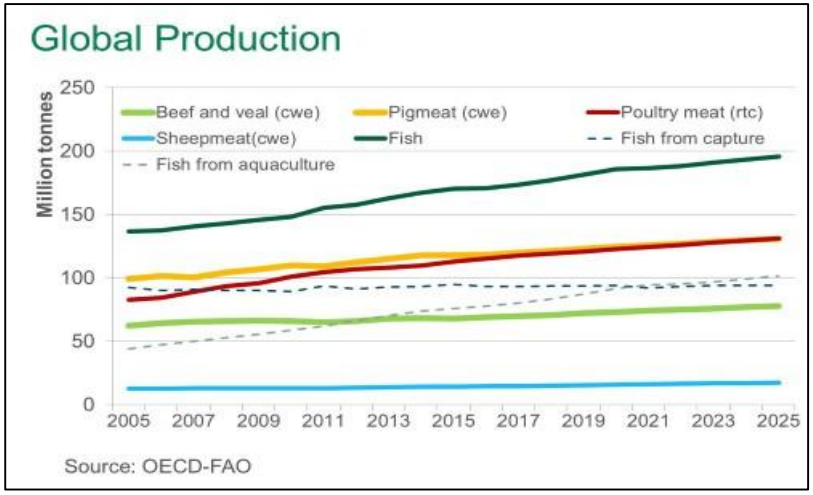
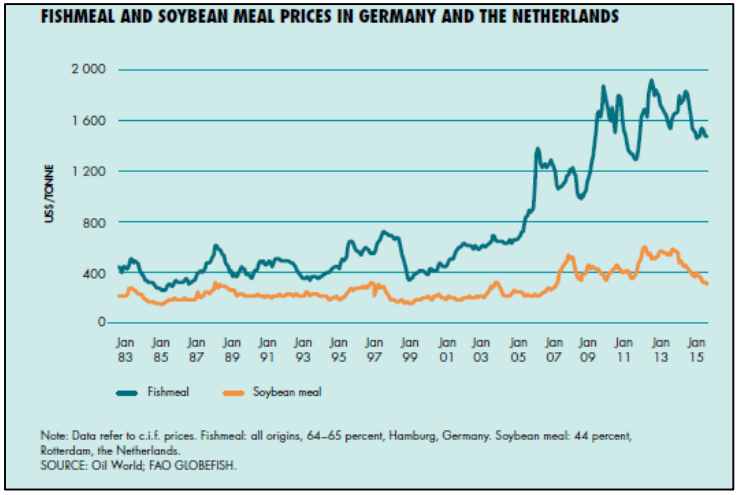
Circular economy in the food system, Jyväskylä, March 8th 2018

Insects as animal feed and food

- 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





Insect farming

Which organic fractions are converted by insects?

- Carbohydrates, Proteins, Lipids
- Depending on the feedstuff, size and weight gain of the insects varies between 20-50% fat and 30-45% protein

Does it make sense to use animal feed for insect production?

- Refinement of feedstuff with short durability and high transport costs (high water content or low bulk density)
- Wide ranging marketing opportunities for insect products in higher price segments

✓ However the utilisation of cost effective residue materials increases the sustainability of the production process and supports the consumer acceptance

Legal framework

In Germany insect products are mainly available in the pet food, fishing and terraristic and aquaristic area and as treatment against pest infestation.

Until 2018 the Directorate-General for Competition, Consumer Affairs and Prevention of Fraud (DGCCRF) had not authorised the placing of insect products on the market of foodstuff for human consumption (EU regulation 2015/2283).

Since January 2018 new novel food-regulation in (EU) 2015/2283
Insects or insect-containing products intended to be marketed as food must undergo health assessment and approval by the European Food Safety Authority (EFSA)
(Each product needs an own approval)

Alternatively, in some cases, traditional foods from a third country may be used if it can be proven that the food has been consumed there for at least 25 years and no safety concerns have occurred

Insects as animal feed and food

Domestic animal species	Feed conversion rate (g TS Input/g FM Output)	Life span	Carcass weight	Exploitation	Slaughter animal market price
Beef cattle	4.5–7.5 (> 6 is typical)	14-24 month	680-750kg	50%	3-4€/kg
Pig	3.8–4.5	5 month	100kg	55%	1.5€/kg
Chicken	1.6–1.9	5-6 weeks	1.2-2.0kg	65%	1.7€/kg
Sheep	4.0–6.0 (40 with straw)	6 month	20-25kg	46%	4.8€/kg
Fish (Aquakultur)	0.75-2 (dry fodder pellets)	6 month	1-3kg	80-90%	7.2€/kg (Salmon Norway)
Hermetia	2.0–3.2 (Palm kernel meal)	12-16 days	130 -140mg	>90	?

Insects as animal feed and food

Insect farming for protein production must be measured against livestock farming and aquaculture

- Water demand
- Efficiency of energy and land use
- Feed conversion
- GHG emmissions
- Utilisation of chemical substances, additives, auxiliary substances, antibiotics and hormones in the production
- Production costs and sales proceeds

Industrial insect farming, EU umbrella organisation and ongoing research

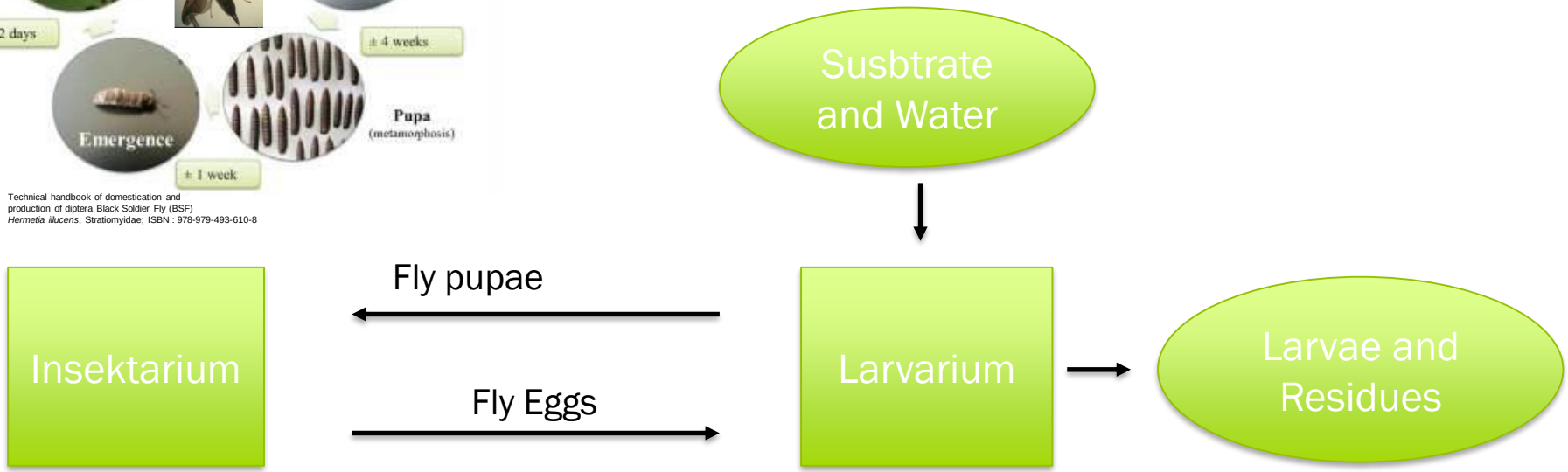
In several countries in Africa, Asia and Latin America Insects play already an important role as animal feed and in some regions for human nutrition. Insect farming in industrial scale is still scarce. In Noth America Insect farming with large production sites by Enterra in Vancouver Canada. In Europe by Hermetia Baruth GmbH, Protix and Ynsect and other companies.

IPIFF- (International Platform of Insects for Food and Feed) is an EU non-profit organisation which represents the interests of the insect production sector towards EU policy makers, European stakeholders and citizens.

INSECTA- (International Symposium on Insects as Feed, Food and Non-Food) international expert's platform on the latest developments and research results on insects organised by Pilot Pflanzenöltechnologie Magdeburg e.V. (PPM) and Leibniz-Institut für Agrartechnik und Bioökonomie e.V. (ATB)

Project short description
Competitive Insect Products (CIP)
Insect framing process steps

Technical handbook of domestication and production of diptera Black Soldier Fly (BSF) *Hermetia illucens*, Stratiomyidae; ISBN : 978-979-493-610-8



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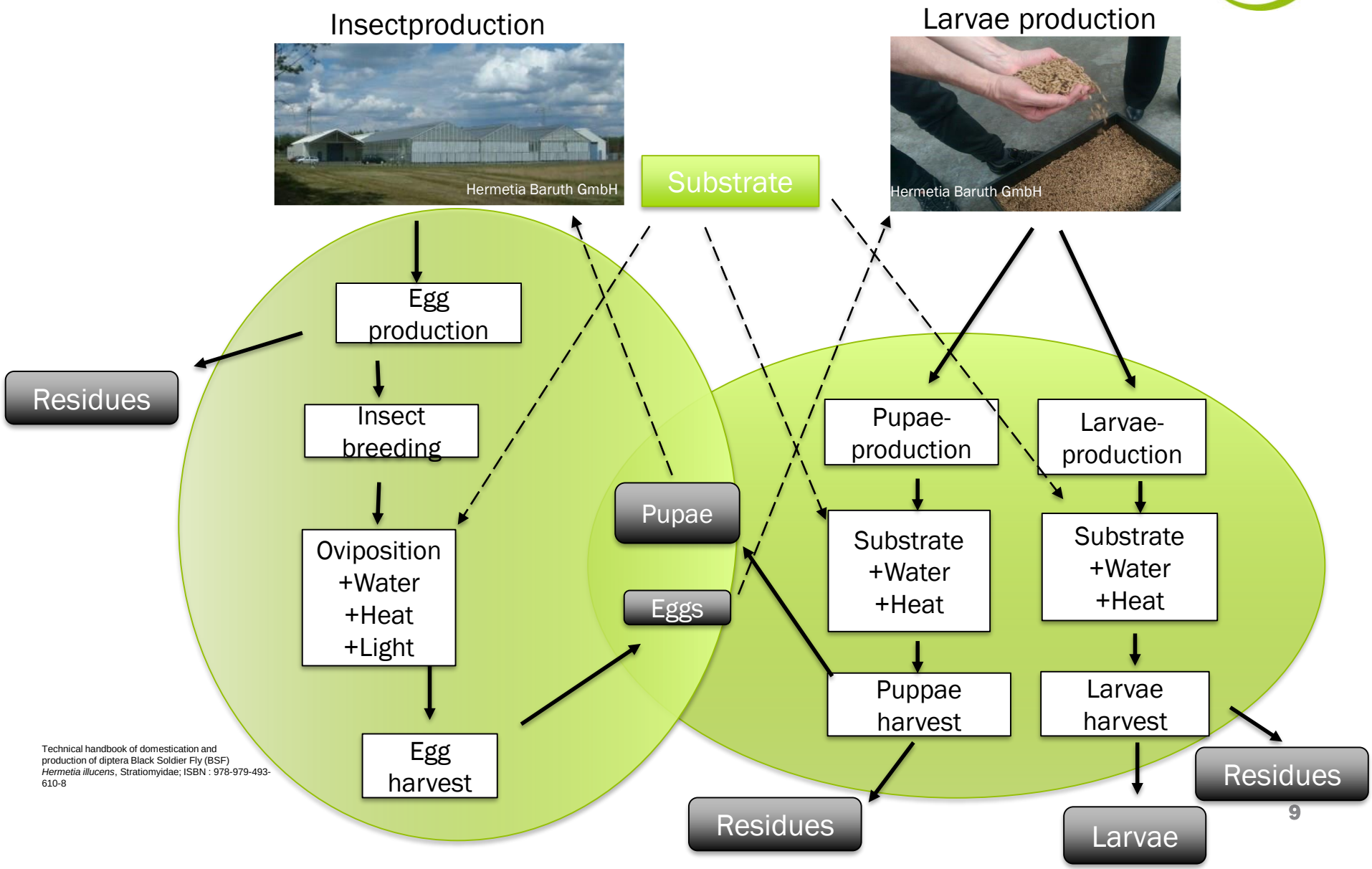

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Project short description
Competitive Insect Products (CIP)

Hermetia Baruth GmbH

- Partner: Hermetia Baruth GmbH
- Duration: 10/2017 – 10/2020
- Funding organisation: BMBF

  Federal Ministry of Education and Research
- Aim: Development of a cost-effective value chain for bio-based olefins and complex nutrient media based on insect biomass with full market viability for industrial application
- Project content: development of new application areas for Insect products, further optimization of the insect production process, development of a biorefinery concept
- Content DBFZ: Feedstock screening and testing, insect feeding trials and mass balancing, feasibility studies on integrated production processes onsite of biogas and bioethanol plants

Project short description
Competitive Insect Products (CIP)

Insect biorefinery: "Waste free biological conversion of residual organic materials into bio-based olefins and anti-allergenic proteins with the help of insects (black soldier flies)"			
Raw materials for insect production	**Biological conversion**	**Insect Products**	**Insect Production residues**
Insect feed: Inexpensive and sustainable feedstocks	Insects (Black Soldier fly)	Pre-products are Insect protein and fat	Feed remains, Residues from product processing
Residual materials and waste streams like (brewery waste, by-products of biofuel production, sugar production and food industry)	Biotechnological conversion of waste materials into valu-able insect biomass	Product refining Target products: *bio-based olefins* (applicable as biodiesel precursor, biological lubricants) *anti-allergenic proteins* (applicable as complex nutrient media)	Residue materials from the insect production process can be used as feedstock in biogas plants.

Project short description
Competitive Insect Products (CIP)

R&D activities within this project			
WP Insect production – raw materials Feedstock screening and material characterisation, suitability assessment, Feedstock handling, storage and conservation	**WP Insect production – process optimisation** Optimisation of the insect production technology in terms of process efficiency and economic sustainability (Insect breeding trials, screening of alternative beneficial insects),	**WP Product Application – Olefins/ Biodiesel and anti-allergenic proteins** Analytical product characterisation and testing, Downstream processing, Product confectioning, market screening, analytical testing of the suitability of insect fats as a biodiesel precursor	**WP By-Product Utilisation – Add on Biogas plant** Concept study "Biogas plant with integrated insect production" (Integrated concept) Valuable products are biomethane and process heat; the digested feedstock is suitable for land application as fertilizing soil amendments

Project short description
Competitive Insect Products (CIP)

Potential feedstuff for technical product application

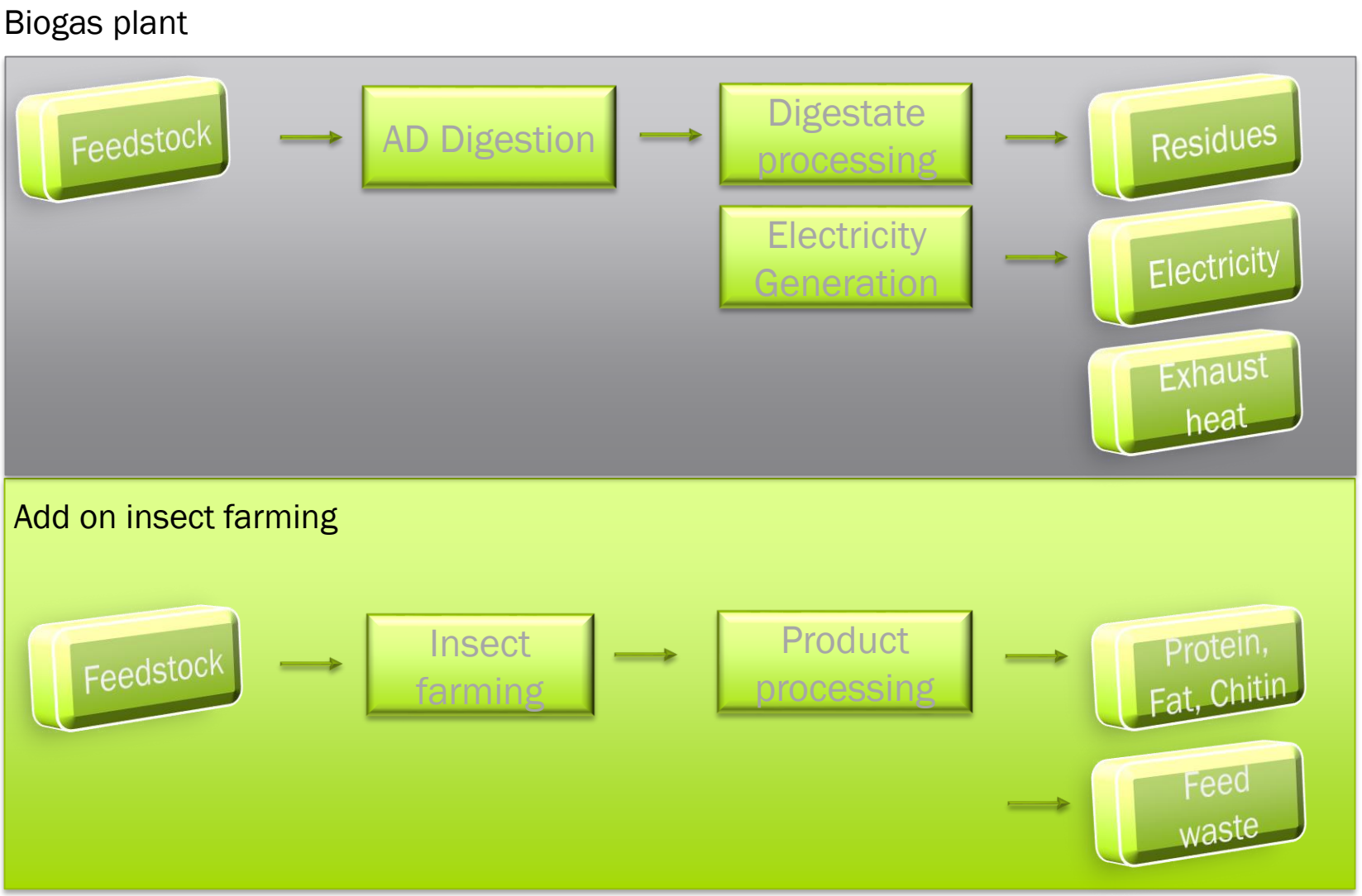
- Animal manure
- AD digestion plant digestate
- Organic fraction of municipal solid waste
- Biowaste (source separated organics)
- Restaurant waste and market waste
- Slaughter house waste

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

Hermetia Baruth GmbH

Process scheme integrated insect production in excisting biogas plants



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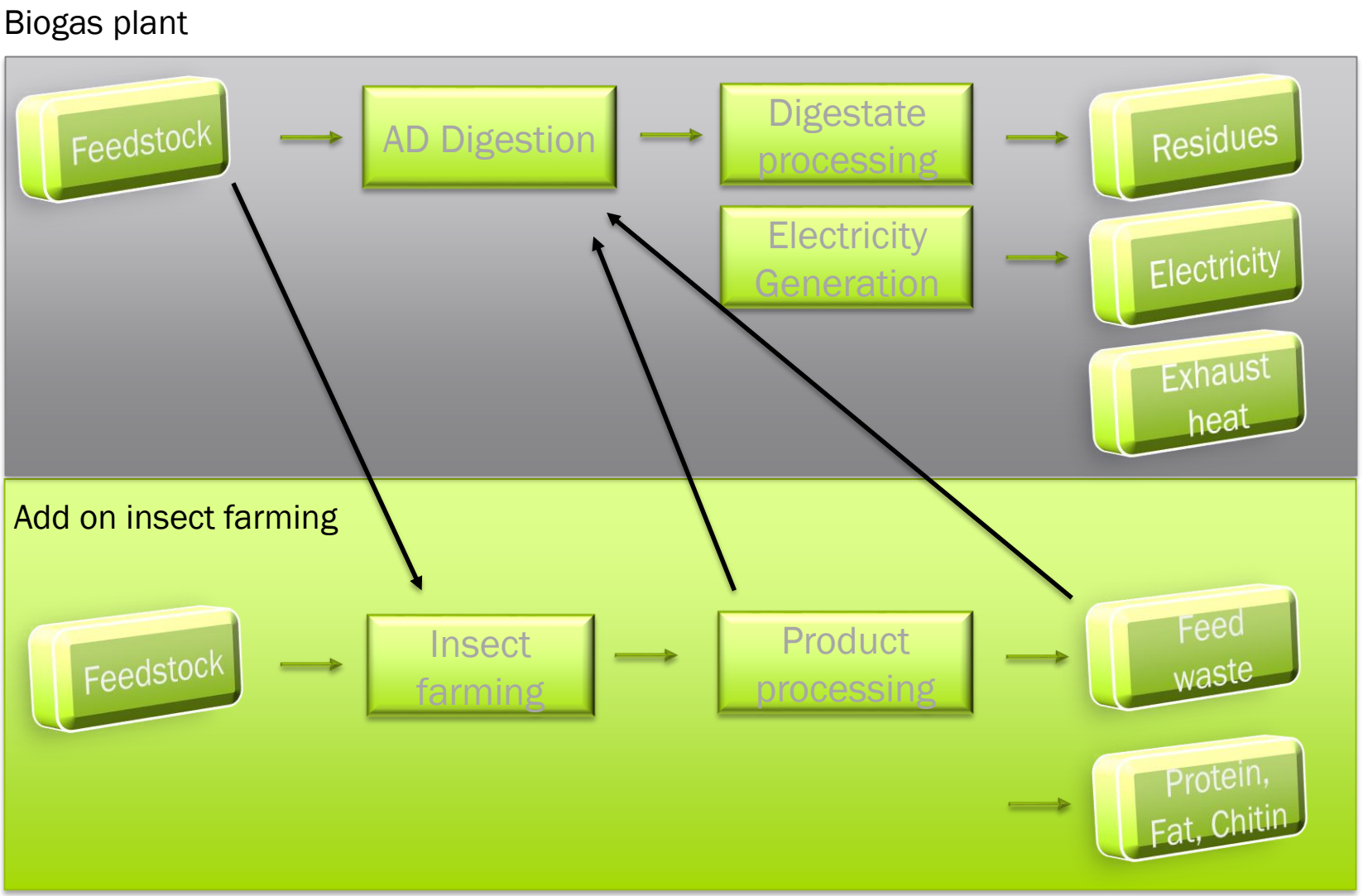

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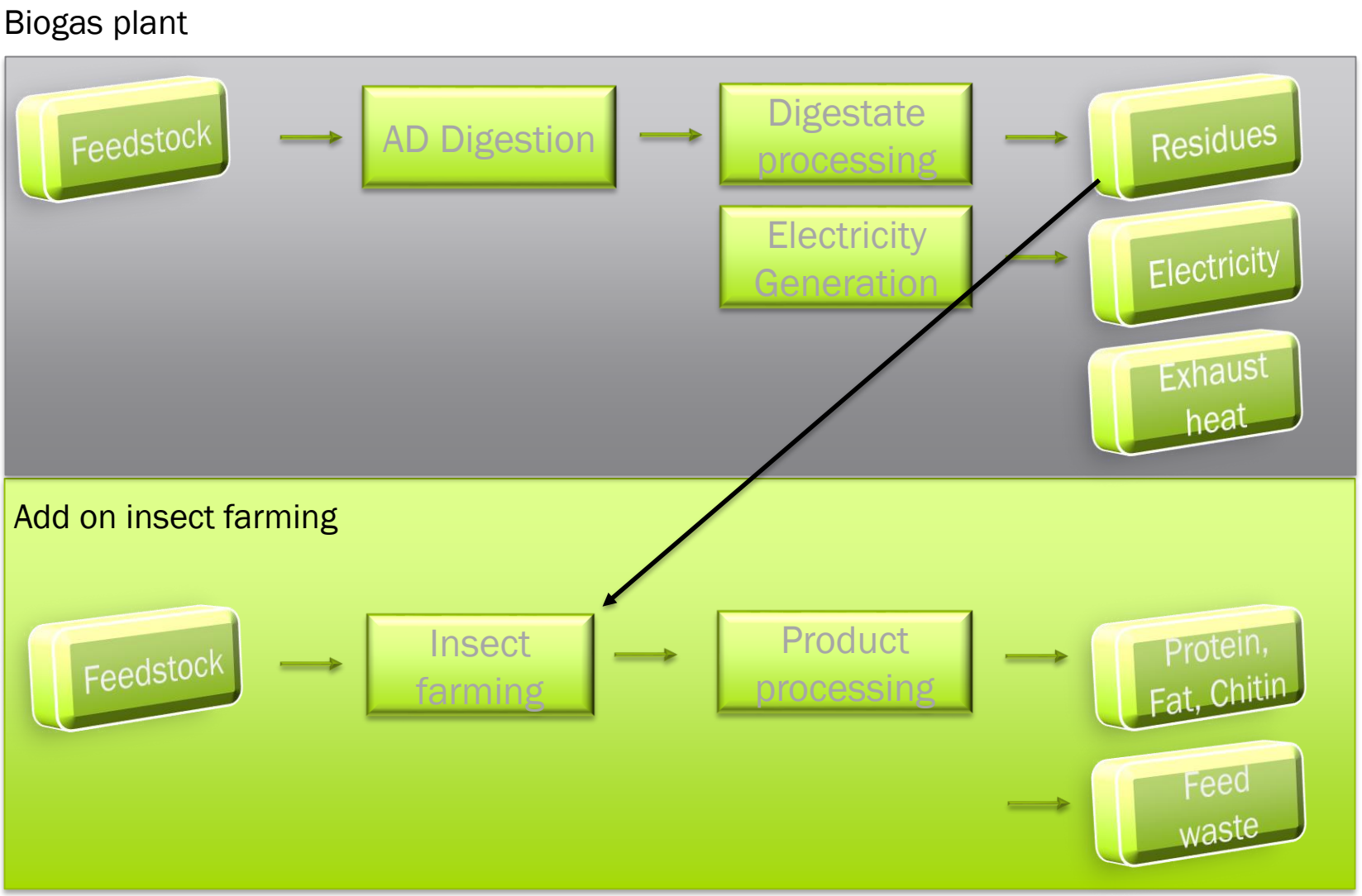

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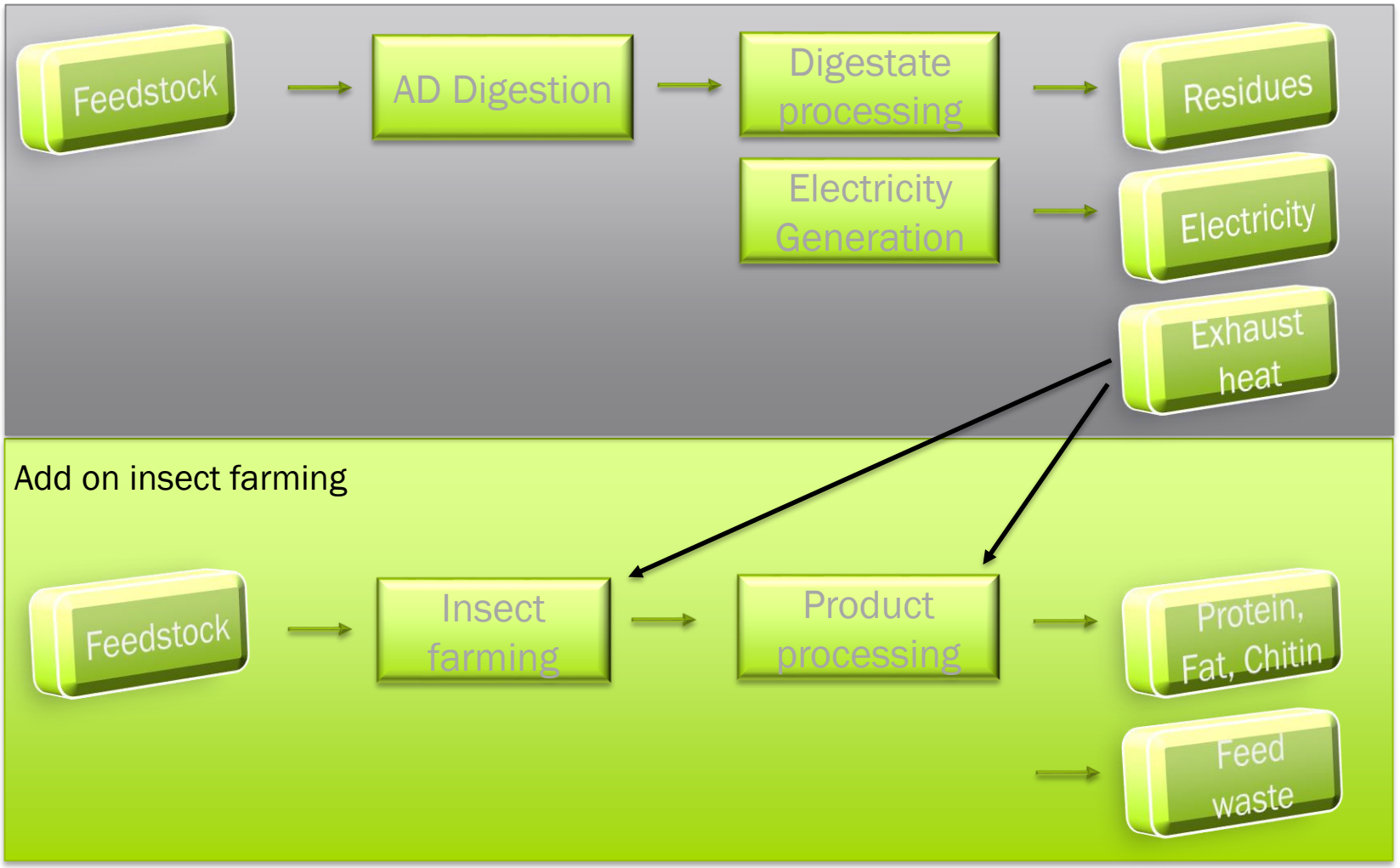

Summary - Research areas

- Process optimisation
- Utilisation of inexpensive raw materials – Testing of feedstuff alternatives
- Development of efficient integrated production methods – Feasibility study to the integration of the insect production process into biogas and bioethanol plants

- Product optimisation
- Product testing for application in biofuel, biolubricants and biotechnology sector
- Testing of the influence of feedstuff and insect species on product quality


Forschungsprojekt
Wettbewerbsfähige
Insektenprodukte (CIP)
Foto: Hermetia Baruth GmbH

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Smart Bioenergy – Innovationen für eine nachhaltige Zukunft

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