

*Repairing the future with
cutting edge, sustainable,
business solutions...*

AgriProtein Oslo 2016





Today is for you – so STOP ME ! Change the direction or destination

- AgriProtein History & Why !
- Breaking up R&D –Science
- Our current F1 facility
- Our F+ EPC&M plans
- Our roll out plans
- Futurology



AgriProtein is a nutrient recycler that produces sustainable animal feed ingredients, lipids, and fertiliser.



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The Protein Crunch

- Curb consumer food price inflation
- Stop world population growth !
- Sustainable alternatives to fishmeal
- *MagMeal* & its derivative friends
MagOil and *MagSoil*



MagMeal™
Animal protein

MagOil™
Lipids

MagSoil™
100% Organic fertiliser

Nutrient Recycling

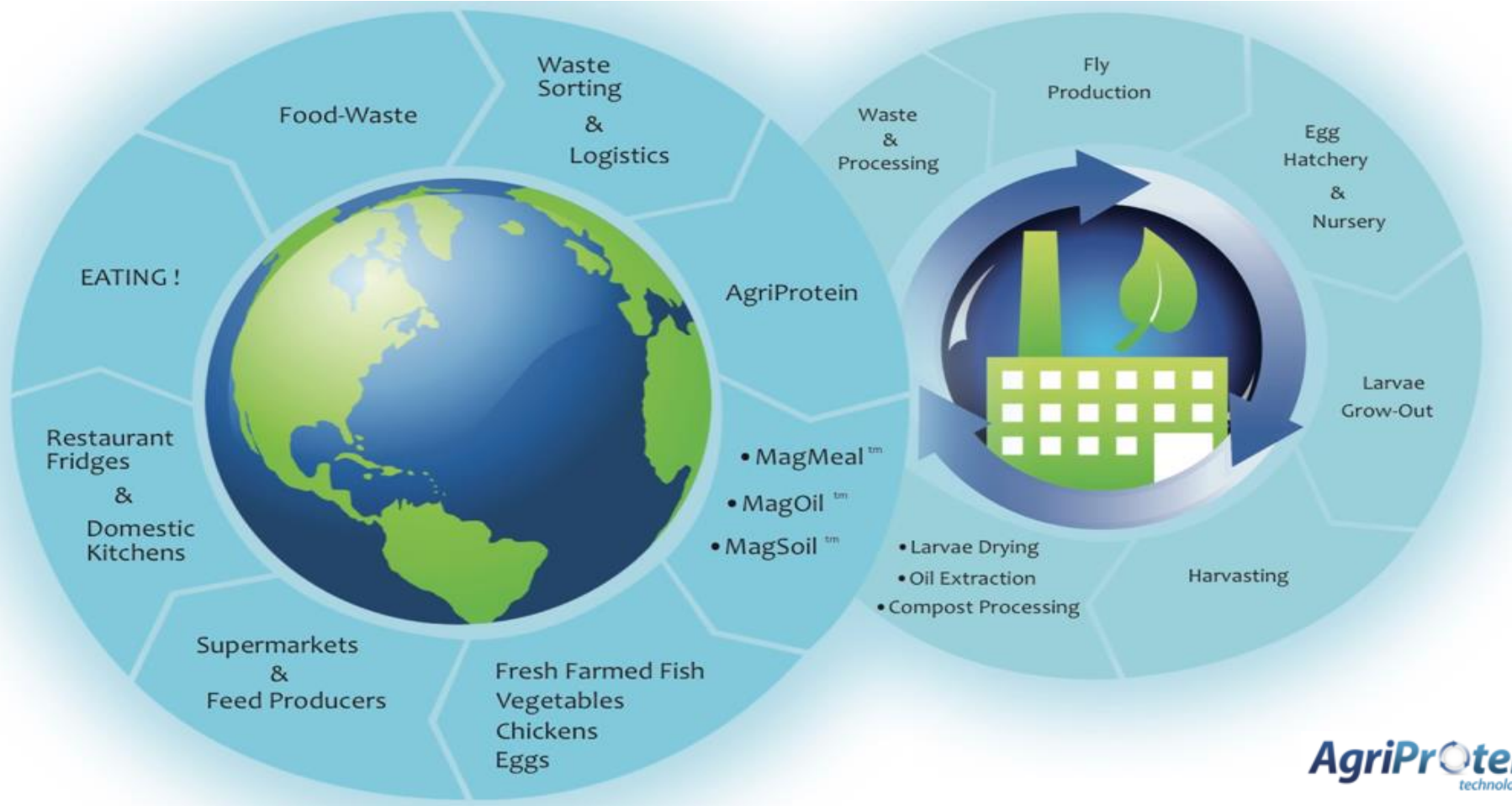
- Nature's cycle

WASTE - FLY EGGS - LARVAE - RICH SOIL

- Insect (animal) protein available where needed
- Natural sustainable insect meal - substitute for fishmeal
- Produce at point of need - save 10,000 km of carbon shipping !
- For every 1 tonne of AgriProtien MagMeal produced an average environmental saving of \$2,800 is made.



THE INDUSTRIAL FLY FARM



The Industrial Fly Farm

Demo Plant – D1



1 Kg MagMeal p/d
Save 6 fish p/d



The Industrial Fly Farm

Demo Plant – D1



1 Kg MagMeal p/d
Save 6 fish p/d

Pilot Plant – P1



100 Kg MagMeal p/d
Save 600 fish p/d



The Industrial Fly Farm

Demo Plant – D1



1 Kg MagMeal p/d
Save 6 fish p/d

Pilot Plant – P1



100 Kg MagMeal p/d
Save 600 fish p/d

Factory – F1



7 t MagMeal p/d
Save 42 000 fish p/d



Making sure our *MagMeal* is perfect every day
Supply homogeneously global markets

AgriProtein
technologies

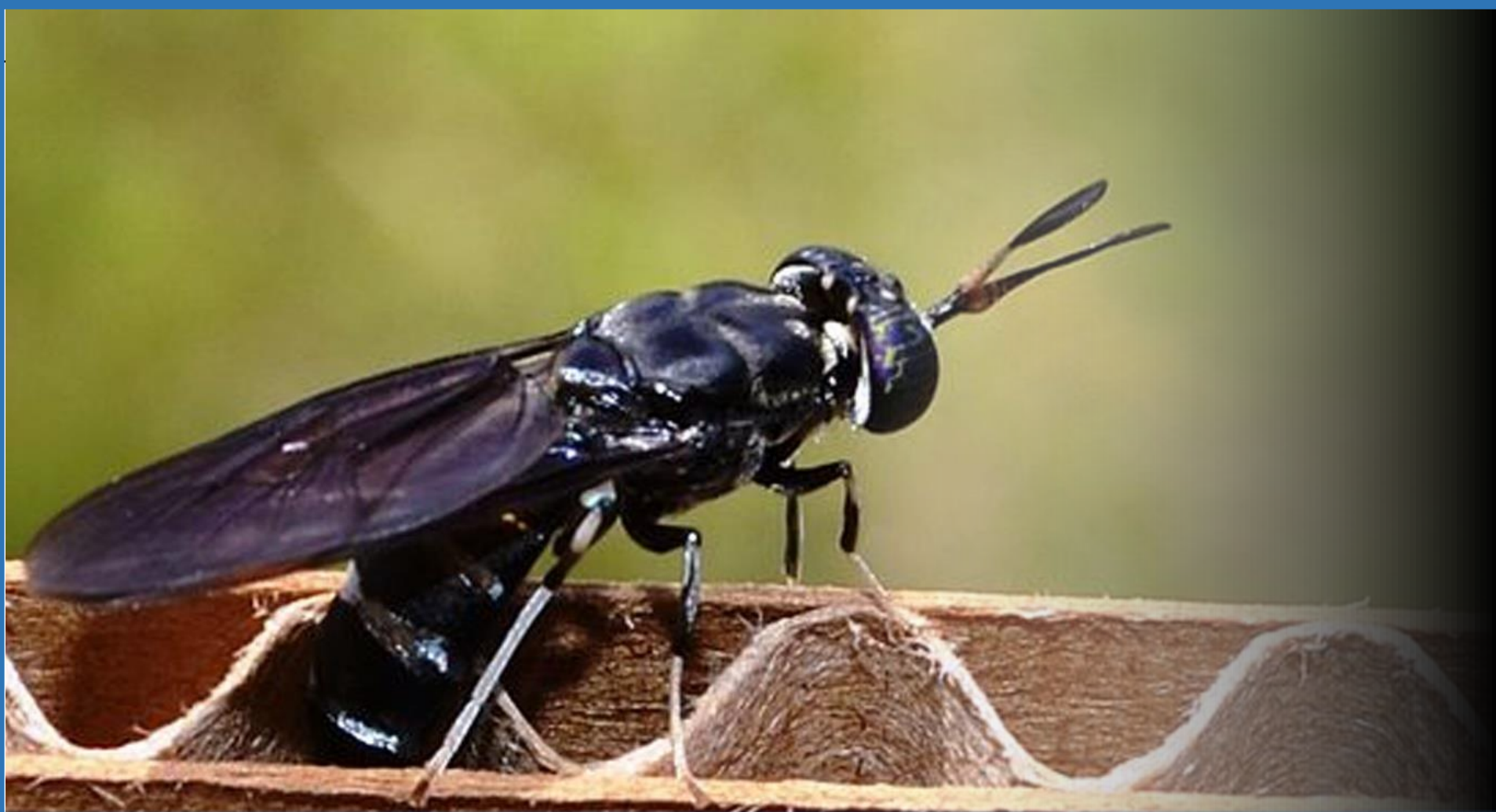


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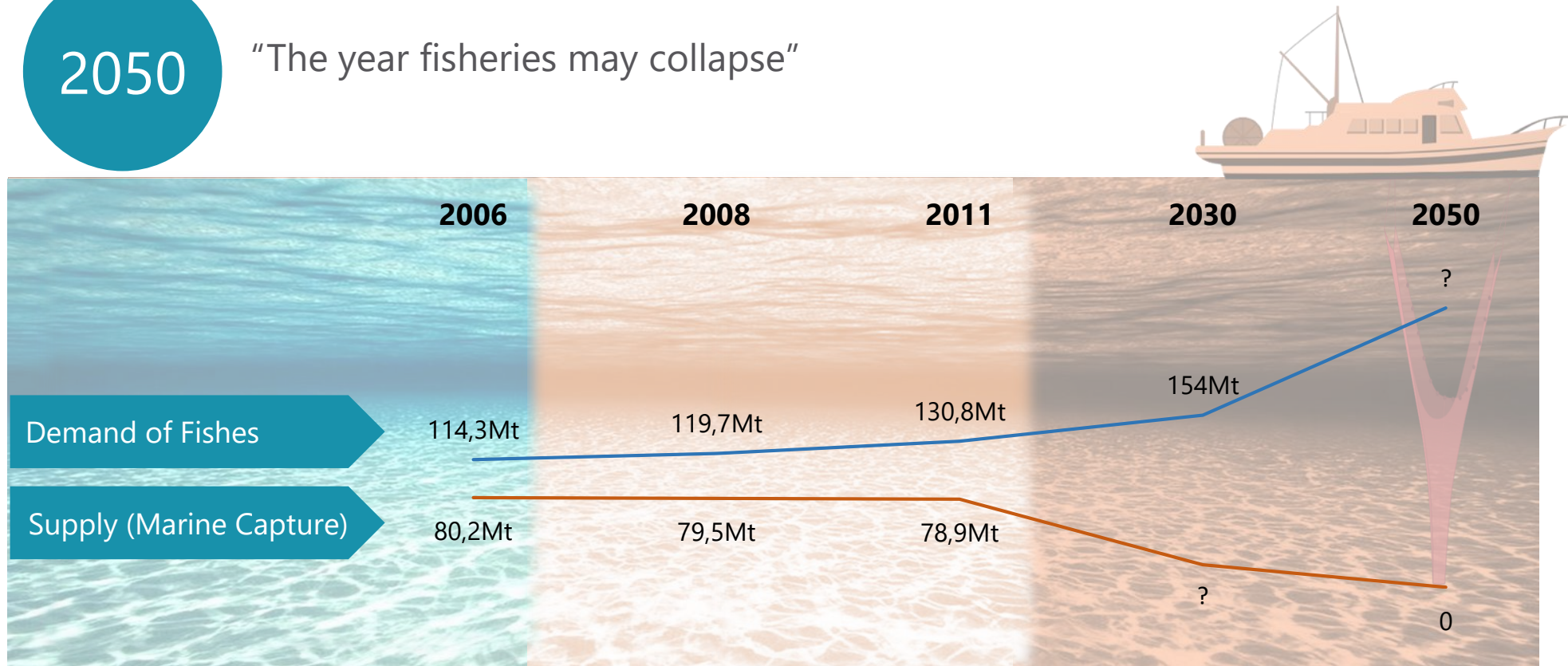


7 billion people today, 8.5 billion by 2030: can we feed us all?

While our ocean fish stocks are collapsing

2050

"The year fisheries may collapse"



300,000

Whales and Dolphins are killed each year via by-catch!



57%

Of the world's fishstock are already fully exploited!



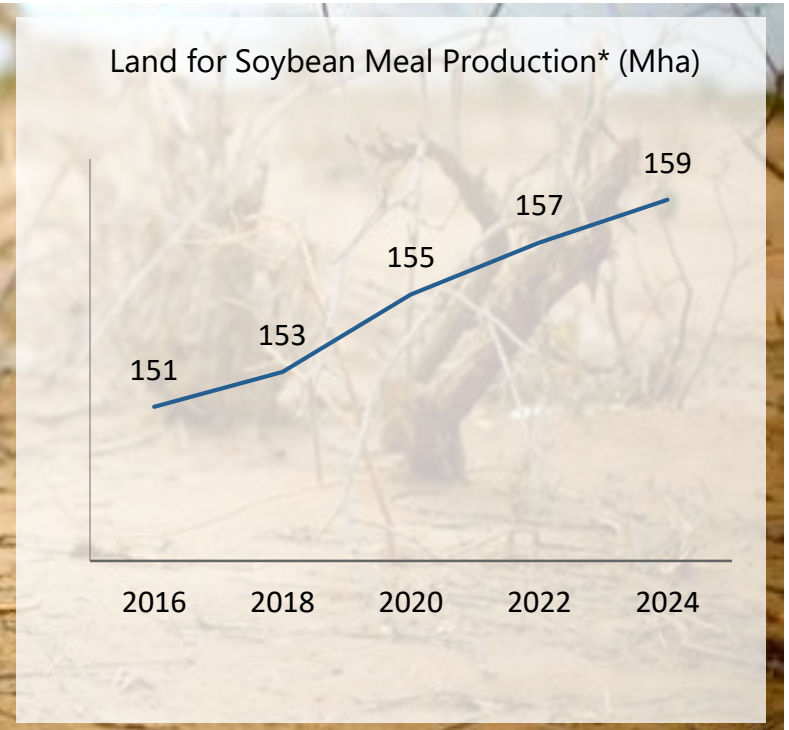
90%

Of predatory fish: Tuna, Sharks, Swordfish, Cod and Halibut are gone!

And food crops are facing competition with livestock feed production

2.2bn

"People can get food security if land for soybean meal can be diverted for cereal production"



+100m

"People may lose food due to land diversion for soybean meal by 2024"



Our business is unique, exciting and aims to help alleviate this problem

We solve the feed problem in a sustainable, environment friendly way



AgriProtein is the solution to multiple problems

"We are here to change the protein feed market forever

– while simultaneously repairing our planet"

01

Close protein gap

Disruptive, scalable solution to animal protein based feed shortage

02

Nutrient Recycler

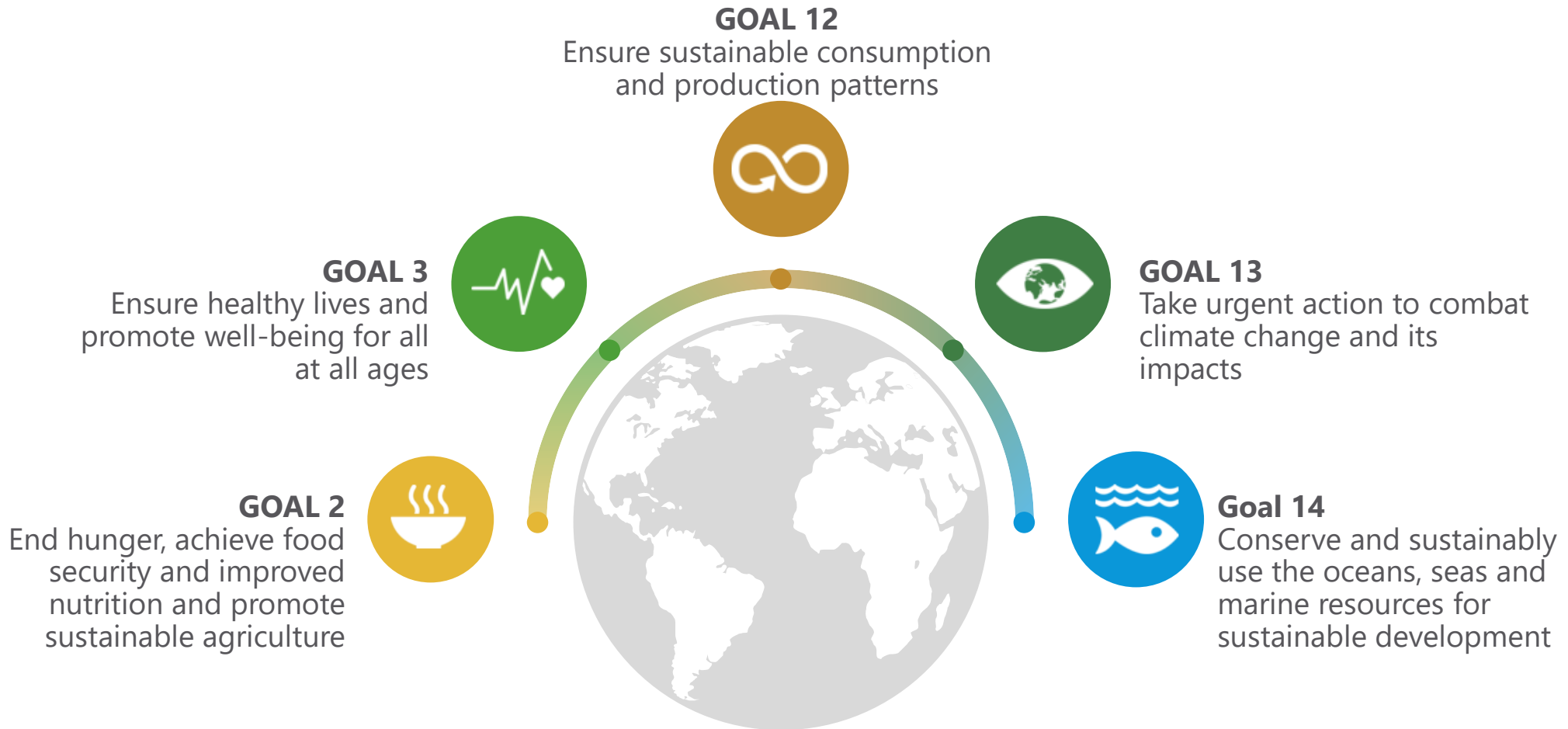
offering sustainable alternatives for domestic and industrial organic waste disposal

03

Climate Solver

Our natural products have a direct and positive impact on marine stocks, carbon emissions and toxic leachates from landfill

We support 5 of the UNs Sustainable Development Goals





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- Breaking up R&D –Science
 - **Our Science Team**
 - Internal Efficiencies QC
 - R&D
 - Product polishing -engineering
 - External QA – Products
 - Product development
 - Animal trials & lab work



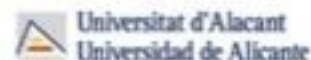
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agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA



RHODES UNIVERSITY
Where leaders learn



The Science

Pupae Quality	Ave. weight (mg)	173,6
	Pupae (%)	97,1

Check Type	Measure	Mean
Waste Plan	pH	5,5
	Temp (C°)	27,2
	Moisture (%)	85,9



- **Internal Efficiencies**
 - Research & Development
 - Biology & engineering influencers – heat & light
- **Product Polishing**
 - Homogeneity
- **External QA**
 - Nutritionists
 - Trials & Tests

Sex Ratio	Female (%)
Eclosion Efficiencies	Eclosed Healthy (%)
Flight Ability	Flyers (%)
Attractant Recipe	pH
Check	Moisture (%)

NA= Nutrient agar. General growth medium that will support large number of species
 SSA= Salmonella/Shigella agar. Selective for Salmonella and Shigella sp.
 EMB=Eosin Methylene Blue agar. Differential for enterobacteriaceae, which include E. coli
 Lis- Listeria selective medium. Selects for Listeria spp.

62°C 60min	
72°C 5min	
72°C 15min	
100°C 2min	

QUALITY PRODUCTS FIRST AND FOREMOST.
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MagMeal™

55% protein, 100% sustainable
natural organic animal feed

MagOil™

Versatile, natural, omega rich
oil for use in feeds



Waste Services

Certified green alternative
to organic waste dumping/landfills

MagSoil™

Natural compost, adds soil organic carbon, increasing soil
health and fertility.

Boosts soil's porosity and ground water retention



QUALITY PRODUCTS FIRST AND FOREMOST.

**BE CONFIDENT & YIBANGUWE. ABANTU
MABAQHAKAMSHELANE, EERSTENS MOET ONS
KOMMUNIKEER, & COMMUNICATE AGAIN. THIS
IS A VOCATION, NOT AN OCCUPATION.
INTEGRITY, EMPOWERMENT, INSPIRATION, &
RESPECT. INNOVATION IS KEY TO PROGRESS.
WE ARE ALL DIFFERENT & WE LIKE IT THAT WAY.
WE HELP TO SAVE THE FISH IN OUR OCEANS AND
DIVERT WASTE FROM LANDFILLS. WE STARTED
WITH AN IDEA NOW WE'RE HEADING FOR THE
STARS. THERE IS OPPORTUNITY FOR ALL OF US
TO GROW. WE ARE INVISIBLE SUPPLIERS TO OUR
CUSTOMERS. ALWAYS ON TIME. SERIOUS WHEN
IT COUNTS BUT FUN ALL THE TIME. PUT IN THE
EFFORT & YOU WILL BE REWARDED. RECYCLE.
SIHLONIPHANE. SAFETY BEFORE EVERYTHING.**

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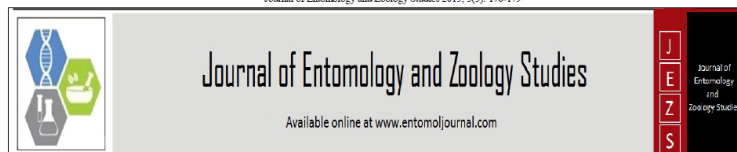


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Antibacterial properties of BSF can provide huge upside to our products

"To survive in some of the most pathologically hostile environments, BSF have had to develop a myriad of powerful broad-spectrum antibiotic compounds and enzymes to thrive over the last 75 million years they have been flying around"

A number of studies have been done to demonstrate existence of anti-bacterial properties in BSF



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Antibacterial activity of larval extract from the black soldier fly *Hermetia illucens* (Diptera: Stratiomyidae) against plant pathogens

Kwan Ho Park, Kyu Won Kwak, Sung Hee Nam, Lee, Hong Geun Kim, Seong Hyun Kim

Abstract

The antibacterial activity of the extracts of whole black soldier fly larvae was evaluated and was tested against six strains of plant pathogens. In our study, the antibacterial properties of larval homogenization after mixing grinded larvae with 0.01% acetic acid well diffusion and growth curve assay, were used to study the inhibition of all six tested bacterial pathogens. Inhibition zone that larval extracts have significant antibacterial activity against further evidence that larval extracts play a role in the defense.

Keywords: Black soldier fly, Larvae, Antibacterial activity, F



Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Fate of pharmaceuticals and pesticides in fly larvae composting

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^a Department of Energy and Technology, Swedish University of Agricultural Sciences
^b Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences

HIGHLIGHTS

- Degradation of pharmaceuticals and pesticides in fly larvae composting (FLC).
- Half-life considerably shorter in FLC than in control with no larvae.
- Half-life of carbamazepine was less than two days in FLC.
- No bioaccumulation in larvae detected.
- FLC could impede the spreading of pharmaceuticals and pesticide in the environment.

GRAPHICAL ABSTRACT



Abstract

Dev Comp Immunol. 2015 Sep;52(1):98-106. doi: 10.1016/j.dci.2015.04.018. Epub 2015 May 5.

Purification and characterization of a novel antibacterial peptide from black soldier fly (*Hermetia illucens*) larvae.

Park SI¹, Kim JW², Yoe SM³.

Author information

A novel antimicrobial peptide exhibiting activity against Gram-negative bacteria of *Hermetia illucens* larvae. The immunized larval defensin-like peptide 4 (DLP4) was purified using solid-phase chromatography. The purified DLP4 demonstrated a molecular

Full text links

ELSEVIER
FULL-TEXT ARTICLE

When established, this opportunity would provide immense boost to our product price and create opportunities for other medicinal byproducts with very high revenue upside



University & Commercial Trials by product type

- MagMeal
 - Tilapia, trout, Abalone, Turbot, Catfish
 - Chicks , Broilers, Layers, Turkey, Piglets, (Quail)
 - Soft dog treats
- MagOil
 - EARLY soaps & Layers
- MagSoil
 - Cress tests, VERY little



Quality & Safety

- Heavy Metals
 - All heavy metals identified in our MagMeal were below legal limits stipulated in South African legislation (Act 36 of 1947)
- Pathogens
 - No aerobic pathogens were identified our MagMeal
 - Process removes 100% *e. coli* & *salmonella*, 99.999% *Listeria*
- Protein %, Fibre, ash, **FAT**
 - Proximate (amino) variance – Omega
- Internal end quality checks & SGS (Shelf life, rancidity & slumping)



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Agriprotein's Above-ground Solution

The first commercial production site (Philippi)

- Recycle organic waste from the City of Cape Town
- Reduce landfill by 35,000m³ per year
- Produce natural animal farm feed using insect-based nutrient-recycling technology
- Produce enough MagMeal™ in a year to leave 7000 tonnes of fish in the sea
- Every tonne of magmeal delivers an environmental cost saving of \$2,800



Reduce Carbon emissions, save the seas & eliminate organic landfill



Our first Cape Town factory is already in production (1/3)



Our first Cape Town factory is already in production (3/3)





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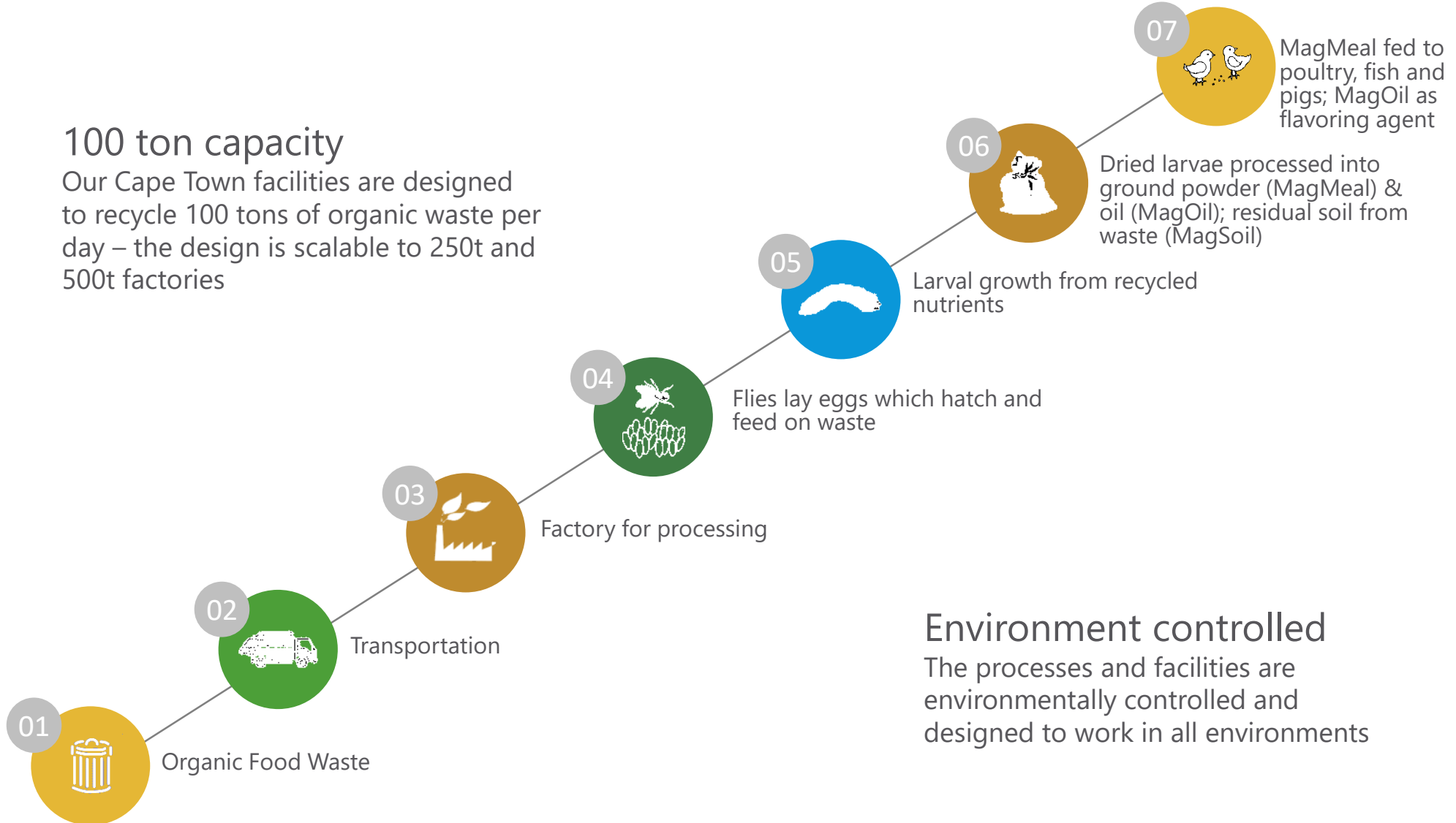


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Our bespoke process is scalable and globally viable

100 ton capacity

Our Cape Town facilities are designed to recycle 100 tons of organic waste per day – the design is scalable to 250t and 500t factories



Environment controlled

The processes and facilities are environmentally controlled and designed to work in all environments

Waste-to-Energy

June 2016



Facts & Figures



+1.900
employees



+100
years

of combined
competences

www.christof.com

subsidiaries
in **15** countries



operating
subsidiaries

active in
+11 sectors



+80
certificates
& licenses



+3.500
reference projects
in more than 60 countries





SAICA Partington / UK - 2012
22 MWth heat (20 bar/215°C)
rejects, paper fibres, sludge



Vattenfall Rostock / D - 2010
87 MWth (42/65 bar, 405°C) grate
RDF, municipal- + industrial waste

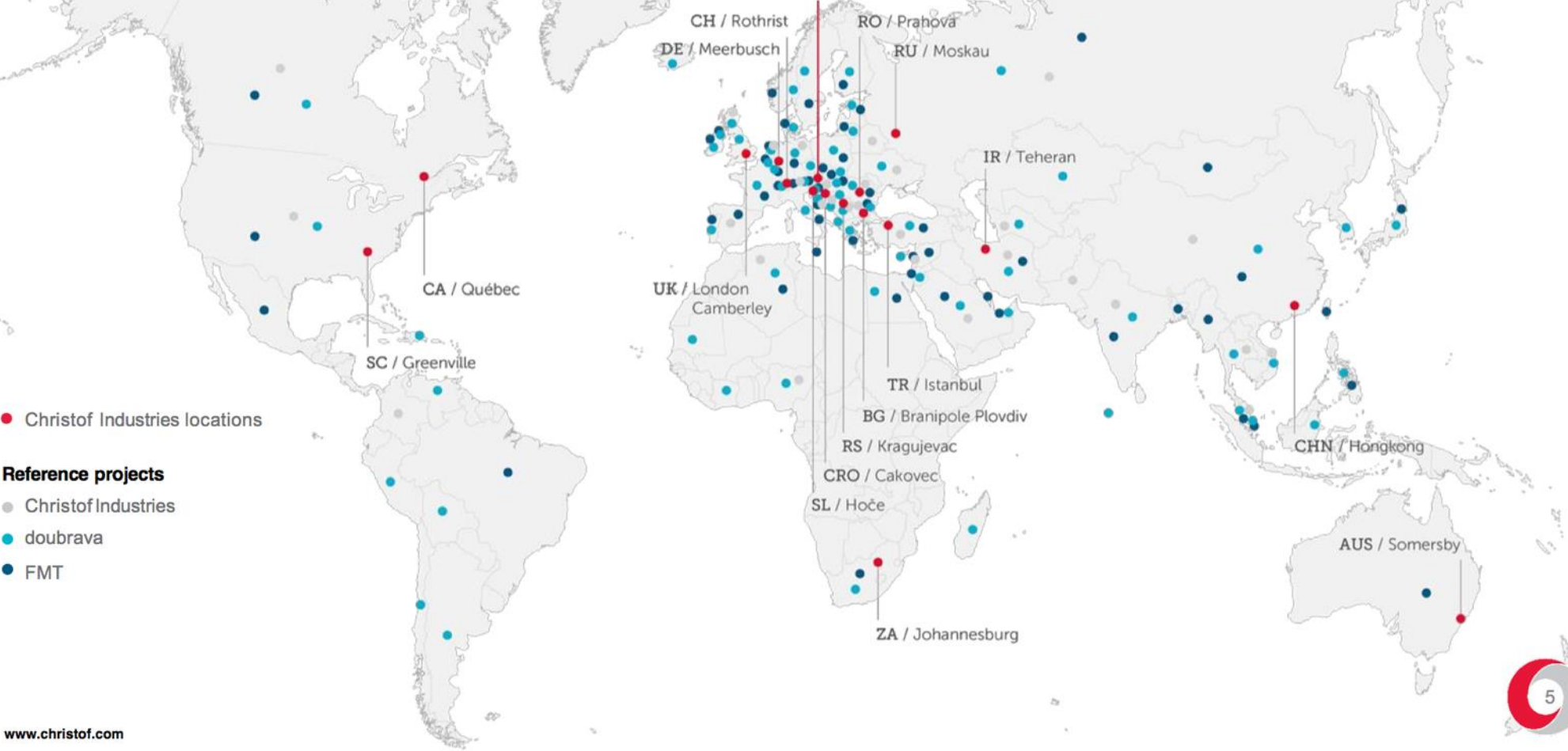


RWE Berlin Neuköln / D - 2006
2 x 53 MWth (60/80 bar, 450°C)
waste wood, RDF



RBB Böblingen / D - 2005
6 MWth (40 bar, 390°C)
biomass, wood residues

Christof Industries locations and reference projects across the globe





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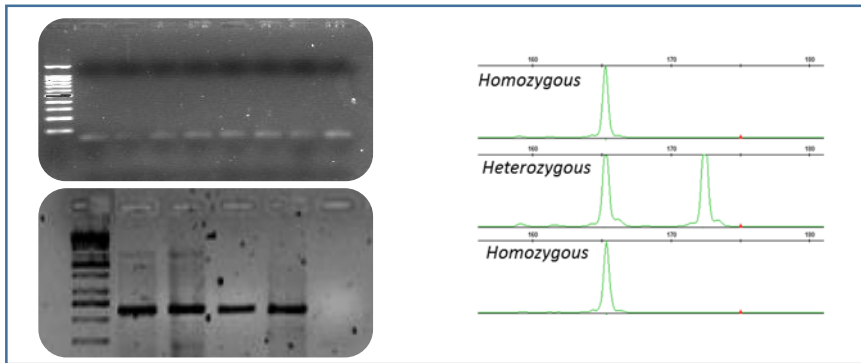
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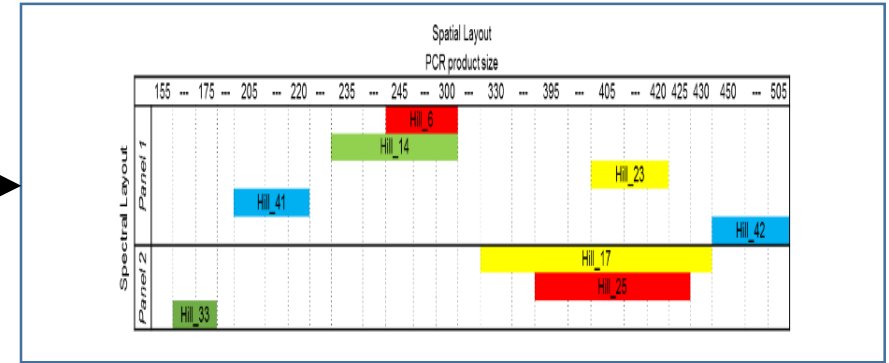
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Developing the tools to assess genetic diversity

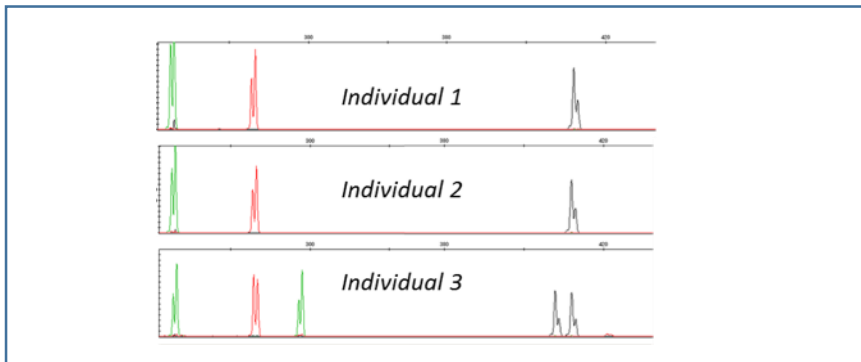
Marker development and optimisation



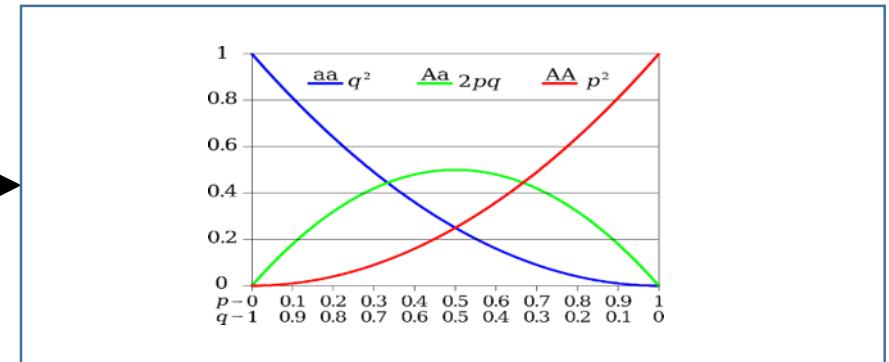
Multiplexing



Genotyping



Data analysis





THE BIOCYCLE

- AgriProtein Special Situations
 - The above ground landfill
 - Blood , Abattoir waste, and
- KZN is live – 20 tonnes per day
 - Different business model
 - Waste not protein business
- Chitin
- Palm oil replacement - MagOil





WE made it ! Thank you !

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