



# Alternative Protein Solutions for Meat Producers. Webinar

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Innovations for a **better world.**

**BUHLER**


# Agenda

1. Market Overview
2. Opportunities for Meat Producers
3. Bean to Burger
4. Bühler Solutions and Post-Extrusion Solutions
5. Our Services
6. Q&A



# We Develop Manufacturing Equipment for Food and Mobility

Billions of people come into contact with Bühler every day



**Feeding  
2 billion**  
people  
every day



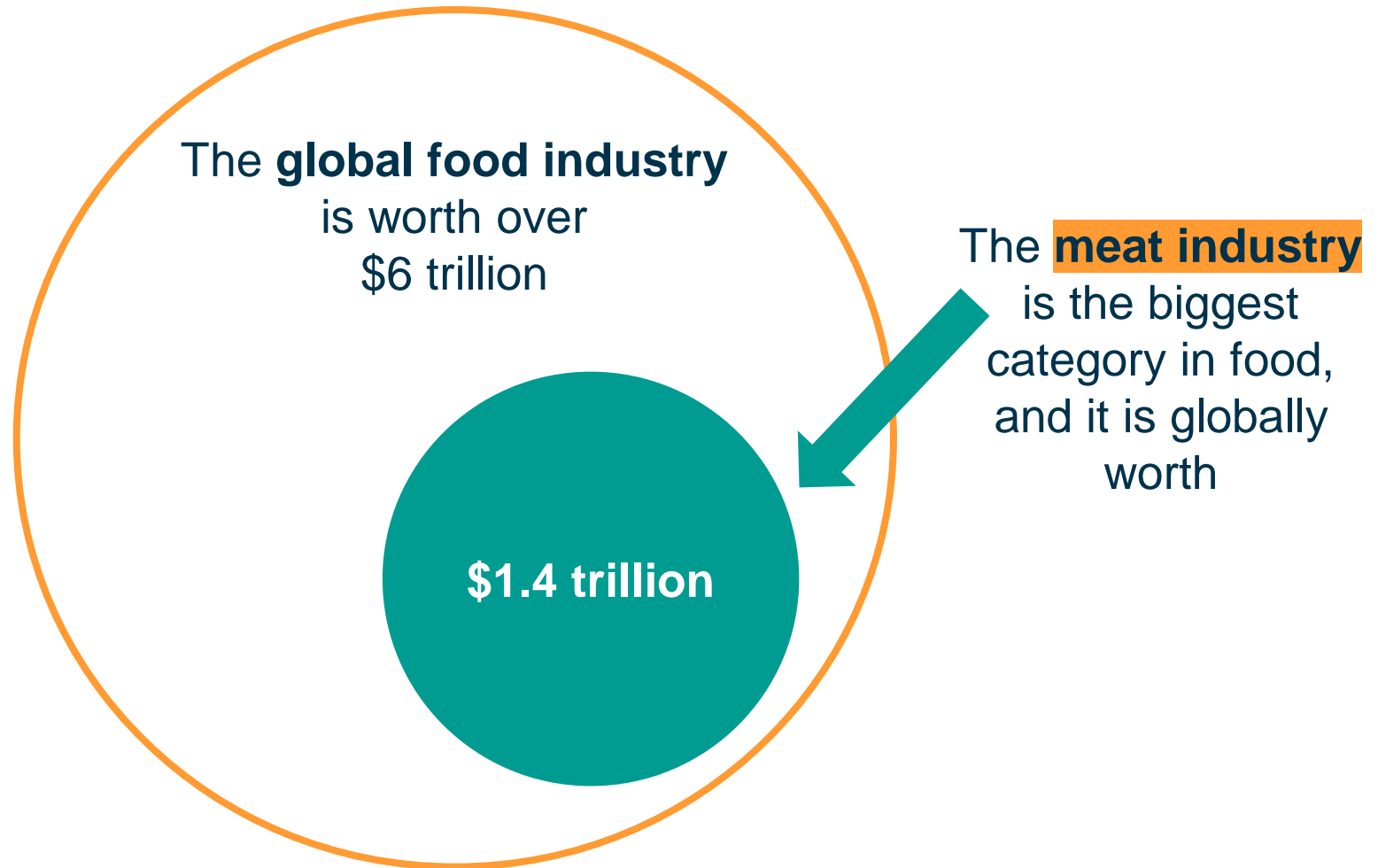
**Moving  
1 billion**  
people  
every day



# Market Overview



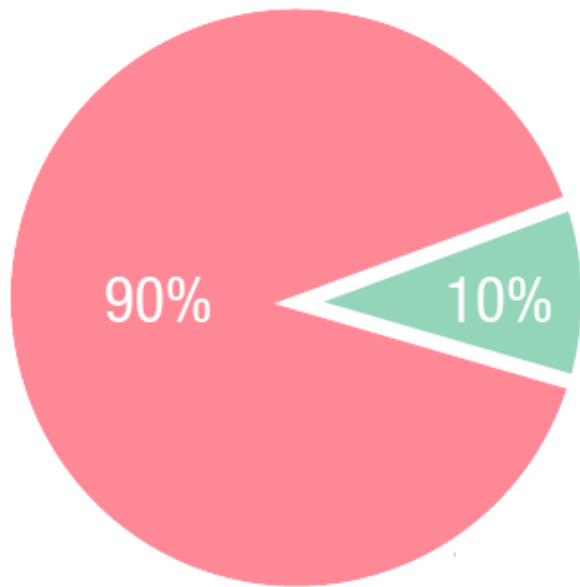
# Market: The Big Picture



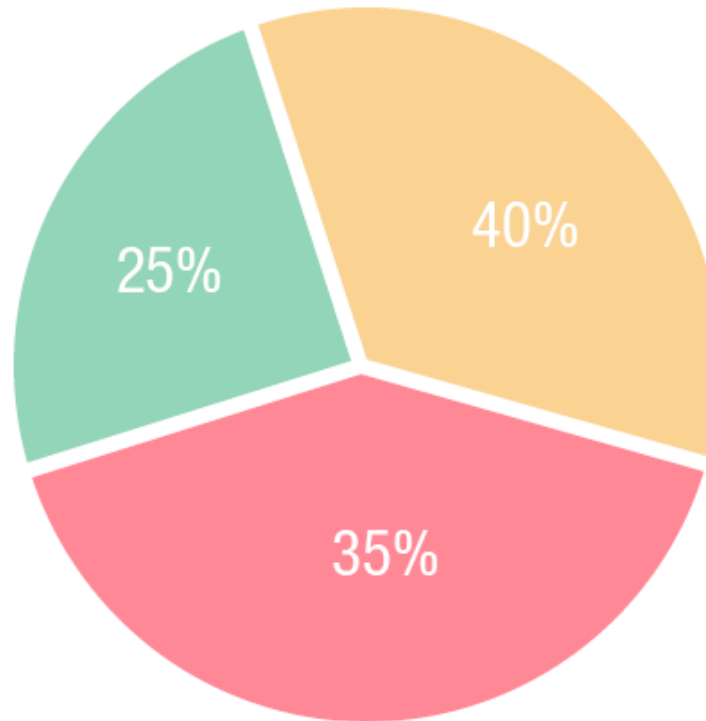
Source: Barclays Analysis 2019

Bühler Alternative Proteins Solutions for Meat Producers - January 2022

## Global meat market forecast.



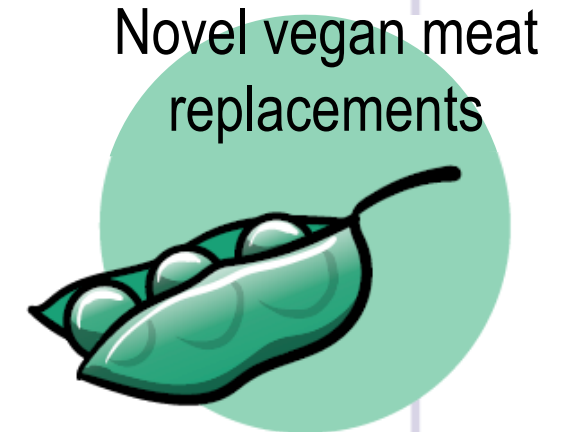
2025



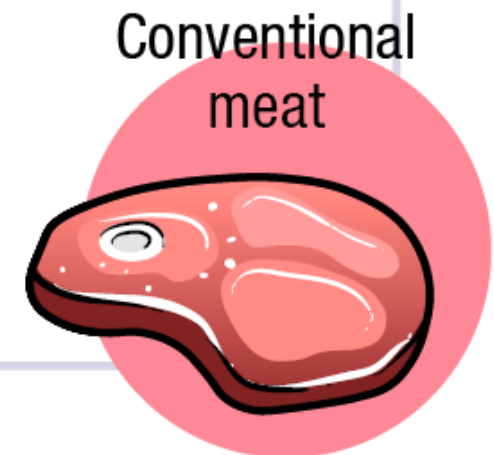
2040



Cultured meat



Novel vegan meat replacements



Conventional meat



# The cost of feeding the world today.

**25%**

of global  
GHG emissions  
is from agriculture

**70%**

of total fresh  
water usage  
for agriculture

**1/3**

of global  
energy  
goes into food production  
from field to table

**3/4**

of all agricultural  
land  
is used for meat & dairy  
(18% of all calories)



# Reasons for consumer interest in plant-based.



Health  
Ambitions



Climate  
Concern



Price



Animal  
Welfare



# What does COVID-19 mean for consumers?

Conscious  
consumption



Mentally  
rebalancing



More  
occasions  
at home



Proudly  
Local



# Opportunities for Meat Producers



# Biggest meat producers already in plant-based



# Why are meat producers best equipped to enter this market?

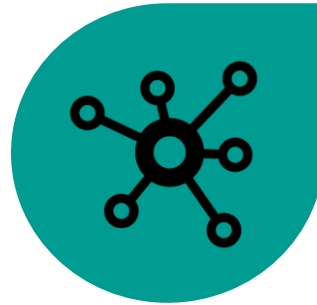
## Cold Supply Chain

Over 94% of all plant-based meat retail products are chilled or frozen



## Distribution Network

Access to retailers on a national or international level



## Food Safety

Experience working with high levels of sanitation and food safety in wet processing



## Similar Products

Knowledge of quality, taste and texture of good meat products, can be applied to plant-based



## Similar End Consumers

Meat brands are trusted among flexitarians and meat-eaters (98% of plant-based meat consumers)



## Similar Processes

In many cases the same equipment can be used for both traditional and plant-based meat

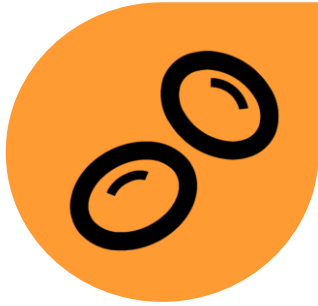




# What challenges do meat producers face?

## New Raw Materials

Working with new raw materials such as protein isolates can be a challenge



## New Processes

Twin-screw extrusion is similar to meat grinders with a die plate but requires different skills



## Investments

Investments in extrusion plants are higher than typical meat industry equipment



## Product Development

New product and recipe development needed



# Bean to Burger

# Extrusion at Bühler.

Dozens of applications developed over the years

## Cooking Extrusion



**Meat Analogues**



**Reconstituted Rice**



**Breakfast Cereals**



**Pet Food**



**Breadcrumbs**

## Cold Extrusion



**Couscous**



**Pasta and Noodles**

# Types of extruded meat substitutes.

## Dry Textured Products

fibrous, spongy texture



shelf-stable, but rehydration

## Wet Textured Products

fibrous, dense texture



direct use, but chilled storage

End Products

Dry tex  
only

Wet tex  
only

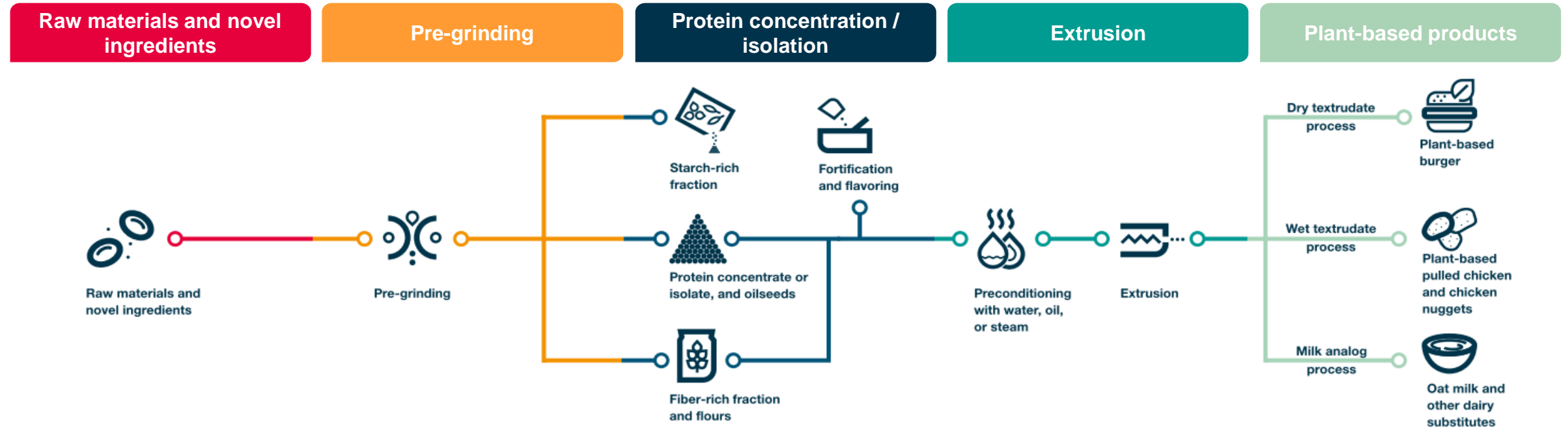
Dry & wet  
tex

Meat &  
dry/wet  
tex



# Solution provider along the protein value chain.

## Market leader from farm to fork.



# Different products made through protein extrusion.

**Samosa with brewer spent grain and soy protein concentrate**



**Cereal bar using oilseed expeller cake mixed with fava bean protein isolate**



**Plant-based chicken with oat expeller cake and pea protein isolate**



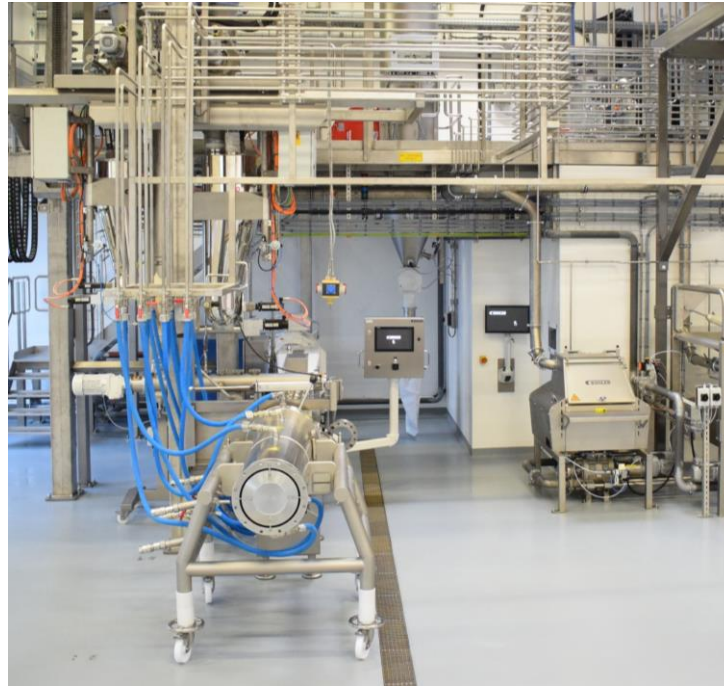


# Three possibilities for production.

Buy semi-finished products  
and turn them into end-  
products

Co-manufacturing

Invest into own production  
plant with extrusion



# What are the advantages of investing in extrusion?

## Capacity

B2B providers and co-manufacturers  
don't always have capacity to meet demand



## Quality

Have more control over the quality  
of your product



## IP Risks & Ownership

Fixed contacts can mean no control of  
recipes or processes



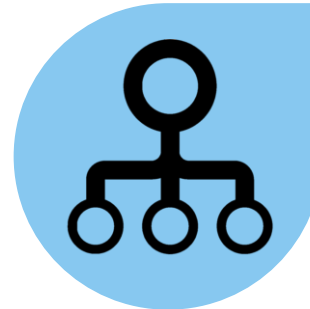
## Profits

Higher margins with the opportunity  
to master extrusion – where the real money is made



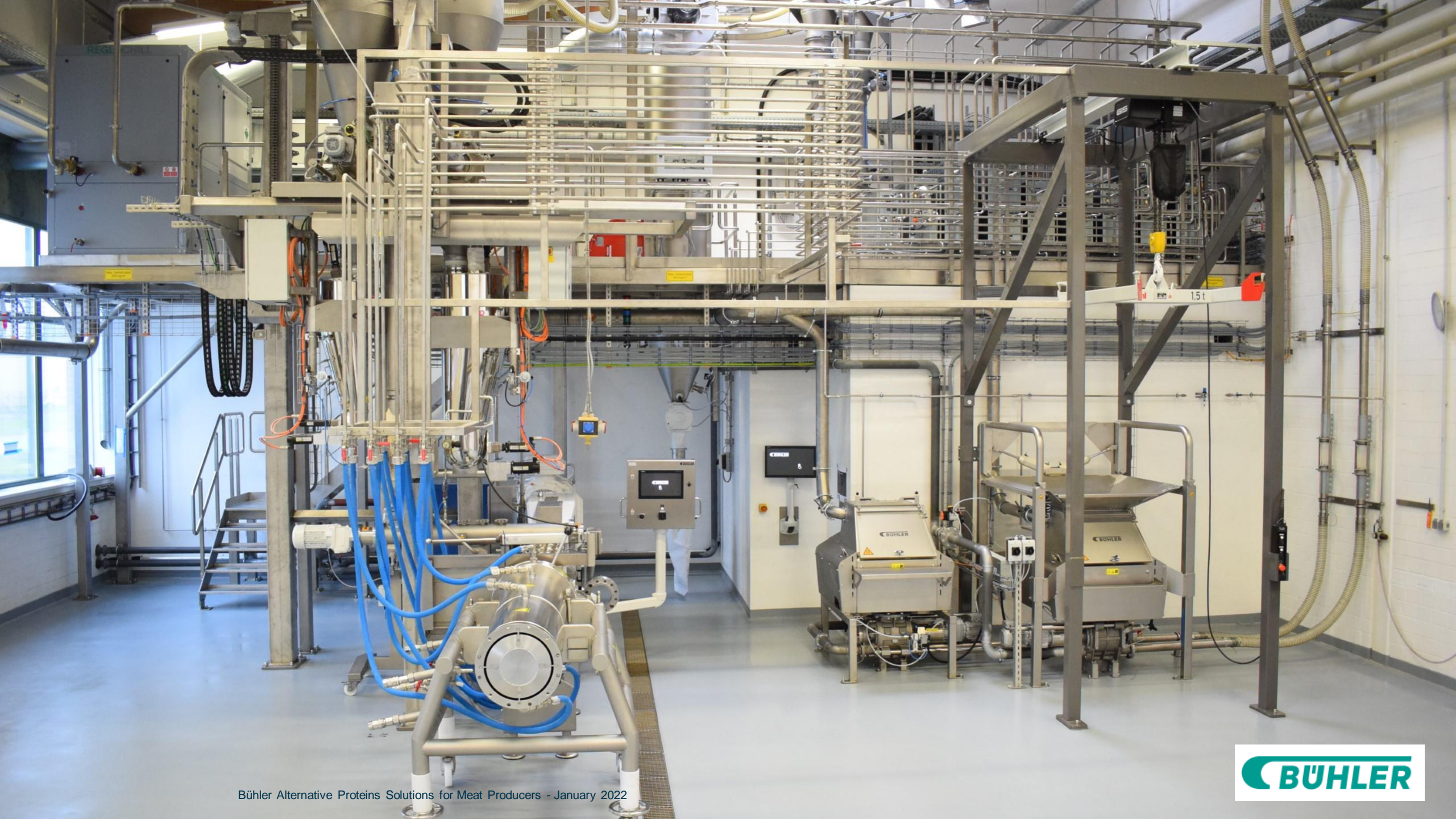
## Diversify Portfolio

Easy to diversify into new products  
like beef, pork, seafood





# Bühler Extrusion Solutions And Post-Extrusion





# Our Extruder Systems



	BCTM	BCTL	BCTG	BCTF	BCTH
Screw diameter (mm)	30	42	62	93	125
Throughput range dep. on product (kg/h)	20-50	50-450	150-1400	500-4500	1000-8000

# Our range of cooling dies.

Bühler has the highest throughput solution on the market.

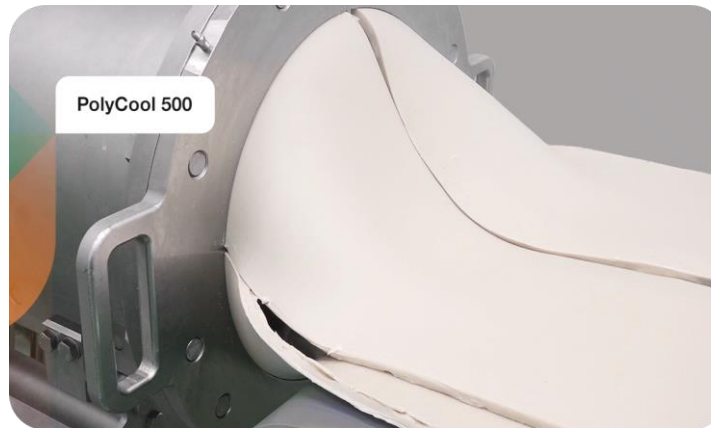
Extruder size	BCTM	BCTL	BCTG	BCTF	BCTJ
Screw diameter [mm]	30	42	62	93	125

Polycool 50

Polycool 500/1000



**~50 kg/h**



**~500 kg/h**



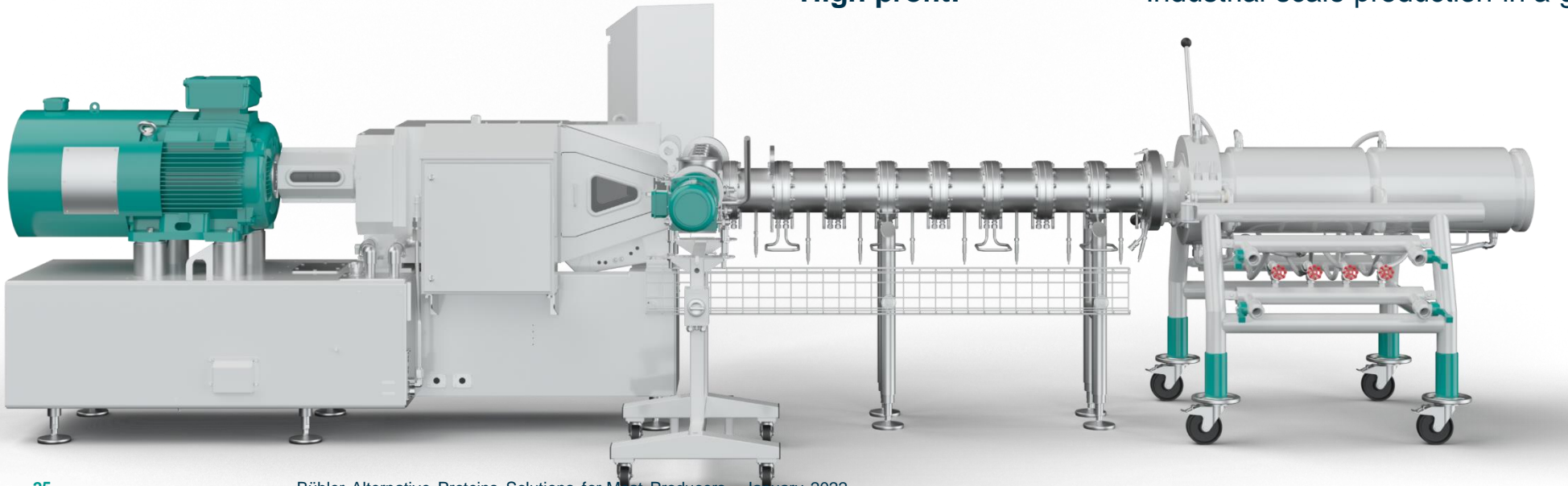
**~1000 kg/h**



# Cooling die, PolyCool 1000.

## Market leading solution.

- **High capacity:** Throughput: 1000 kg/h (depending on product)
- **Precise output:** Control individual cooling circuits
- **Flexibility:** Wide range of raw materials
- **Maximized food safety:** Easy to clean  
Electropolished surface
- **Fast installation:** Easy to assemble
- **High profit:** Industrial scale production in a growing high-demand market



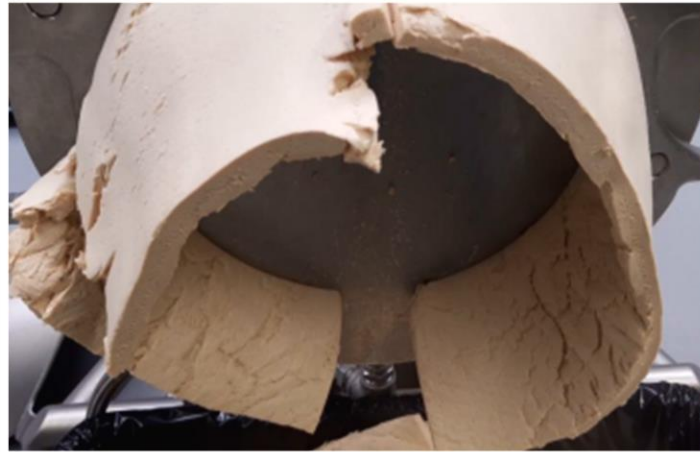
# Protein Aeration Technology

## Added value in product characteristics

**Microporous** structure

**Lighter colour** - more like chicken

**Thicker product**



**More flavour absorption**

**Biting** properties and **mouthfeel**  
closer to meat

**Reduced raw material costs** –  
more volume and weight



# Protein Aeration Technology

W/O Protein Aeration



0.05% Gas Injection





# Post-extrusion processes.

**BUHLER**

**holac<sup>®</sup>**

**VEMAG**

**Extrusion**



**Slicing**



(Mixing)



**Forming**











# VEMAG - Ingredients

Wet Texturdate



Dry Texturdate



Water



Oil



Starches



Fibres



Colours



Flavouring



## Example: plant-based balls



**VEMAG presents**  
**the production of plant-based balls**



## Example: plant-based mince



plant-based minced into trays

HP30E + MMP223 + SL305





# Our Services



# FROM PROTOTYPE TO PRODUCTION

How DIL supports the protein transition



# FACTS AND FIGURES

## THE DIL AT A GLANCE

FOUNDED **1983**

MEMBERS **184**

EMPLOYEES **200**

### LOCATIONS

- **QUAKENBRÜCK (GER)**
- **BERLIN (GER)**
- **KARLSRUHE (GER)**
- **BRUSSELS (BEL)**

### LEGAL STATUS

**REGISTERED ASSOCIATION**

### DIRECTOR

**DR. VOLKER HEINZ**

### MISSION

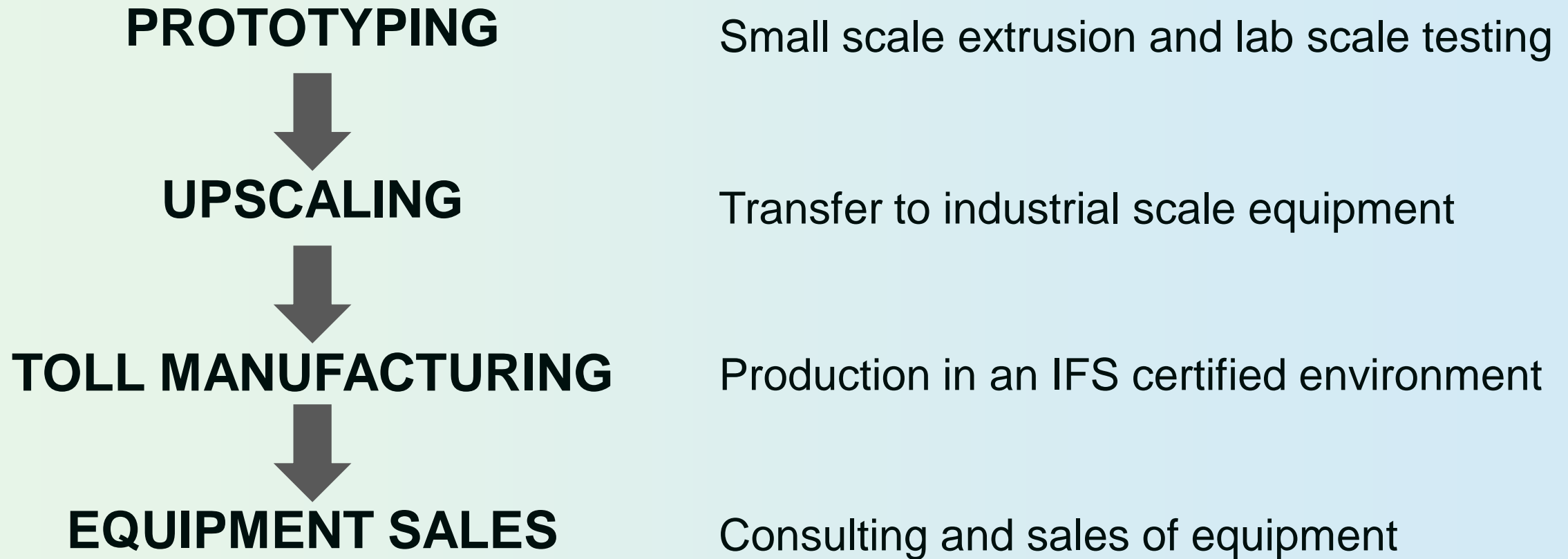
**KNOWLEDGE FOR SUPERIOR FOODS**





# FORM PROTOTYPE TO PRODUCTION

ROUTE-TO-MARKET FOR INDUSTRIAL R&D PROJECTS



# PRODUCT INNOVATION

DEVELOPMENT AND OPTIMIZATION

Source: DIL

- ❖ Recipe and process development
- ❖ Testing new raw materials
- ❖ Performance of taste tests
- ❖ Physico-chemical characterization
- ❖ Access to meat technology center



# PRODUCTION SCALE

UPSCALING



Source: DIL

## ❖ Extrusion

- ❖ Wet extrusion
- ❖ Dry extrusion
- ❖ Snack extrusion
- ❖ Encapsulation
- ❖ Agglomeration
- ❖ Multi-purpose cutting
- ❖ Cryogenic freezing
- ❖ Fluid-bed drying



# TOLL MANUFACTURING

EXTRUSION PLUS DOWNSTREAM

- ❖ IFS accreditation
- ❖ Up to 4 tons per day of cut and frozen wet extrudate

Source: DILL



# HIGH MOISTURE EXTRUSION

THE WORLD OF COOLING DIES

## PolyCool 500

Mid scale production  
250-500 kg/h

## FKD 2100

Small scale production  
100-250 kg/h

## PolyCool 1000

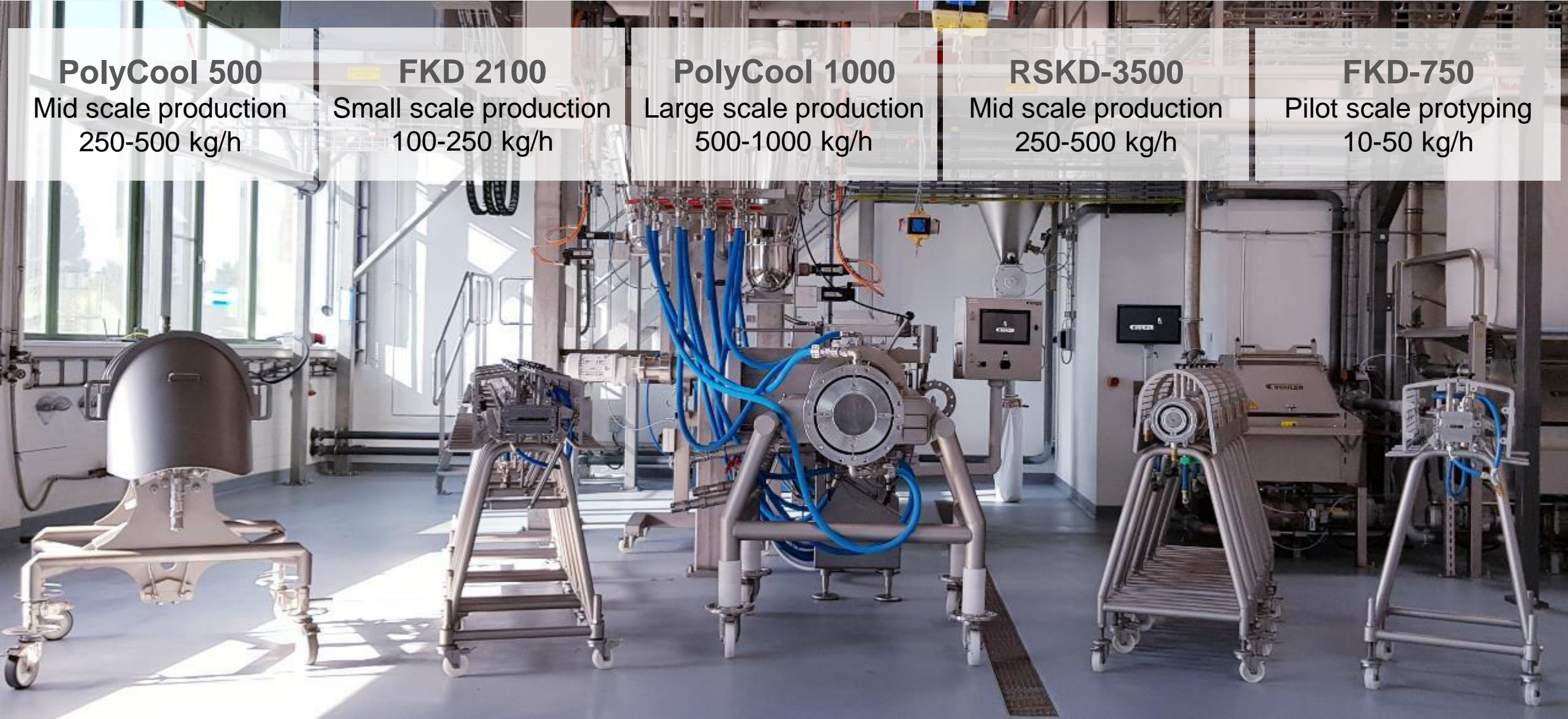
Large scale production  
500-1000 kg/h

## RSKD-3500

Mid scale production  
250-500 kg/h

## FKD-750

Pilot scale prototyping  
10-50 kg/h





# Virtual Workshops



Bühler Group Food & Feed Extrusion

3,705 followers

3w • 🌐

Many thanks to the participants of our Proteins Extrusion Workshop Pre-Session this morning!

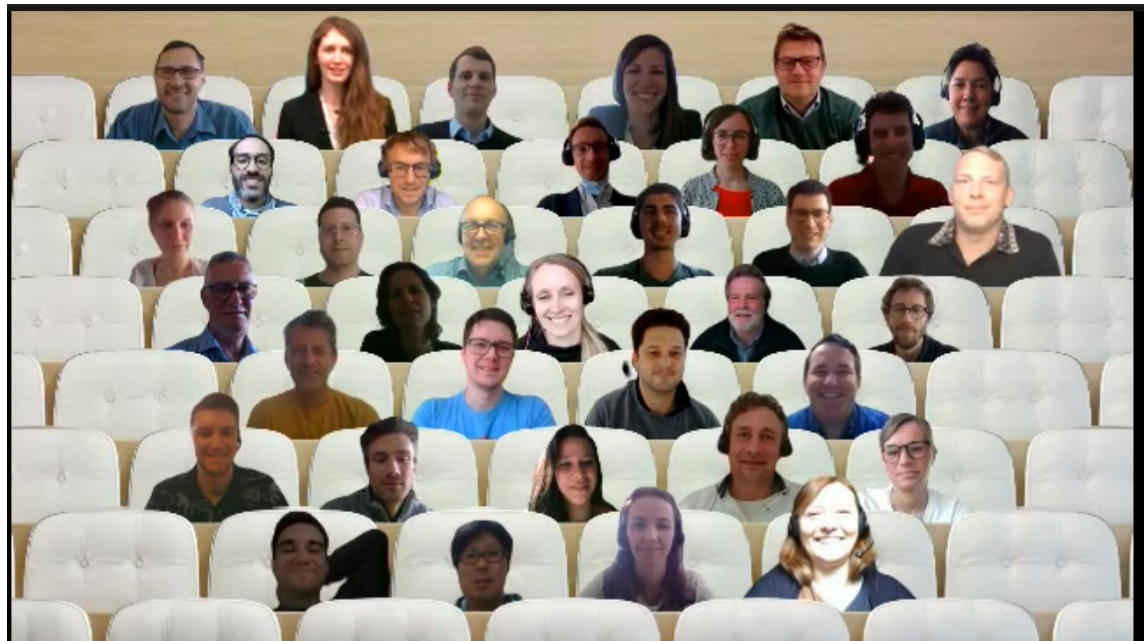
Our studio crew and extrusion specialists are very excited to start the official workshop next week.

We still have a few spots available here: <https://lnkd.in/dJm3iBp>

📅 26. October 2021 - 29. October 2021

📍 virtual

#workshop #protein #alternativeproteins






# Digital pre-training (+ practical on-site)



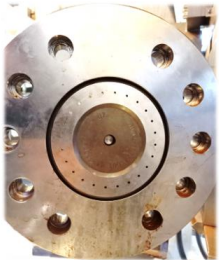
## Examples



Fixation de la géométrie de distribution et de la filière

Matrice (orientation opposée par rapport à la plaque d'extrémité)

Total: 24 trous, chacun avec 2 mm de diamètre



Training Competency Matrix

Operator ↓	Training									
	Tipping & Conveying	Powder dosing (Silo → feeder)	Extruder & screws	BCTB Polycool software	Line Start-Up, Troubleshoot	BCTC Pre-conditioner	BFTK Cooling die	BFTK-C Cutter	Regloplas	Mercury MES
Team member A	0	1	2	3	4	4	2	1	0	2
Team member B	1	0	4	0	1	0	2	4	0	0

- 0 - No competence
- 1 - Attended theoretical training
- 2 - Theoretical and practical training
- 3 - Comfortable with topic
- 4 - Able to train others



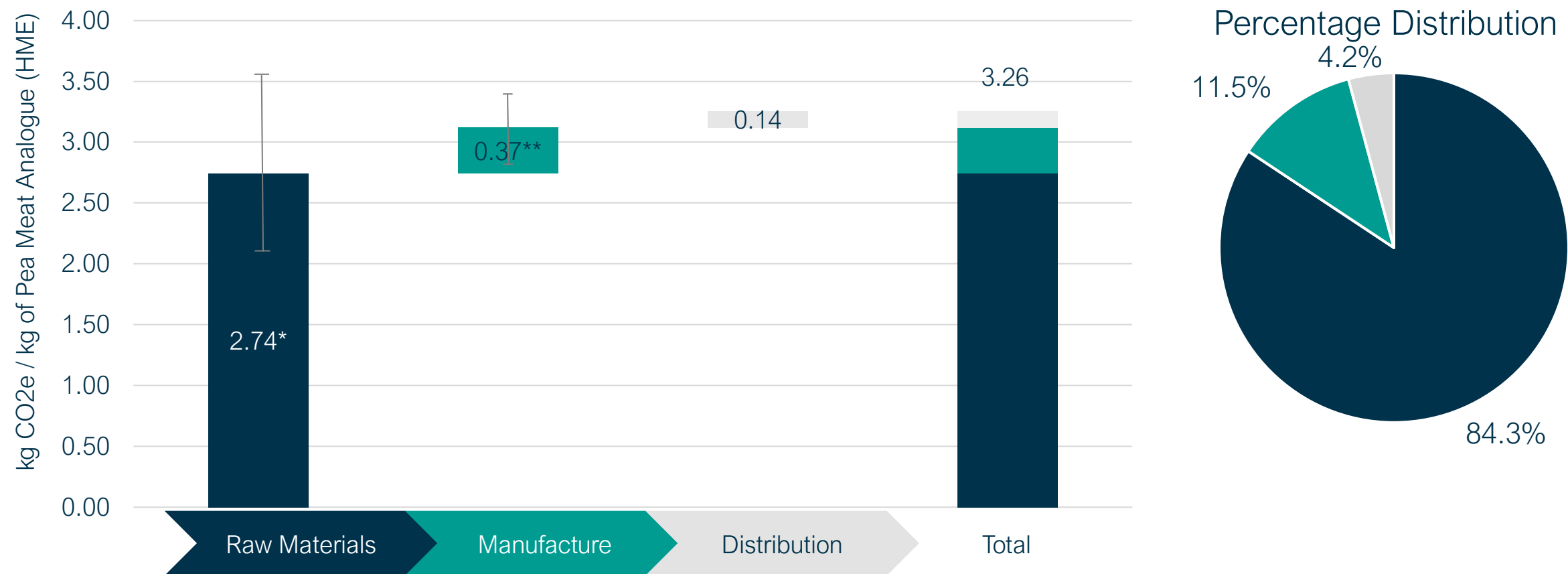
Software training



(Dis)mounting & Cleaning



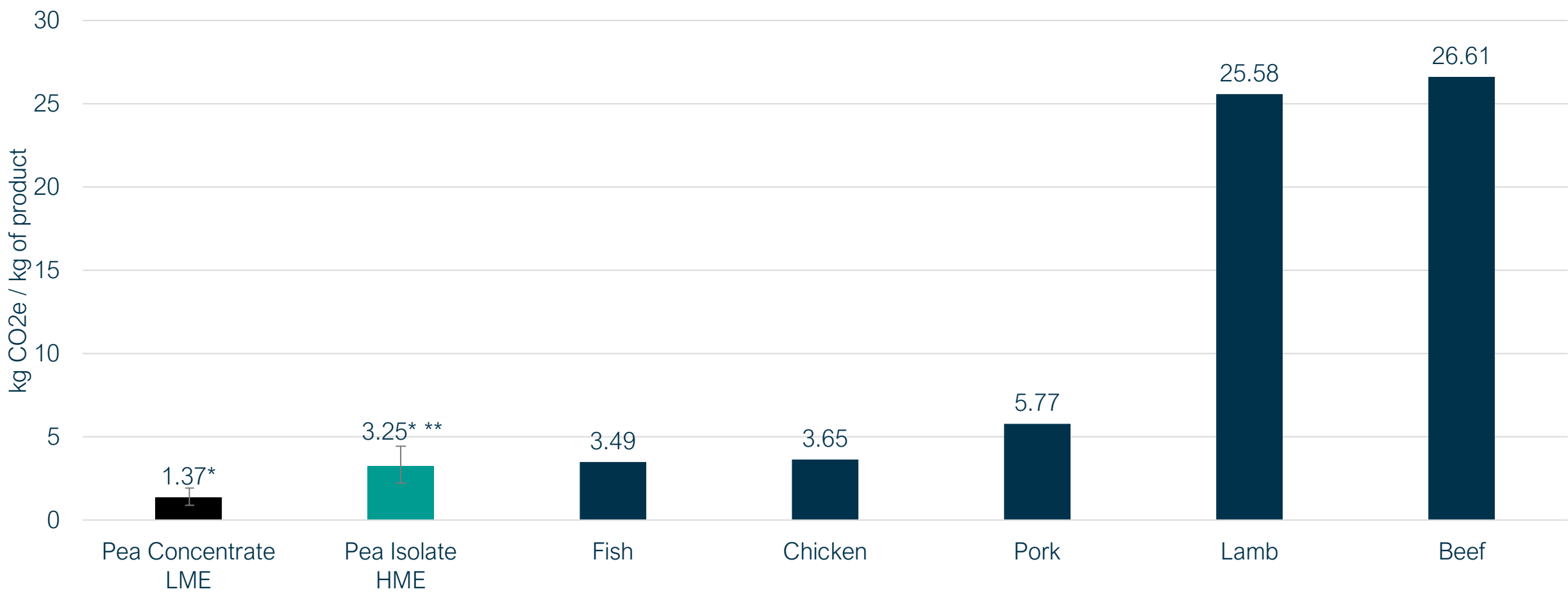
# CO<sub>2</sub>e Distribution of 1 kg of Pea Meat Analogue (HME)



\* Assumption: Average of literature value regarding energy consumption of Spray Drying in protein isolate production: <https://www.tandfonline.com/doi/abs/10.1080/07373937.2016.1275675>, Error bar indicates resulting min/max values

44 \*\*Averages of different sources for food packaging (<https://www.energy.gov/eere/amo/downloads/bandwidth-study-us-food-and-beverage-manufacturing>, <https://www.sciencedirect.com/science/article/pii/S0924224417303394>), error bar indicates resulting min/max values

# CO<sub>2</sub>e Footprint of Meat Production (conventional vs. plant-based)



\* Averages of different sources for food packaging (<https://www.energy.gov/eere/amo/downloads/bandwidth-study-us-food-and-beverage-manufacturing>, <https://www.sciencedirect.com/science/article/pii/S0924224417303394>), error bar indicates resulting min/max values

\*Assumption: Average of literature value regarding energy consumption of Spray Drying in protein isolate production: <https://www.tandfonline.com/doi/abs/10.1080/07373937.2016.1275675>, Error bar indicates resulting min/max values





# Four fully equipped application centers around the globe.



## Food Application Center Minneapolis, USA

The Food Application Center (FAC) is the playground that exemplifies our vision for the Future of Food in Minneapolis. Developing new ways to transform peas, chickpeas, beans, corn, oats, special grains and many other sources of alternative proteins, into flours, flakes, snacks, pasta, breakfast cereals, meat analogs, and a myriad of extruded products together with you.



## Extrusion Application Center Uzwil, Switzerland

Our Extrusion Application Center is a multi-purpose lab, where you can conduct tests on food and animal feed. In our Extrusion Application center we have fully equipped production lines, where we run trials on a laboratory scale, but also use industrial-size equipment under real operation conditions.



## Innovation Center Singapore

Bühler's equipment and processing expertise combined with Givaudan's flavor, taste, ingredient, and product development expertise creates a unique offering and synergy that will be greatly advantageous to those developing new products, particularly when using wet or dry extrusion



## Nutrition Application Center Wuxi, China

Test our new technologies and production processes and see how our latest technologies can help make your products. We use state-of-the-art technology – with the possibility to integrate your own machines.

# Global network supporting transition to sustainable proteins.

- FAC Minneapolis 



-  NC FOOD INNOVATION LAB

-  UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

## USA

## MEXICO

-  Tecnológico de Monterrey

## CHILE

-  UNIVERSIDAD DE SANTIAGO DE CHILE



- **ETH** zürich

-  DIL

- Application Center Uzwil 

## CHINA

-  江南大学  
JIANGNAN UNIVERSITY

- Application Center Wuxi 

## SOUTHEAST ASIA

- PIC Singapore  with Givaudan 

-  University Collaboration

-  Application Center, Lab



Join us in

ENGLISH

*Jan 20, 2022*  
*16:00 – 17:00 CET*

### **Alternative Proteins for Meat Producers**

The world of plant-based meat and alternative proteins is booming. Many players...

GERMAN

*Feb 3, 2022*  
*16:00 – 17:00 CET*

### **Alternative Proteine für Fleischproduzenten**

Die Welt der Fleischersatzprodukte und der alternativen Proteine boomt. Viele...

FRENCH

*Jan 27, 2022*  
*14:00 – 15:00 CET*

### **Protéines végétales extrudées : les nouveaux alliés des producteurs de viande animale**

La viande d'origine végétale et des protéines alternatives sont en plein essor...





INNOVATIONS FOR A BETTER WORLD