

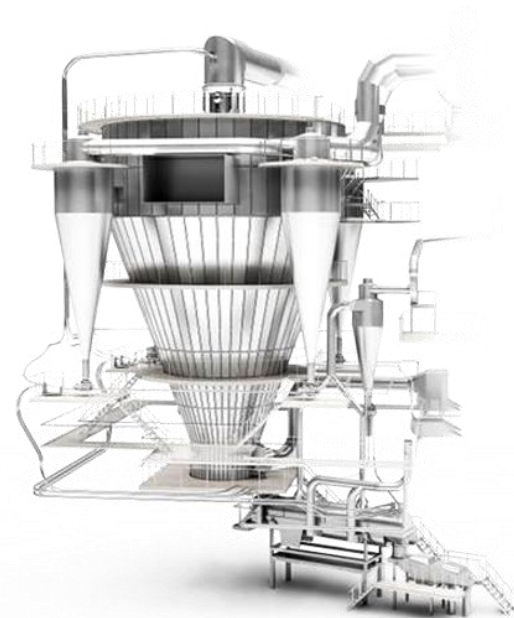
# Managing Humidity

(and Moisture)

SJP, PTC-DRYING AND POWDER PROCESSING, 2018-04-10



- Intro to GEA
- Drying Technologies
- Future Outlook



# Our ambition: Be your no. 1 choice

We strive to be the world's leading global engineering group, in supplying smart solutions for sophisticated process industries. Our goal is to be the customer's preferred partner in the industries we serve.

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)



**564**  
million operating  
EBITDA (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.

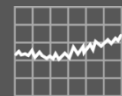


**4,751**  
million order intake (EUR)

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



**4,605**  
million revenue (EUR)



**1.31**  
earnings per share (EUR)



**12.2**  
% operating EBITDA margin

# Strong local presence around the globe

## North America

👤 1,763  
€ 846 million  
% 18

## Latin America

👤 471  
€ 317 million  
% 7

## North and Central Europe

👤 2,927  
€ 583 million  
% 13

## DACH & Eastern Europe

👤 6,398  
€ 944 million  
% 21

## Asia Pacific

👤 2,904  
€ 1,027 million  
% 22

## Western Europe, Middle East & Africa

👤 3,401  
€ 889 million  
% 19

📍 GEA locations  
(sales office, service branch or  
other GEA sites)

👤 Employees in 2017 (FTEs)

€ Revenue in 2017

% Regional revenue split in 2017 (only continued operations)



# We make processing equipment and solutions



- Heat exchanges
- Reverse osmosis
- Valves



- Pumps
- Freeze dryers
- Evaporators
- Packing
- Aseptic filling

- Nano filtration
- Milking machines
- Thermoformers
- Cooling towers
- Separators
- Ultra filtration
- Homogenizers
- Storage tanks
- Auxiliary equipment
- Compressors
- Freezers

- Ice machines
- Tableting
- Refrigeration



- Air conditioning
- Decanters
- Blow choppers
- Powder manufacturing
- Spiral cookers
- Slicers
- Tumbling
- Defrosting
- Bag filters

- Feeding systems
- Barn equipment
- Centrifuges
- Farm design
- Purgers
- Chillers
- Heat pumps
- Calcining
- Emission control
- Bioreactors
- Pelletization



- Coating
- Lyophilization



- Automation & Control Systems
- Bakery Lines
- Beverage Plants
- Brewery Plants
- Cleaners & Sterilizers
- Distillation & Fermentation Systems
- Dryers & Particle Processing Plants
- Emission Control Systems
- Evaporators & Crystallizers
- Filling & Packaging Systems
- Flow Components
- Food Processing & Packaging
- Homogenization Solutions & Systems
- Liquid Food Systems
- Liquid Processing Systems
- Membrane Filtration Systems
- Pharmaceutical Systems
- Product Handling Systems
- Refrigeration Solutions & Systems
- Separation Solutions & Systems
- Systems for Milk Production and Livestock Farming
- Vacuum Systems

# Our applications – in touch with GEA every day

## 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



**Around 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** is handled by GEA equipment

## Chemical



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

## Utilities



**Each industry we serve** utilizes GEA's industrial refrigeration technologies

## Marine



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



# Megatrends – understanding and taking advantage of opportunities



## URBANIZATION WITH GROWING MIDDLE CLASS

Growing demand for processed food and medication

**GEA offers**  
components and process technology for processed food, ready meals, fortified lifestyle beverages and food, medications



## GREATER FOOD SAFETY AND QUALITY

Readiness of industry to invest more for greater process reliability

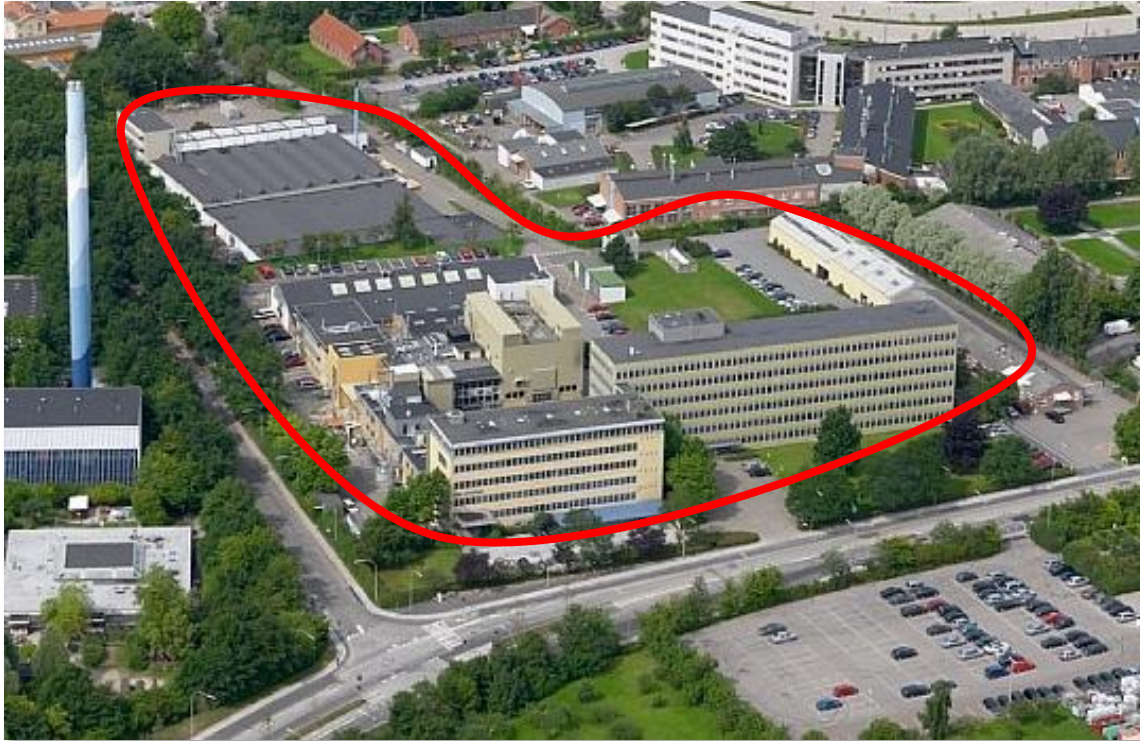
**GEA offers**  
certified hygienic/aseptic processes and components to meet the strict standards of the industry



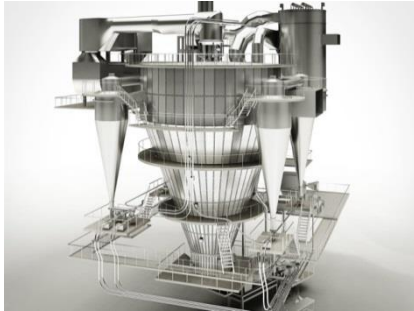
## ENERGY SCARCITY AND STRICTER ENVIRONMENTAL REGULATIONS

Greater interest in efficient and resource-saving production processes

**GEA offers**  
intelligent engineering processes for resource-economical technologies, energy-saving machines and processes, as well as heat recovery



## Spray Drying



## Fluid Bed Drying



## Ring Drying



## Freeze Drying



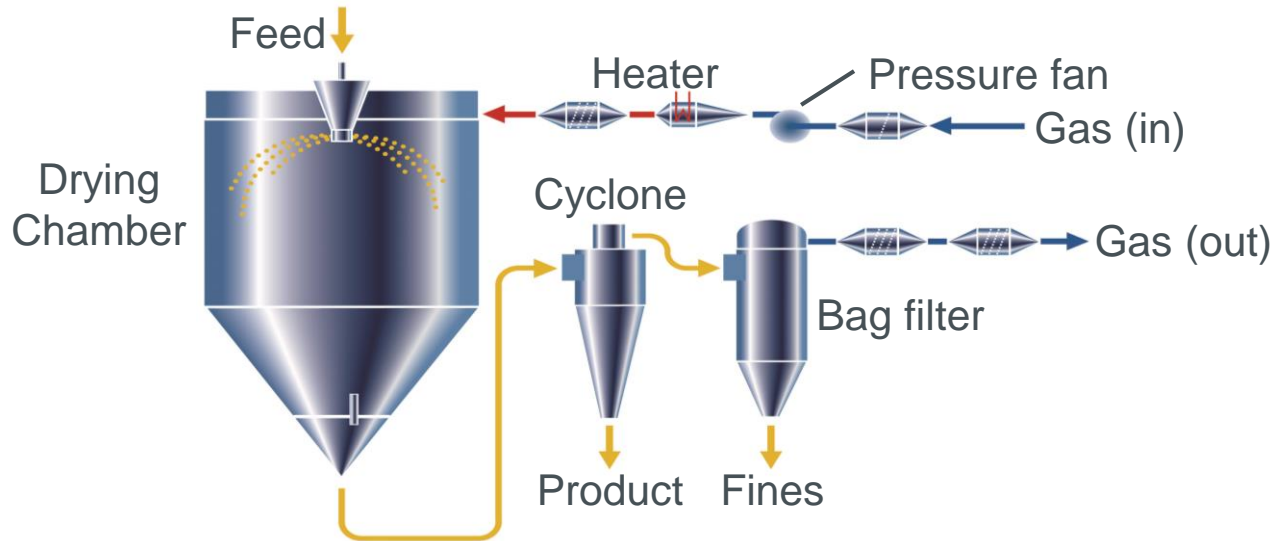
## Rotary Drying



- Milk
- Coffee
- Whey
- Infant formula
- Starch
- Dye
- Polymer
- Lithium-ion
- API (Active Pharmaceutical Ingredient)
- Hard-metal
- Ceramics
- Formaldehyde



- Spray drying
  - Conversion of a solution or a suspension into a dry powder product
- Process steps
  - Atomization
  - Drying
  - Separation



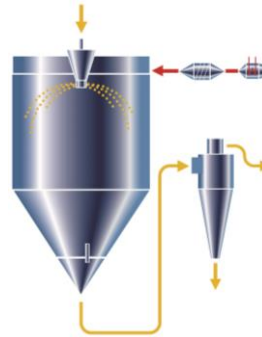
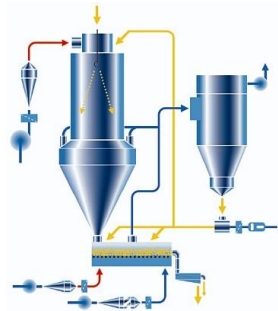


# Spray Dryer Designs

## 1. Size

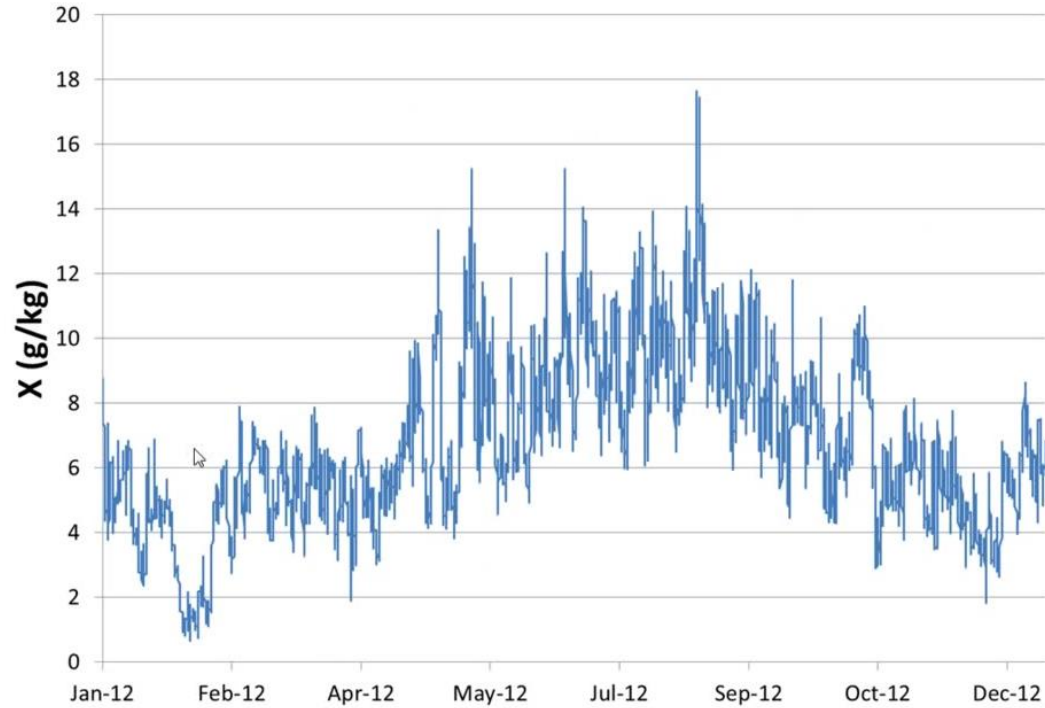


## 2. Configuration





Ambient air  
humidity variation -  
Europe



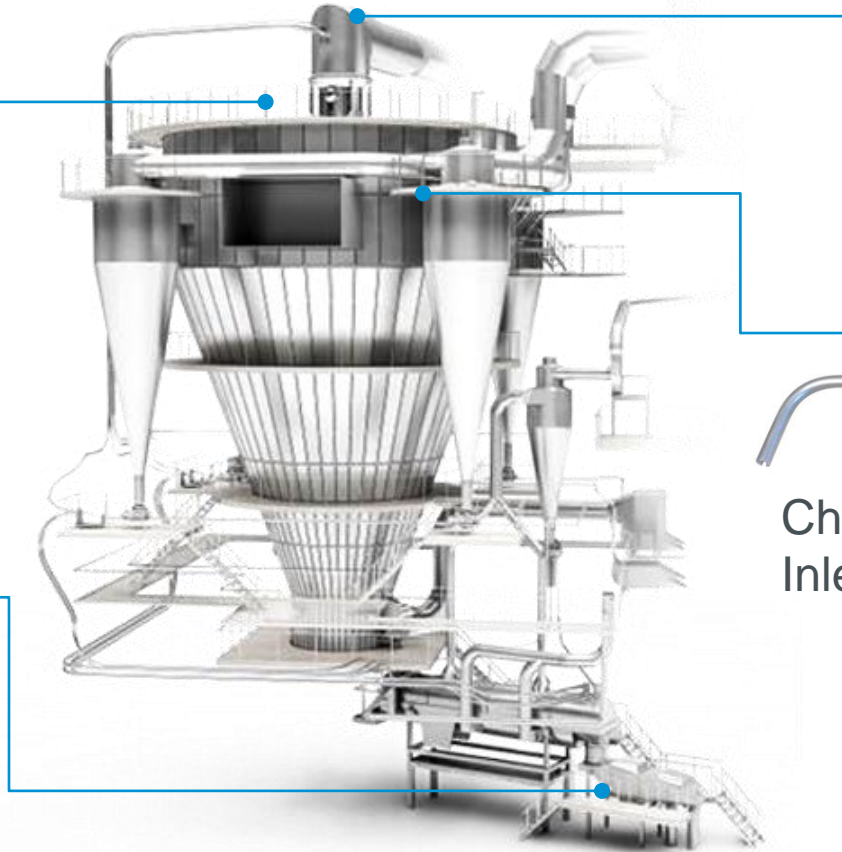
# In line sensors

Total solids  
in feed

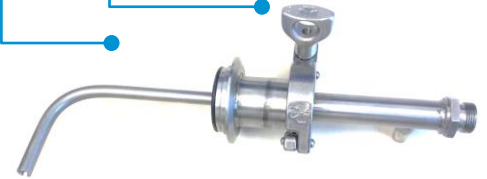


Powder moisture  
Scorched particles  
Density

Property of GEA



Chamber humidity  
Inlet air humidity sensor

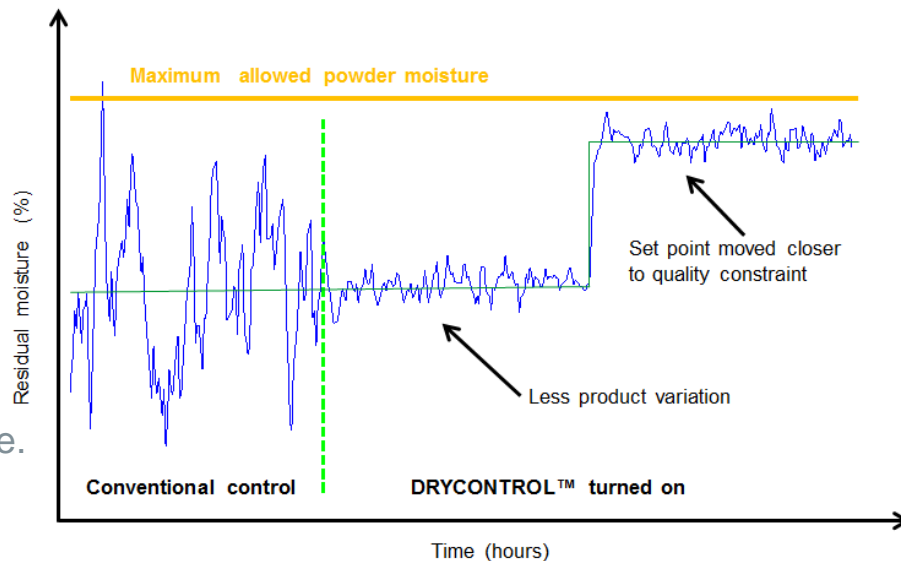


## Overall Spray Dryer or plant

- Simulating different control actions real time
- Selecting the optimal combination of actions

## The value lies in 'Squeeze and shift'

- Variation of the process is squeezed
- Set point can be shifted closer to the maximum value.





- Need for sensor development
- Humidity in process stream not just a disturbance

