

**High performance, efficient and flexible all electric  
injection moulding technologies for thin-wall containers**

**ENGEL**

Willkommen

**Welcome**

## ENGEL | **Facts & Figures**

### Foundation

1945 by Ludwig Engel

### Ownership

The company is 100% family owned

### Production Program

Injection moulding machines  
from 28 to 5500 t clamping force & robots

### Turnover ENGEL worldwide (FY 13/14)

937 million Euro

### Staff ENGEL worldwide (FY 13/14)

4,500 employees



## ENGEL | Production Plants

Schwertberg / AT



Pyungtaek / Korea



York / USA



St. Valentin / AT



Shanghai / China



Dietach / AT



Hagen / DE



Kaplice / CZ



- Small- and medium-sized machines up to 5,000kN clamping force
- Robots and automation systems
- Large-sized machines from 3,500kN to 55,000kN clamping force
- Component manufacturing

## ENGEL | **Business Units**



automotive



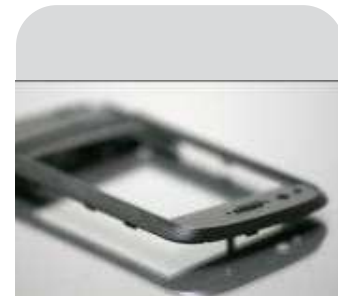
medical



packaging



technical  
moulding

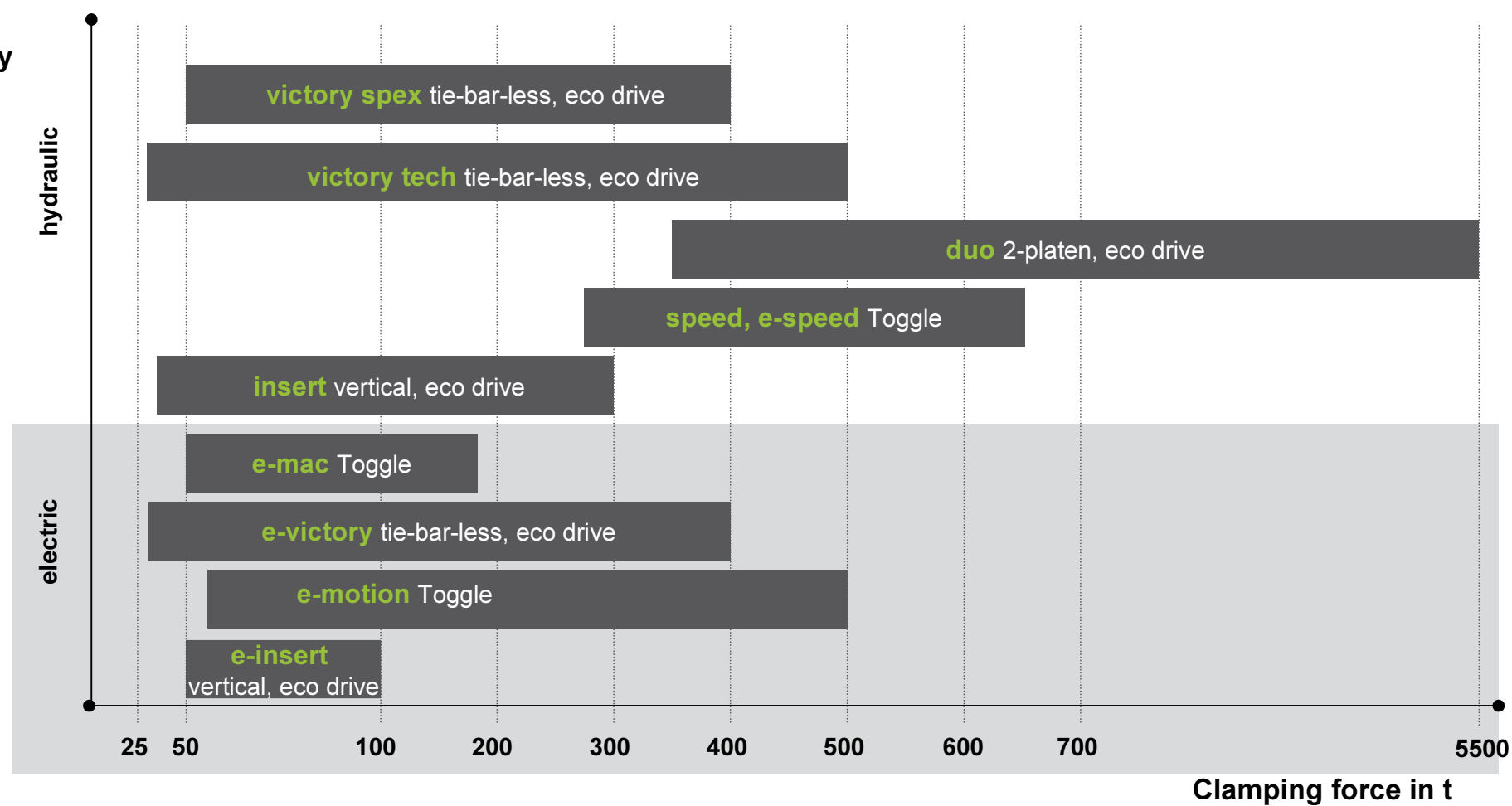


teletronics

# Engel at a Glance

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Drive  
technology



- **Thin wall packaging in the 20th century**
- **Trends and requirements for thin wall packaging today**
- **Challenges of modern food packaging**
- **Efficient manufacturing with all electric machines**
- **Design requirements**
- **Information and decoration/IML**
- **Increasing shelf life/barrier technology**
- **Sustainability aspects**

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# Thin wall packaging in the 20th century

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- Simple design
- Simple or no decoration
- Thicker walls
- Raw material with MFR 30-40

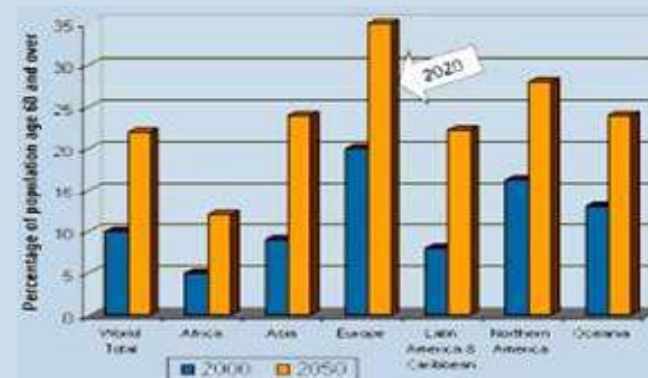
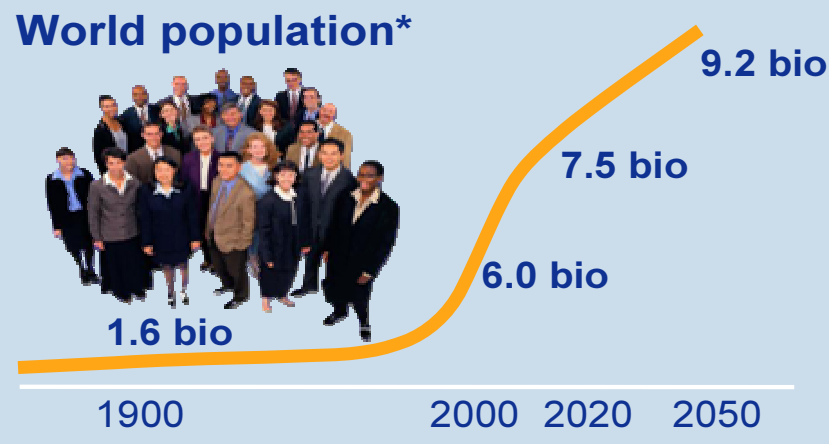




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# Trends - Demographic Trends

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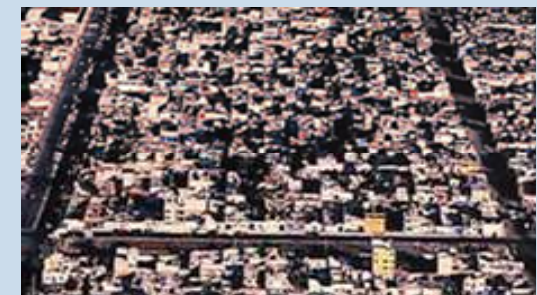
**Ageing  
60+  
increasingly  
important**



**DINKS**  
Double  
Income  
No  
Kids

## Urbanisation

In 2020 more than  
50% of world  
population will live  
in cities



Quelle: Präsentation Borealis 2007 – Dünnwandmarkt und –trends von Bala Kona

# Trends - Branding / packaging as advertising medium

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# Trends - Efficient manufacturing / Optimizing of production costs

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- Weight optimization / Thinner walls
- Output maximization / Higher cavities
- Energy savings and cycle time optimization



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# Challenges of modern food packaging

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- Unique design / high recognition value
- Smaller packaging units (for single/DINK households,...), easy to portion
- Shelf life (improved barrier features of the raw material and / or label)
- Careful handling of resources (recycling, energy saving)
- Convenience packaging (Safety-tamper evidence, transparent windows, additional functions, i.e. integrated spoon, microwave safe...)
- High quality decoration (In Mould Labelling with high-quality labels)



# Modern food packaging

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- Offers a special design, additional functions and acts as advertising medium



# Modern food packaging

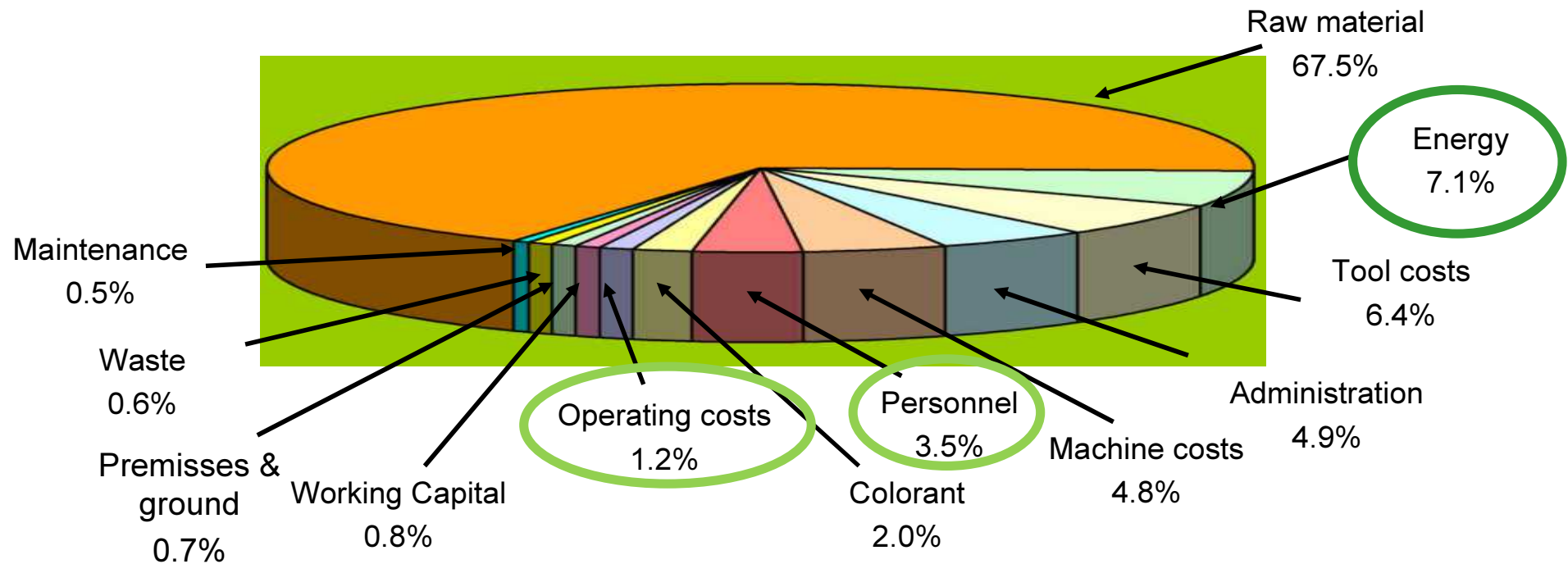
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- Optimized in production costs and sustainably produced



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## Breakdown of production costs per packaging part





## **A modern injection moulding machine for the production of packaging parts is:**

- A high-performance machine
- Energy efficient: Electric
- Contributes to a sustainable production process

# Efficient manufacturing with all electric machines

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**e-motion series** | fully-electric high-performance machine | clamp force range 100 to 500t

- All movements servo-electric

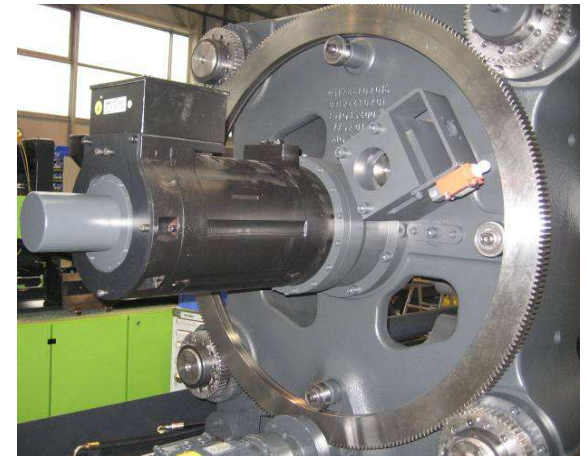


# Efficient manufacturing with all electric machines

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## e-motion clamping side 5-point toggle

- Increased clamping drive for shortest dry cycle times



# Efficient manufacturing with all electric machines

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## e-motion injection unit

- Increased drive for higher injection power

Unit	Standard	High	Premium
310	220	330	450
440	180	265	450
740	175	330	450
940	150	300	450
1340	210	250	400
1640	160	215	400
2440	120	180	300

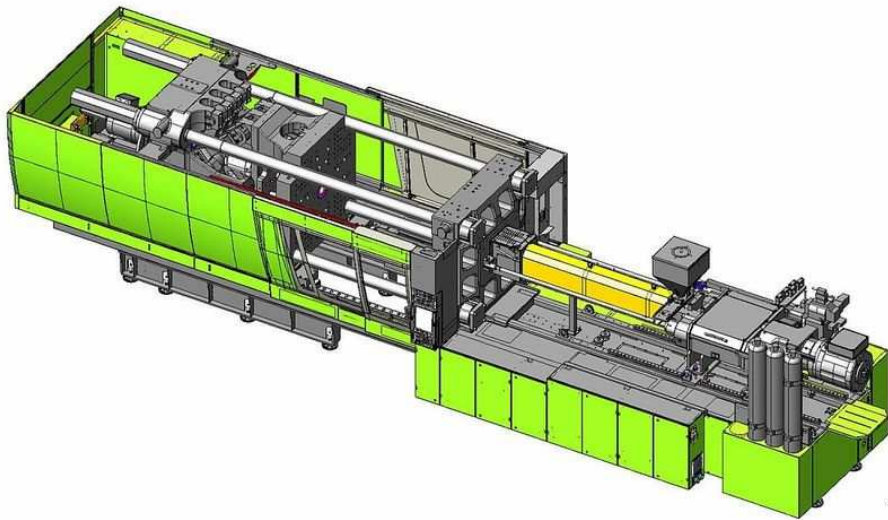


# Efficient manufacturing with all electric machines

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## e-speed 650

- Electric high-performance machine with hydraulic for fast injection





# Efficient manufacturing with all electric machines

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## Cup, 6 cavities | shot weight 74.76g PP

### Hydraulic

(Full-accu machine , YOC 2002)

#### Energy measurement

(Figures acc. to customer)

•

• Total energy : **51.38 kW**

Spec. Energy : **1.05 kWh/kg**

### Full-electric

(e-motion 740/280 T)

#### Energy measurement

• Drive : 11.908 kW

• Heating : 7.138 kW

• Control : 0.747 kW

• Hotrunner : 3.798 kW

• Total energy : **23.636 kW**

Spec. Energy : **0.421 kWh/kg**

- 60%



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# Efficient manufacturing with all electric machines

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Food Container, 2 cav. | **shot weight 160.1 g PP**

Hydraulic  
(speed 380/80)

## Energy measurement

- Drive / Hydraulic: 62.516 kW
- Heating : 10.461 kW
- Control : 0.734 kW
- Oil filtering unit : 1.240 kW
- Total Energy : 74.951 kW

Spec. Energy : 0.792 kWh/kg

- 60%

Full-electric  
(e-motion 2440/380 T)

## Energy measurement

- Drive 19.164 kW
- Heating : 10.595 kW
- Control : 0.756 kW
- 
- Total Energy : 30.515 kW

Spec. Energy : 0.323 kWh/kg



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# Efficient manufacturing with all electric machines

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## Product Protection with clean machines

- **High Performance combined with cleanliness**
  - Grease-free tie-bars, non-guiding
  - Clean toggle with oil return system



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## Unique design

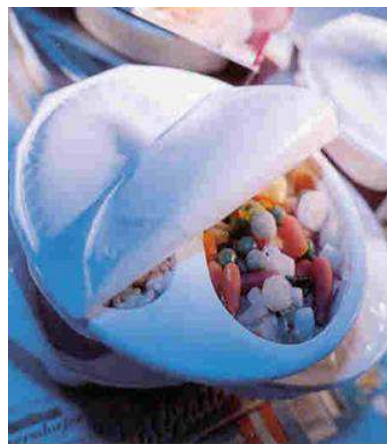
- 2 cups in one
- 2 colors





## Multi-function – convenience packaging

- Temper evident solutions
- Double function containers



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# Information and decoration

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Advertising on side walls and lid

Information about the product on container bottom



## High quality decoration as part of the product quality

- Best quality decoration with IML



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## Consideration of the packaging industry

Replace glass- and metal cans with plastic containers with barrier function.

- **Advantages of plastic containers**
  - Flexible in design
  - Lighter
  - Logistic: Usually stackable

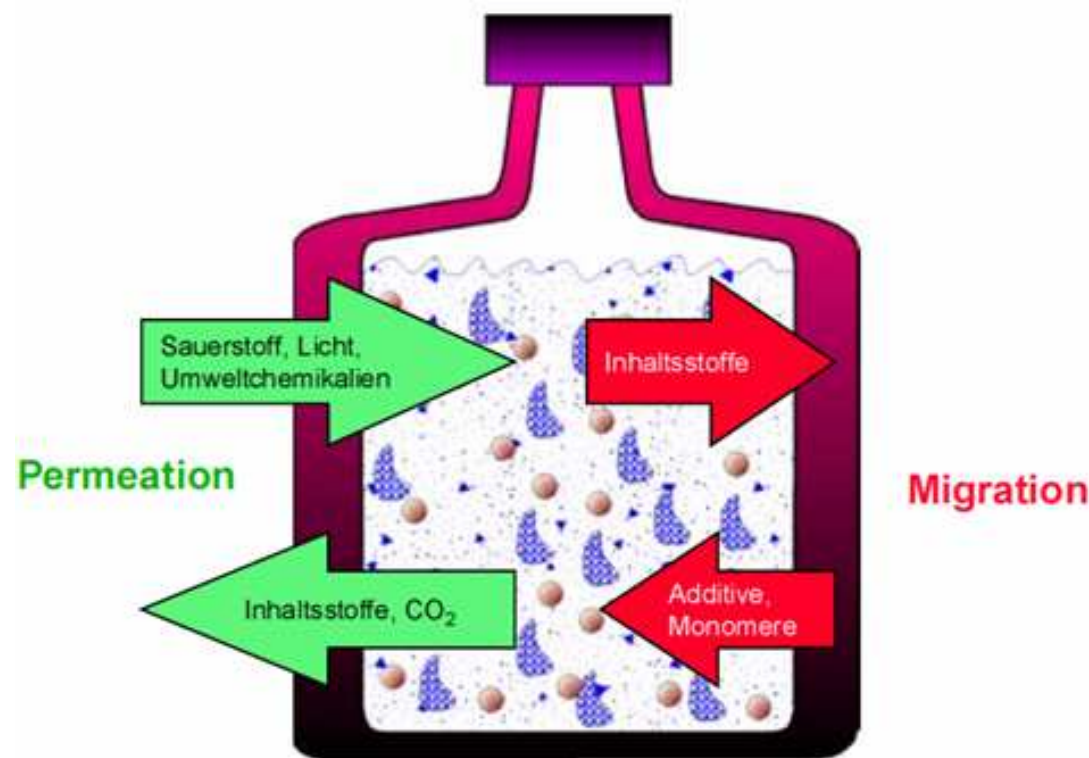
FROM CAN TO PLASTIC  
HIGH-BARRIER PLASTIC CUP  
FOR RETORT FOODS

- NO PRESERVATIVES NEEDED
- STORE AT ROOM TEMPERATURE
- LONG SHELF-LIFE
- TRANSPARENCY
- MICROWAVEABLE





## Why a barrier?



## Plastic container with barrier function

- **Thermoformed container:**

Already on the market(Packaging containers, laminat tube made of multi-layered material)

Disadvantage:

- Expensive
- Less flexible in design

- **Injection-moulded container:**

Already on the market: Bottles with barrier layer (2K-Preform)

At the beginning: Thinwall food containers with barrier characteristics



## Injection moulded container with barrier function

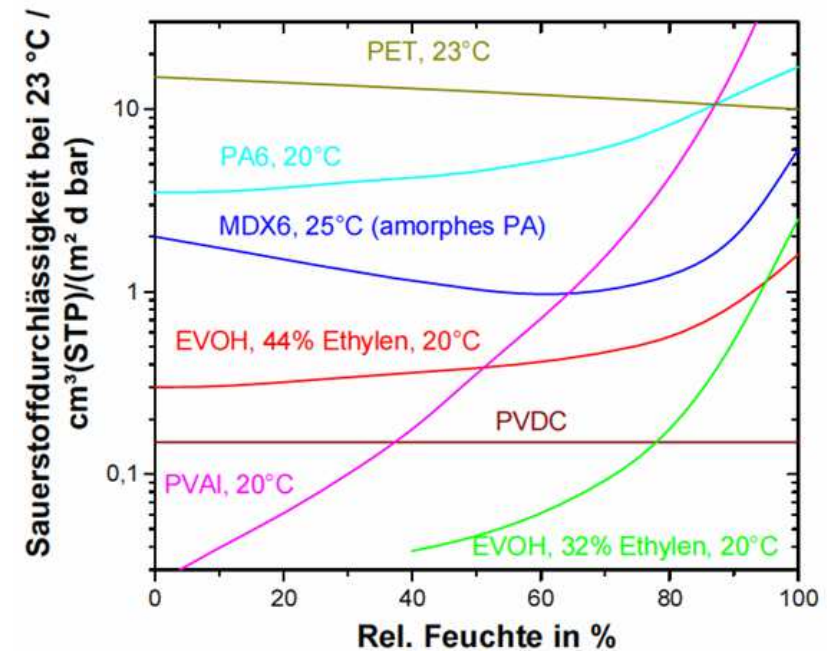
- Technological approaches
  - IML with barrier label (Multi-layer barrier label with EVOH layer, SiOx-coated barrier foil)
  - Co-injection
  - Coating



## Co-injection

- Possible barrier materials
  - PA
  - EVOH
  - PVDC (Saran): Polyvinylidenchlorid (DOW)
  - Overmoulding of tin foil on both sides

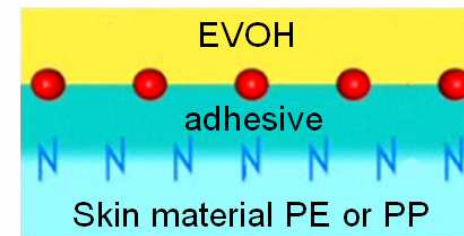
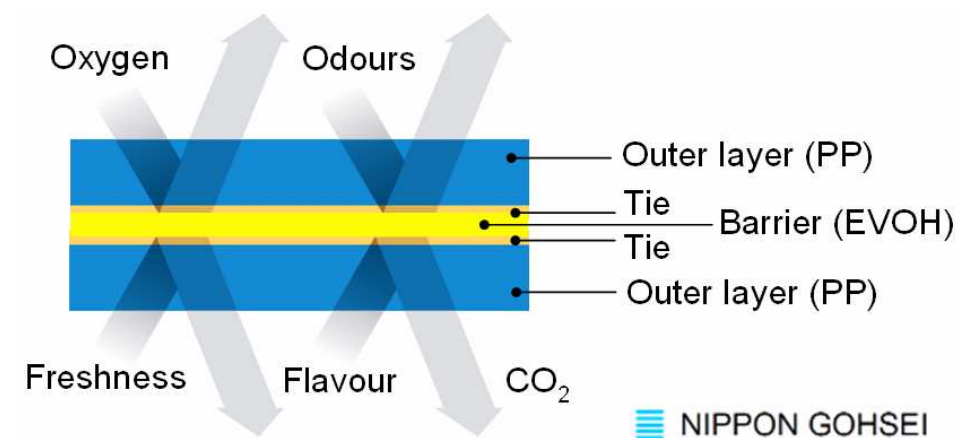
EVOH: copolymer consisting of ethylene and vinyl alcohol



Humidity dependent  
O2-Permeability

## Challenges

- Create a very thin EVOH barrier layer (about 0,05mm) to be competitive against glass and tin formats.
- Get the adhesive bonding between the layers



## Production cell for barrier co-injection technology

- The co-injection technology is a revolutionary alternative to traditional packaging methods
- All electric high performance machines guarantee maximum output and low energy consumption
- High precision servo driven injection units secures that the barrier layer is reliably implemented up to the edge
  - Use of a small 15mm screw for the injection of barrier layer



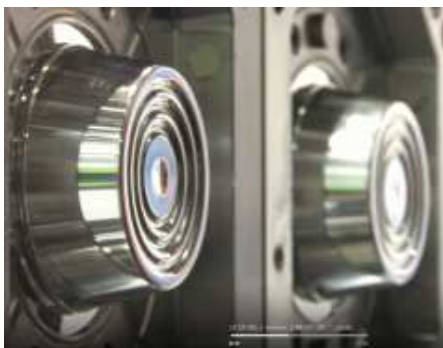
e-motion 310H/50V/180 T combi



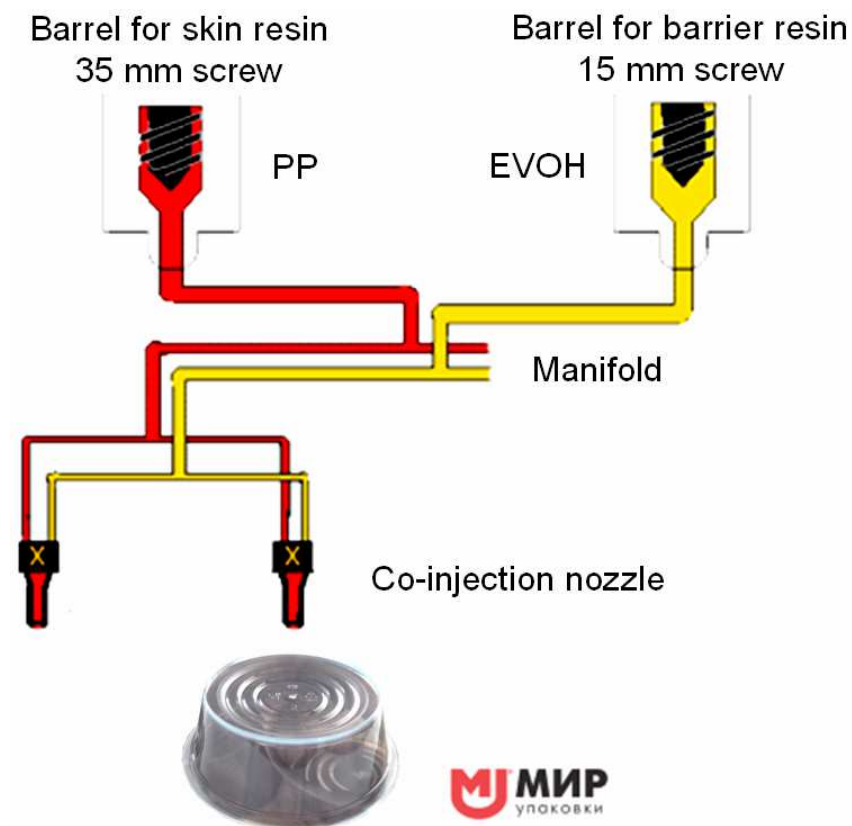


## Mould and hotrunner technology

- Mould with 2 cavities for a pet food container
- Specially designed co-injection nozzles and manifold technology that combines melt streams and provides balanced fill



 Otto Hofstetter AG

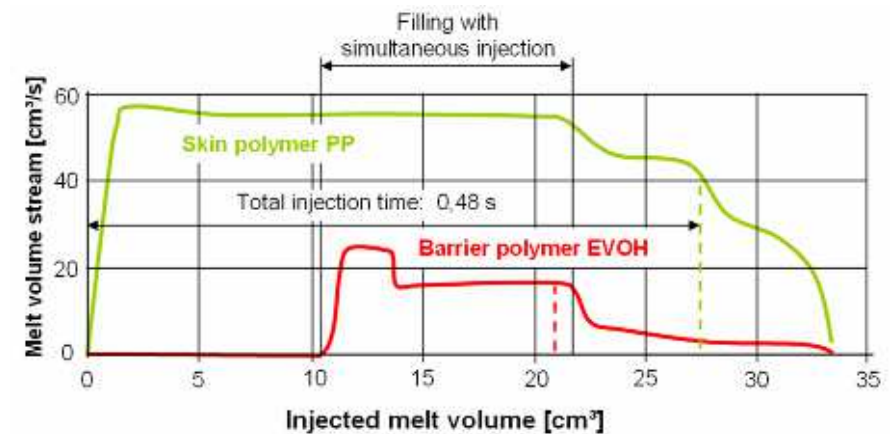
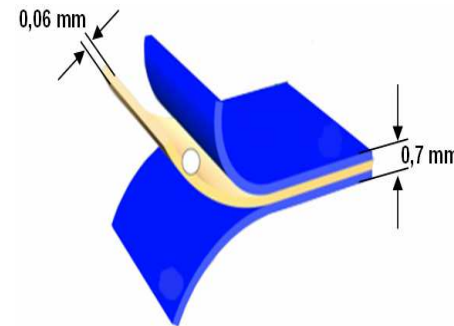


# Increasing shelf life/barrier technology

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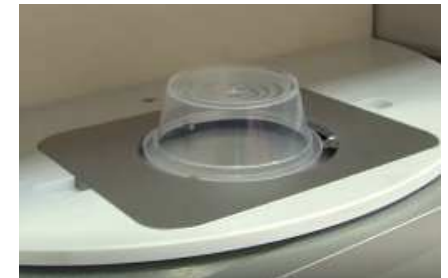
## Process

- Cycle time: 5,5 sec.
- Part weight: 8,7g
- Simultaneous co-injection
  - Minimize barrier layer wall thickness



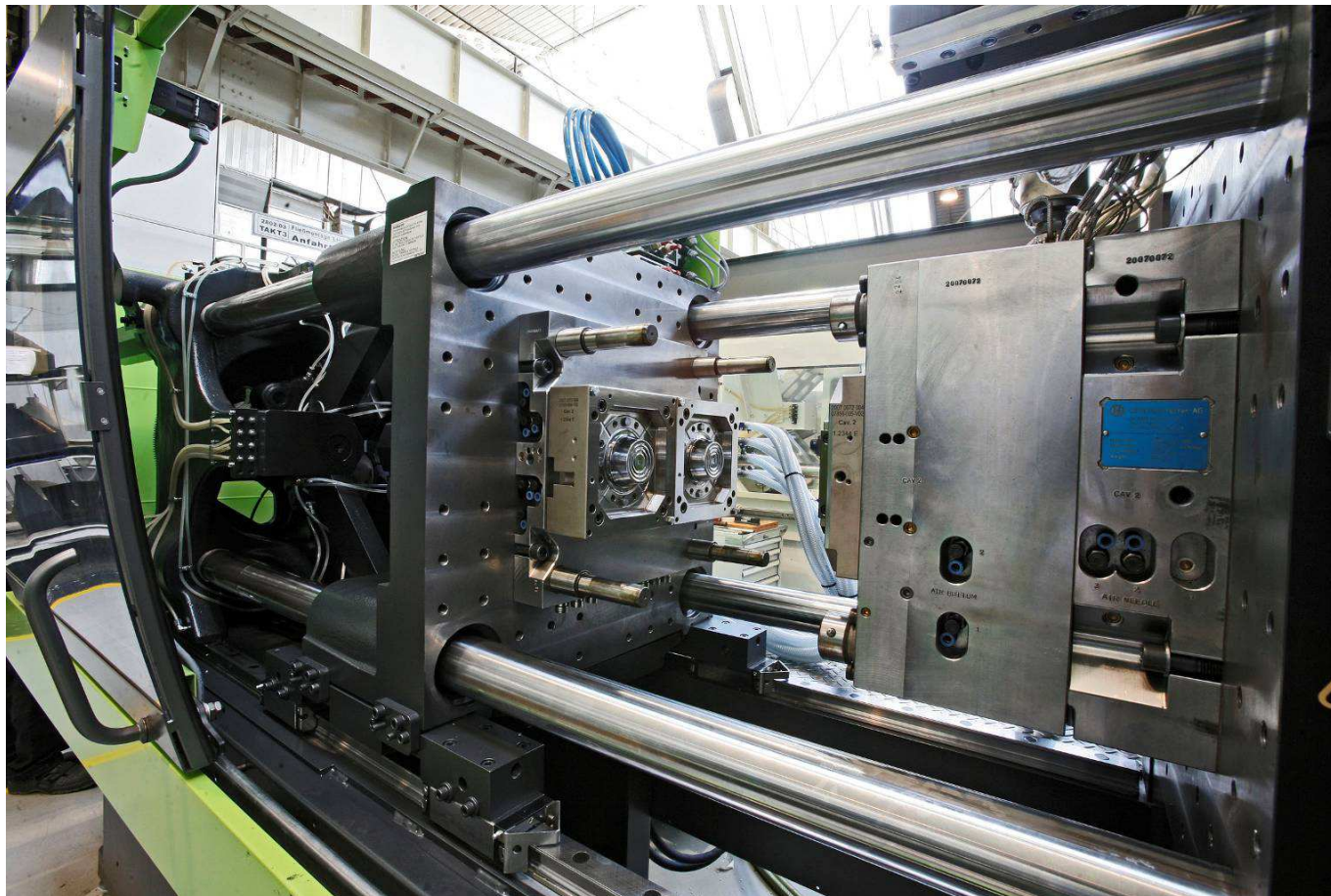
## Barrier watcher | In-line Inspection of Layers

- Specialized camera system detecting insufficient layer thickness and distribution, holes and defects in comparison to the reference image
- Capable of inspecting EVOH barriers and additional barrier materials



# Increasing shelf life/barrier technology

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## Being sustainable through:

- **Clean manufacturing**  
Electric machines | Clean (sealed toggle) | Oilfree mould area





## Being sustainable through:

- Lean manufacturing & Reducing carbon footprint

Traditional production: 4 steps



Manufacturing footprint: around 250 m<sup>2</sup>

Injection moulding: 1 Step

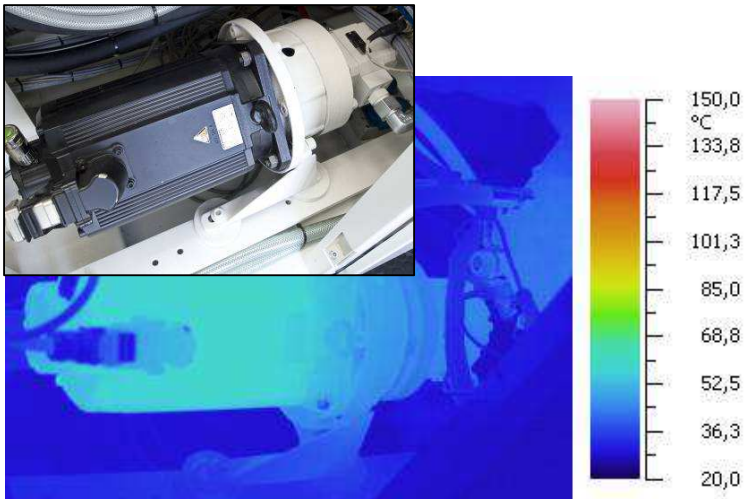


Footprint: 60 m<sup>2</sup> for comparable output,  
being 75% less production area

## Being sustainable through:

- Manufacturing performance: saving energy, reducing oil

Drive side: **ecodrive**



Injection side: **Insulation**



## Being sustainable through:

### Using biodegradable resins

- **Processing biodegradable materials**
- **Advantages**
  - Resin biodegradable within 6 months
  - Products are compostable
  - No shrinkage
- **Disadvantages**
  - Difficult to process with thin walls (small process window, resin degrading with high process temperatures, not easy to fill)



**High performance, efficient and flexible all electric  
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Vielen Dank

**Thank you**