



Innovation, partnership and efficiency: a success story for overmolded mechatronic assemblies

08.03.-10.03.2023 - Arburg Technology Days



www.schlaeger.com

# Schlaeger M-Tech – what we do ...





#### ICE:

- Coils fuel injectors
- Turbo charger actuator
- Camshaft actuator
- SCR dosing systems









## **Consumer / gaming:**

12mm mouse wheel stator!

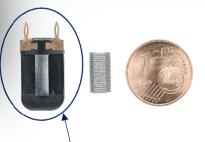






- Temperature sensors
- Stator/rotor thermo-management
- High voltage battery actuators







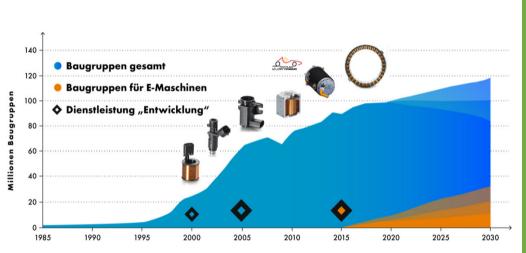


#### **HEV:**

- Stator segments (600V / 120 kW traction)
- Integrated temperature sensors
- Actuator coils & drives for cooling valve

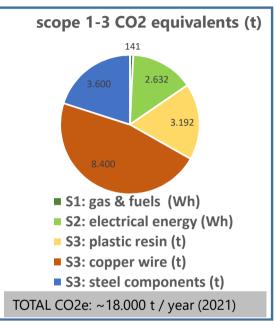
# Schlaeger M-Tech 2021 in numbers ....





#### Resources

- > 6,1 GWh electrical power
- > 0,6 GWh gas & fuels
- > 940 t plastic resin
- 2.000 t Copper
- > 1.200 t steel
- > 2.000 m<sup>3</sup> water



#### **Business**

- EUR ~ 90 Mio. turnover
- ~ 90 Mio. mechatronic products
- 450 employees / 20 R&D
- > < 0,02 PPM field quality

## **Production equipment**

- 100 thermoplastic molders
- > 350 winding spindles
- > 300 automized units
- > 80 welding units (res. & laser)

## **Innovation & projects:**

- > Overmolding with high functional integration
- toolshop (x 50 tools / year)
- ➤ High volume production < 1,2 sec / part
- Industrialization with own engineering team

# Automation projects (Turnkey) "insert molding" - MILESTONES

**Growth & Standardization** 

(e.g. only electric ARBURG



>30 projects in 20 years









A & H types)





**Best Practice** 

Improved inter-action between molding tool, gripper system, machine size

> sensitive PPA / **PPS** material

-30% % cycle times -80% % specific energy

2001

14 sec. cycle time 13 kWh/ kg nylon 2011

2021

2023

<10 sec. cycle time <2 kWh / kg nylon

# First automation (turnkey) project 2001:





#### **Product**

- Insert molded bobbin
- Manufacturing step 1 of 5 to finished injector PWG
- 8-cavity hot runner tooling
- 150 Mio. pieces produced (18,8 Mio shots / 20 years)

#### **Machine / Automation / Parameters**

- ARBURG 320 C
- Linear handling
- (feeding systems supplied by schlaeger)

#### **Resources / CO2e**

- Sprueless / nylon PA 66 GF35
- Ca. 13 kWh / kg nylon
- Ca. 4,6 Wh / piece,

1. Insert Moding

2. E-Assembly

3. M-Assembl

4. Overmodin

5. EOL Testing

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# **Current automation (turnkey) project (2021):**





#### **Product**

- Insert molded bobbin PPA GF35
- Manucturing step 1 of 6 to finished actuator coil
- 4-cavity hot runner tooling
- SOP 2021 / 4 variants

#### **Machine / Automation / Parameters**

- ARBURG 370 H "gestica"
- Linear handling
- Turnkey with feeding, packaging
- Cleanliness level 200 microns

#### Resources / CO2e

- Sprueless PPA GF35
- Ca. 1,7 kWh / kg PPA
- Ca. 10,0 Wh / piece

1. Insert Molding 2. E-Assembly 3. M-Assem

4. Over-modling

5. M-Assembly

6. EOL

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# Partnership & Innovation – how we made progress together









## **In-line horizontal molding machines**

- Special programming for machine behaviour acc. to complete line status line / machine communication
- Agile automized scrap routines
- Joint development of set-up mode "Zustimmbetrieb"

#### **In-line rotary table molding machines**

- Speed & communication optimization
- Operator accessability / protection & safety switches
- Auxillary hydraulics with parallel movements

1. Bobbin

2 M-Assembly

R F-Assembl

M-Assembly

5. Overmodling

6. M-Assembly

/. M-Assembl

8. EOL

# **Automation projects (turnkey) – 5 Years OUTLOOK**



People & organization

Higher complexity in material, process, tolerances

Next level predictive maintenance – Requirement specific maintenance actions

Need for less complexity in usage (operators skills)

Machine & process

Improved digitalization & traceability / availability of data

Fast adoption to changes & product lifetimes

Thin wall overmolding for high efficiency products (200 microns)

**Product & material** 

V0-material / High wear / Long-term resistant wear parts

Inline HV-testing ° 3 kV

Effects of bio-based materials & recycling grades

Technical cleanliness
- e.g. from 600 to
400 microns

Resources & CO2e

2025 2035

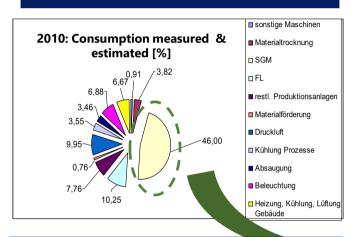
Our goal: additional minus 10-15% 2045
DE-neutrality!

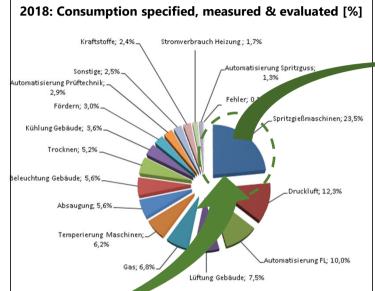
# How to work in energy efficiency categories ...



#### **Consumption categories**

- Audits & estimates in 2010
- > 16 categories monitored 2018 ff





## **Plastic processing**

> Strongest category improvement



#### **Actions "Infrastructure":**

- Accept ROI > 5 years
- Central energy levels downsized: system pressure, cooling levels
- Heat recovery where possible

## **Actions "assembly units"**

- Avoid air as energy source
- Central electric drives
- Strong focus on equipment specs
- Ask always "what else can be done?"

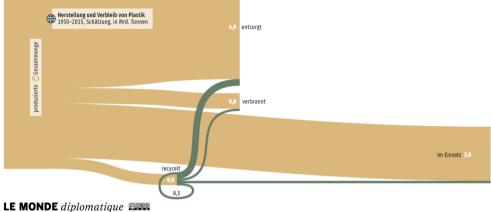
## **Actions "Plastic processing":**

- Best operation point focused
- electric machines /re-cuperation axis
- Cycle times down
- Special tooling technologies

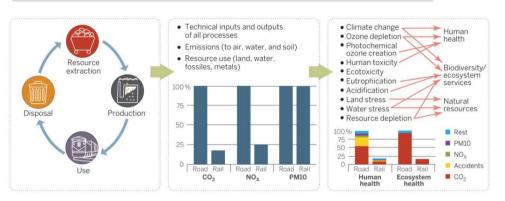
# Material ressources: where we are and where we have to go



## 1. How we define the real value of plastic products?



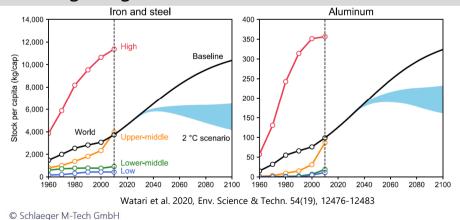
## Need for life cycle assessments (LCI / LCIA)



#### LE MONDE diplomatique

Quelle: Roland Geyer u. a., »Production, use, and fate of all plastics ever made», Science Advances, 2017, doi:10.1126/sciadv.1700782

## 2. Change in growth for all materials on the horizon?



## How will plastic & products react?



Solutions through: Non-fossil content / biobased Mass-balanced Full material recycling & circularity

2023 Folie 10

## 70 Years of mechatronic – where will we be in 2035



100% CO2-neutral plastic resin purchased

High material efficiency assessed by high-level LCA-calculation

2035

minimal material usage with high functional integration & hybrid metal-plastic-assembly

100% renewable energy / 50% own local production (scope 1 & 2)

recycling concepts for production & end-of-life = full circulatity



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# THANK YOU VERY MUCH FOR YOUR ATTENTION

# A milestone for our plant in Bayreuth: CO<sup>2</sup> neutrality since 2019

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