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Sustainability and Resilience

How we re-think the value chain

SDA Conference, Brussels 2022

Thomas Pfund

We pioneer motion

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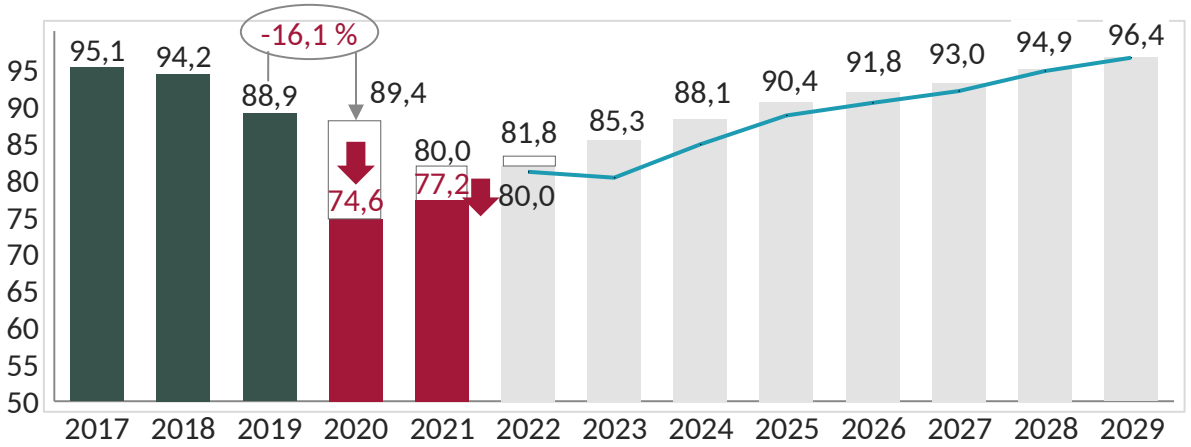
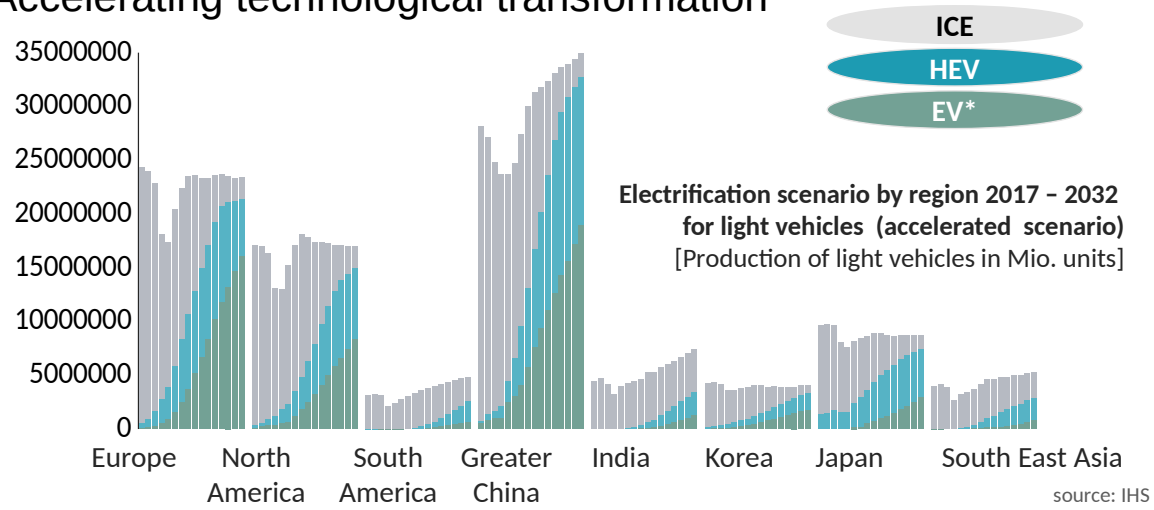
Business Environment

Worldwide production volumes



source: IHS

Accelerating technological transformation



Electrification scenario by region 2017 – 2032 for light vehicles (accelerated scenario)
[Production of light vehicles in Mio. units]

source: IHS

Climate Change

2020

>1,5°C

source: Vital Signs of the Planet (nasa.gov)

Availability of Materials and Resources

Schaeffler Activities & Measures

Transformation

New/refurbished plants:

DGNB Gold certification

CO_2 neutral

Fit4 Programs

employee qualification:

90 training courses & learning paths

3100 employees trained in 2021

650 employees transferred to e-mobility

Portfolio

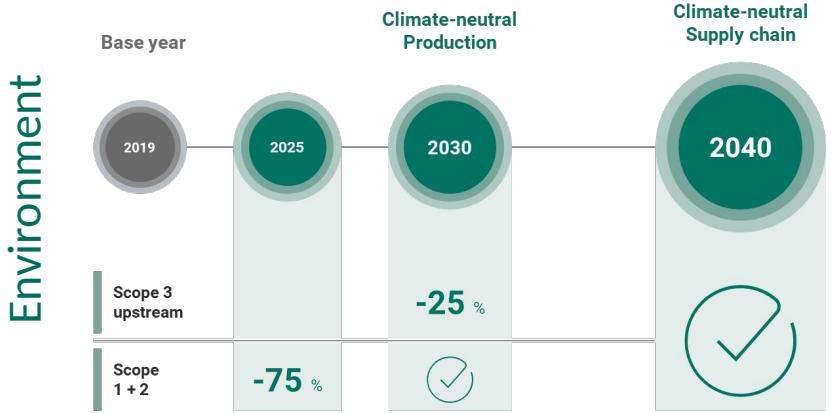
Systems

Sub-Systems

Components

Production Excellence

Schaeffler Sustainability Goals



People

Schaeffler Academy

CareerXperience

Safe Work@Schaeffler

Sustainable Sites

Schaeffler Health & Ergo Scout

Gender Diversity

10% average annual reduction of accident rate (LTIR) by 2024

Technology & Materials

100% purchased power from renewable sources by 2024

100 GWh cumulated annual efficiency gains

Replace gas by H_2 or electric energy

90% of purchasing volume of production material from suppliers with sustainability self-assessments by 2022

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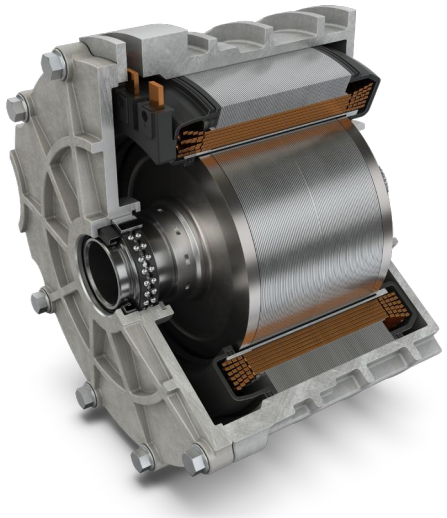
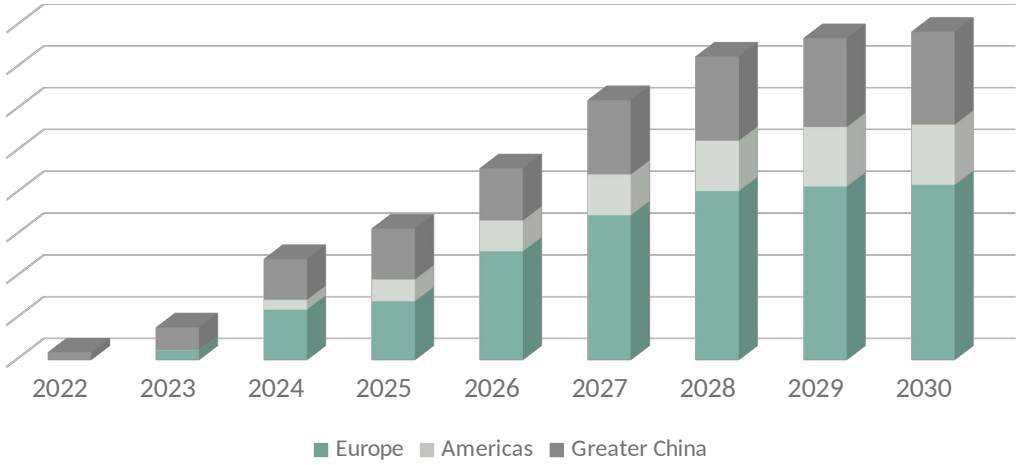
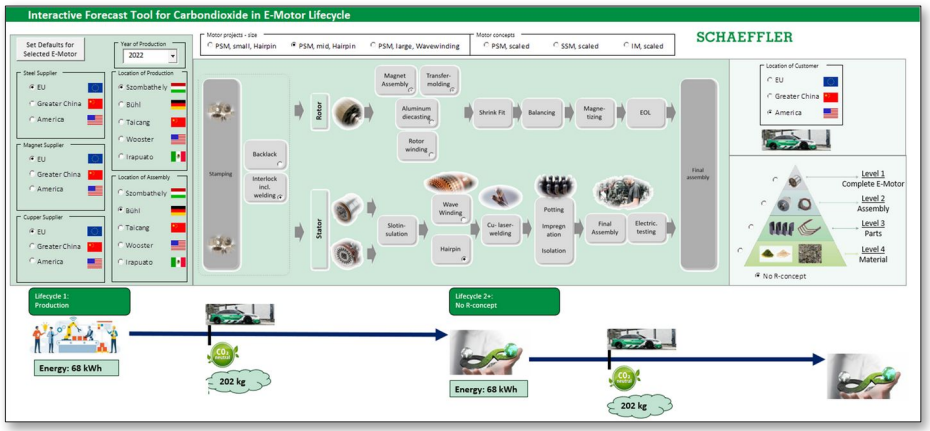
Example: E-Motors



Business Case E-Motors (in pcs.)



Life Cycle Assessment



1.000.000 t CO_2

(energy mix 2019)

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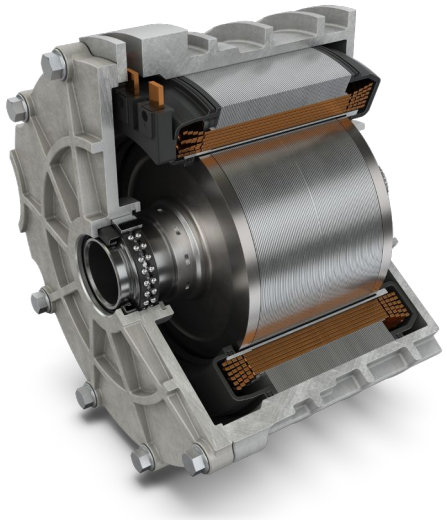
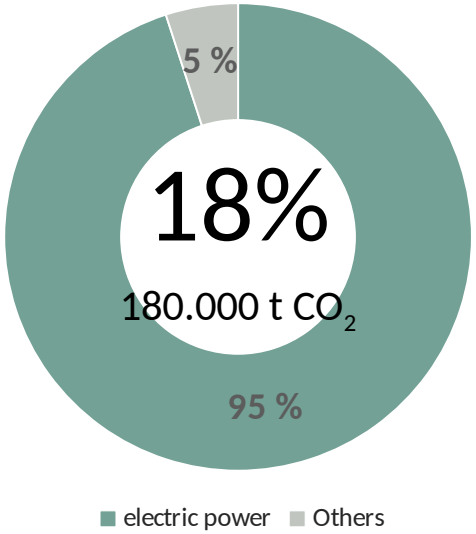
E-Motor Scope 1 to 3u



1.000.000 t CO_2

(energy mix 2019)

Scope 1 & 2

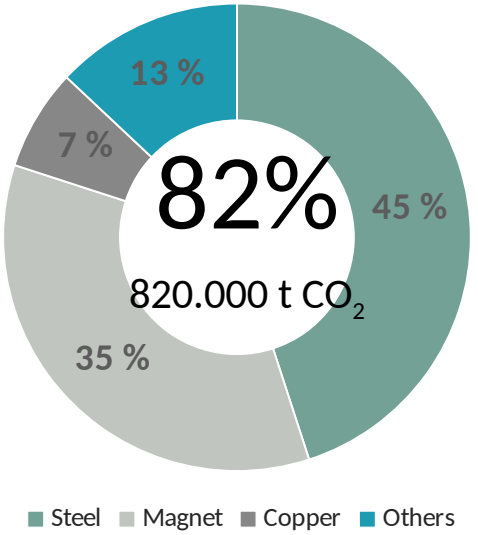


Target 2030

-100%

Achievable due to Schaeffler green energy policy

Scope 3 upstream



Target 2030

-205.000 t (-25%) !

NOT achievable with current supplier policy and without on-cost

25% material saving could compensate the gap

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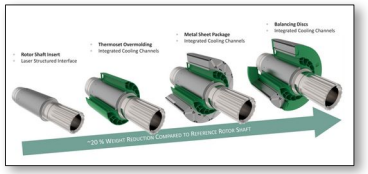
Additional Options

Material & Resource Efficiency challenges the complete value chain

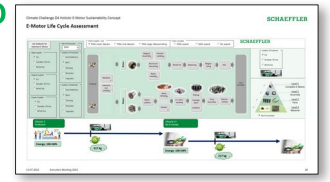
System Architecture -2%

- High speed e-motor
- Thermal management



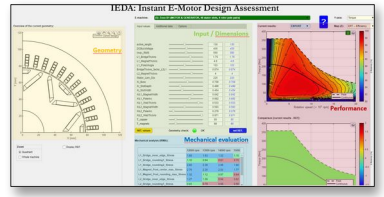
E-Motor Technology -2%

- PSM, SSM, ASM
- Radial / axial flux motor



E-Motor Design -3%

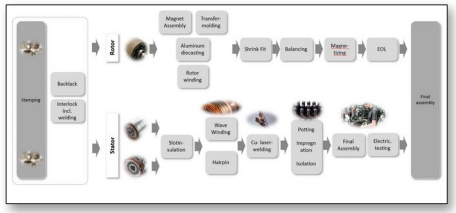
- Power density increase
- Smart cooling



Production Technology -8%

- Waste, scrap
- Gross weight
- Energy consumption

2



R-Strategies -10%

- Waste, scrap
- Material re-use

1

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Recycling Pyramid | Grade of reuse

1

Challenges

- Sourcing of motors Internal / external
- Analytic for motor condition
- Disassembly strategy & process
- Refurbish strategy & process
- Reuse of raw material with partners
- Market / customers for refurbished motors

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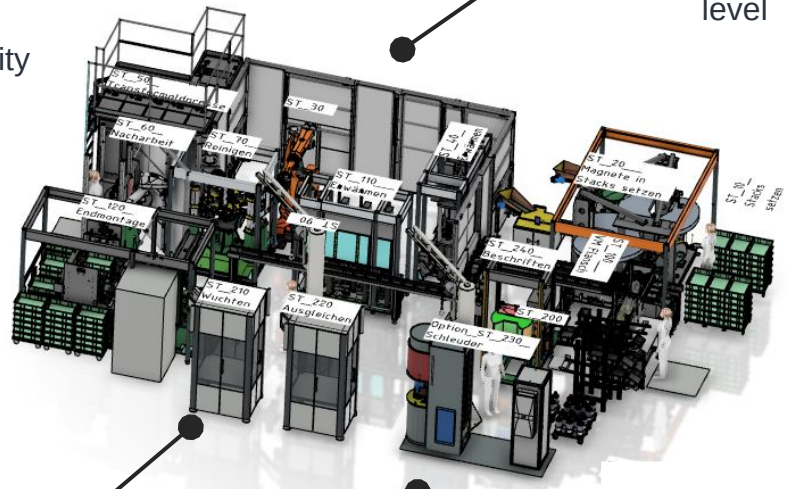
Highly efficient and flexible Production

Flexible functional units

- Tool based flexibility
- Kinematics based flexibility

Modularization

- Modularity on system, module and process level



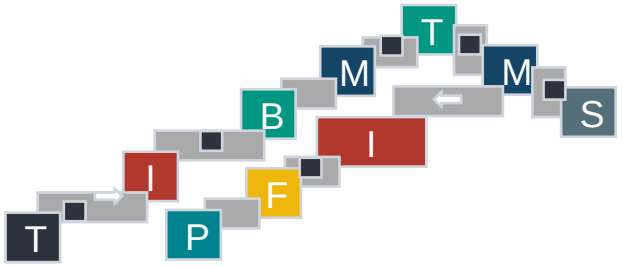
Smart control system

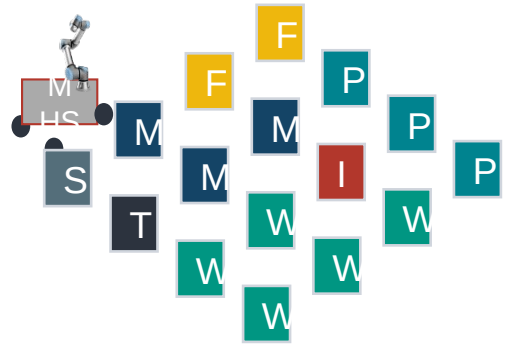
- Continuous recording and processing of process and quality data
- Model based process and system parameters

Interoperability

- Cross-vendor communication standards
- Standardized interface configuration

Interlinking according to business model





Enabler Digitalization

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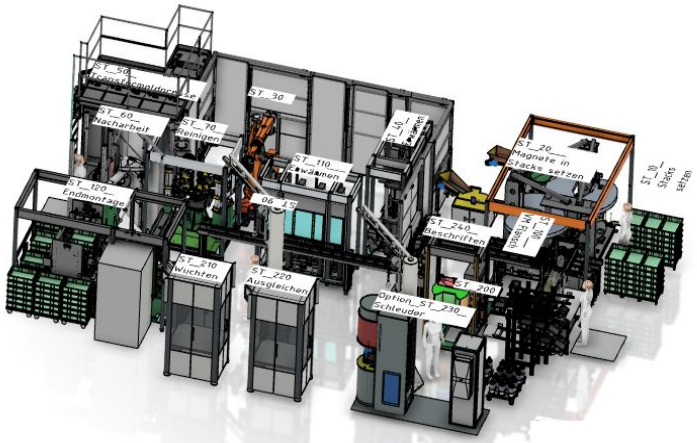
Digital Twins and Individual instances

Product

KI based data exchange and control algorithms



Production system & process

Offline Link

Derive production related degree of freedom in product design

Investigate influence of production deviations on product properties

Parametric tool design & manufacturing

Align product and production modular system

Online Link

Function oriented process and quality control

(i.e. rotor core – shaft – connection; balancing single tolerances to achieve required e-motor properties)

Federal Ministry for Economic Affairs and Climate Action

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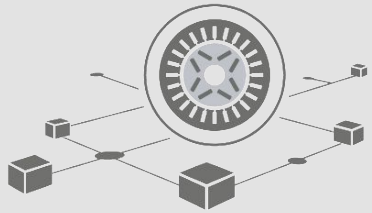
Agile production systems and modular product kits for electric traction motors

Funded research project by the German Federal Ministry for Economic Affairs & Climate Action (BMWK)

AgiloDrive2



Cooperation leader:
Schaeffler Automotive Bühl GmbH & Co. KG

Consortium:
18 Partner

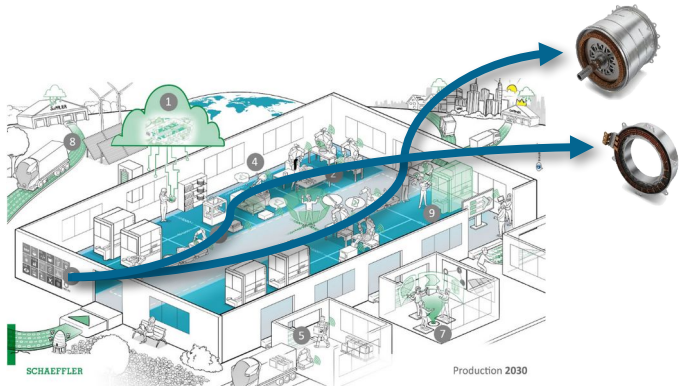
Project start:
November 2021

Duration:
3 years

Vision

AgiloDrive2 as part of Schaeffler's "*Production 2030*" strategy

High productivity along with high type flexibility

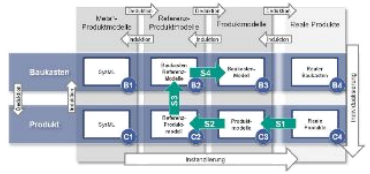


Manufacturing of individualized product designs in the convertible production system

- Fast and digital configurable
- Economical from lot size 1

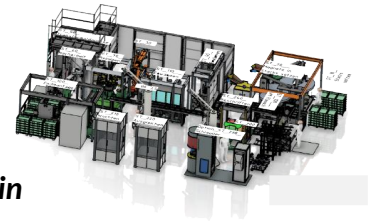
Approach

Intelligent product kit



Digital twin

Process modules



- ✓ **Lot size specific integration**
- ✓ **Optimal utilization and re-use of investments**
- ✓ **Process and product co-design & online quality control**

Innovation Laboratory Ultra-Efficiency Factory

UltraELab at Schaeffler

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Universität Stuttgart
Institut für Energieeffizienz in der Produktion EEP

KIT Karlsruher Institut für Technologie

ifab

Fraunhofer IPA

Energy Efficiency + Climate Protection

- Efficient energy conversion for production processes
- Innovative technology concerning infrastructure-, machines and production
- Intelligent energy management due to digitalization and linkage (Holistic Energy Management)
- Own generation of renewable energies

Environment + Resource Efficiency

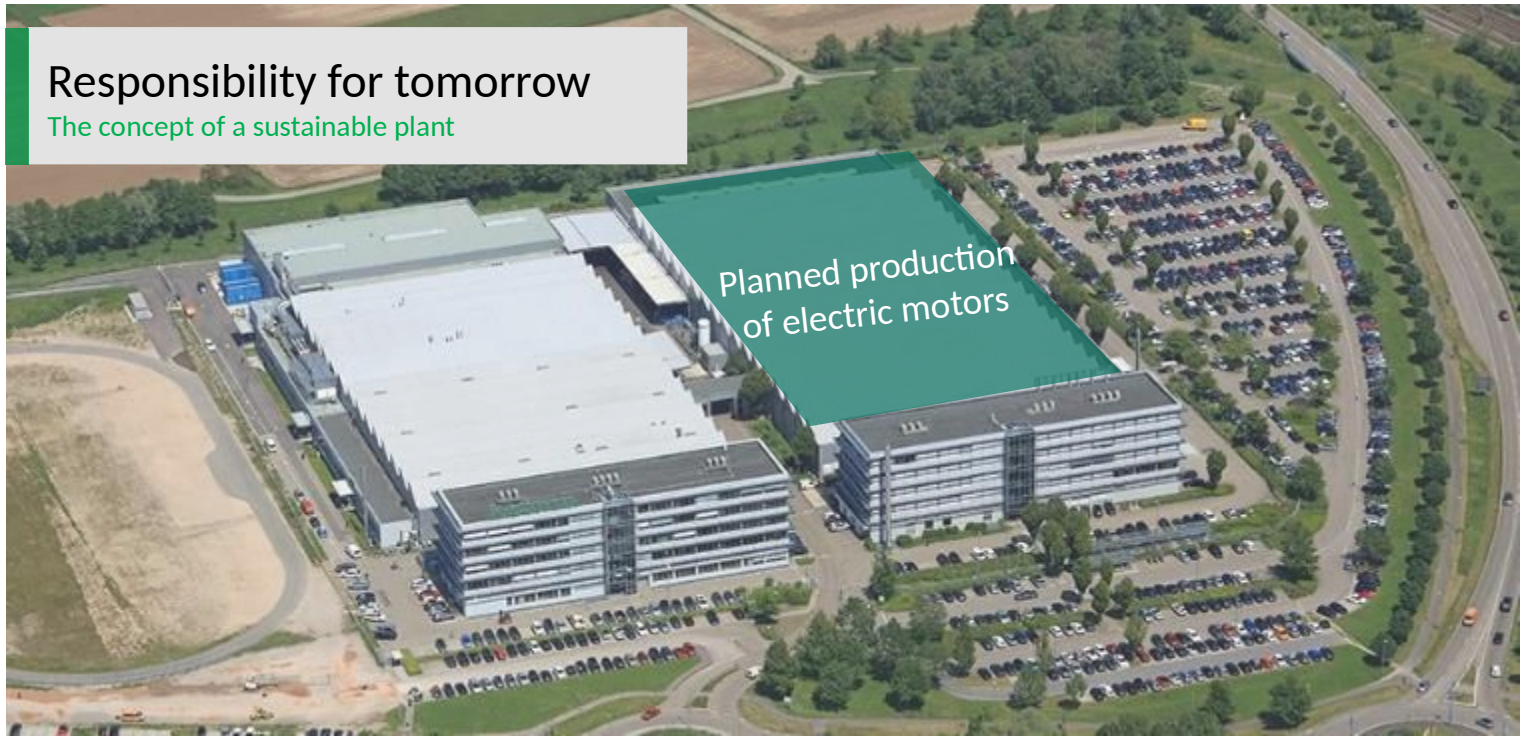
- Intelligent waste management for minimization of waste
- Support for recycling economy
- Reduction in fresh water and production free of waste water
- Certification of building/campus structures following recognised building standards concerning sustainability

Human Resource Development

- Upskilling of staff within e-projects
- International training concept for e-motor production
- New Work/digitization/Industry 4.0
- Accessibility
- Health-promoting and safe

On- and Off-Campus Mobility

- „Green“ mobility infrastructure with charging stations for e-bikes
- Charging stations for cars, Schaeffler-Mover
- Connection of the campus to the railway network – “S-Bahn”-station
- Environmentally friendly logistics concept



Ultra-efficient Processes

- Minimum of material usage
- Linked processes, learning systems
- Minimum of scrap rate and rework rate
- Intelligent automation, reduced personnel deployment
- Maximum of flexibility referring to variations in products and volumes
- Agile value streams

Flagship project for next level SCHAEFFLER Production
supported by SP

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We pioneer motion