MAGNA DRIVETRAIN FORUM
SOLUTIONS FOR THE ENERGY TRANSITION 2.0

1) Introduction of KREISEL
2) Energy transition 2.0
3) Challenges of implementation
4) Targets of e-mobility
5) Targets of industrialization
6) Summary
KREISEL ELECTRIC

FOUNDERS

- Markus Kreisel
  Sales, Marketing

- Johann Kreisel
  Production

- Philipp Kreisel
  Development, Research
HEADQUARTERS RAINBACH
UNIQUE ARCHITECTURE
HEADQUARTERS RAINBACH
WORK / LIFE
HEADQUARTERS RAINBACH
PRODUCTION & ASSEMBLY
Kreisel’s unique business model combines global number 1 modular battery technology with the company’s engineering skills to develop various electrified applications and provide related specialized solutions.
COMPETENCES & TECHNOLOGIES

CORE COMPETENCE
SOLUTION PROVIDER

Battery Development / Manufacturing
Vehicle Integration & Testing
Prototyping / Series Production
Software Engineering
Own Products
BATTERY SOLUTIONS
FOR AN ELECTRIC WORLD
ELECTRIC G-WAGON PROTOTYPE
DEVELOPED WITH ARNOLD SCHWARZENEGGER

- 80 kWh displayed range about 350 km
- 18 min charging 80% SOC (prepared)
- Liquid cooled/heated battery system
- 0-100km/h in 5.5s
VW E-GOLF PROTOTYPE
DOUBLE RANGE

- 55.7 kWh displayed range about 430 km (original 24 kWh/200 km)
- No additional weight! 330 kg
- Liquid cooled/heated battery system
HTW 100 E³
BATTERY FOR HYBRID TRACK MAINTENANCE MACHINE

- Redundant operational reliability
- Enables new fields of operation
- Electrical efficiency of up to 94%
- >100€/h saving per operating hour
- Noise reduced by 10 dBA
VDL MIDBASIC & MIDCITY
ELECTRICAL BUSSSES

- First serial vehicle with Kreisel technology inside
- 3,5t and 5,5t model
- 200 or 300 km range
- Cooperation with VDL Bus & Coach (Netherland)
SOLAR STRATOS
1ST FULL ELECTRIC FLIGHT TO STRATOSPHERE

- Airplane battery with 7.41 kWh
- Liquid cooled version
- Incl. power distribution unit with plug for charger & three electric motor
- Very safe battery due to liquid circulation direct at the cells
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- Climate goals 2020 ff
- Solving approaches for urban environments
- Approaches for industrial environments
- Approaches for e-mobility
CLIMATE GOALS 2020 FF
EMISSION OF GREENHOUSE GASES IN GERMANY (EXEMPLARYLY)
STATIONARY PRODUCTS
E-MOBILITY CHARGING & STORAGE

- **MAVERO**
  Home energy storage

- **Energy Rack**
  Industrial & commercial energy rack storage solution

- **Smart Charger**
  22 kW design charging station

- **Power Charger**
  Quick charging station with integrated battery
ENERGY RACK
INDUSTRIAL & COMMERCIAL ENERGY RACK STORAGE

- Comercial Storages create a significant contribution to a homogeneous power grid
- Up to 15% reduction of power losses can be achieved
- Commercial plants may work on a full balanced energy consumption level
- Energy losses in production processes can be used
- The headquarter of Kreisel is designed to work balanced
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CHALLENGES OF IMPLEMENTATION
NEEDS AND CHANGES

- Traditional models of procurement and infrastructure need to be completely reconsidered.
- This creates new business models with more distributed skills. Controlling these competence networks requires new solutions in organization, collaboration, and communication.
- IP protection must not become an innovation brake. Good solutions require rapid dissemination.
- Not only at the political level but also at the operational level, regional and company policy barriers need to be reduced.
- The car industry has a high contribution to make.

Mobility will have to be even more integrated into an overall energy concept.
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“The production of an electric vehicle currently consumes more CO2 than a conventional comparable vehicle. In order to perform better in the CO2-life-balance, e-drives and batteries should already have longer lifespan.”

“E-cars are about a third more expensive than conventional combustion cars, and a new batteries costs several thousand euros.”

“Electricity at public charging stations is already expensive in many places, that driving costs more than having gas in the tank.”

“E-car manufacturers have at least three months, up to one year delivery time. It is not surprising that, despite subsidies, the number of e-cars is still very small, even more than 30% of consumers believe in electric mobility.”

My message: working on convincing and true concepts is a common task of all stake-holders in industry and politics and requires a global mindset.
TARGETS OF E-MOBILITY
WHAT DRIVES THE SUCCESS OF E-MOBILITY

- The overall energy footprint of e-mobility needs to be reduced to a comparable level of conventional vehicles.

- To reduce manufacturing costs, new procurement strategies and business models need to be developed. Available raw materials must be obtained efficiently, environmentally friendly and sustainably. The recycling rate must be increased.

- The attractiveness of using electricity instead of gasoline can only be increased over competitive prices. Here, the need for a sustainable overall concept becomes visible.

- Vehicle architectures require increasing flexibility in the use of various drive technologies.

- Can EVs and conventional vehicles be built on one and the same line?
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TARGETS OF INDUSTRIALIZATION
WHAT ARE THE MAJOR GOALS ON BATTERY LEVEL

- **Reduce costs** – reduction on material costs and labor costs
- **Enable scaling** – being able to grow ‘with market’ w/o high efforts
- **Increase safety** – achieve standards of predecessor technologies
- **Restrict investment** – shorten ROI due to fast changing technologies
- **Improve time to market** – achieve delivery on demand for customer
- **Allow specific requirements** – solve standardization vs individualization
- **Manage complexity** – identify drivers of new value chains
- **Ensure flexibility** – manage change of technologies in the assembly
- **Increase product quality** – establish robust processes
In the vehicle sector, there will be an intermediate step until final electrification, which will allow vehicles to be equipped with alternative propulsion systems.

Different architectures will be required:
1. Strongly Embedded Systems Architecture (SESA)
2. Low Embedded Systems Architecture (LESA)
3. Off-Shelf Systems Architecture (OSSA)
### TARGETS OF INDUSTRIALIZATION

#### DIFFERENT CHARACTERISTICS OF BATTERY ARCHITECTURES *

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<td>Single application</td>
<td>Derivation for various applications (platform)</td>
<td>Multiple applications</td>
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- **High performance level**
- **High cost level**
- **Exchange of System difficult**
- ...

- **Mid performance level**
- **Mid cost level due to standards (low investment strategy)**
- **Exchange of battery system easy**
- **...**

- **Different performance classes**
- **Low cost level due to high quantities**
- **Exchange of battery system easy**
- **...**

| race cars, sports cars, high performance cars, PHEV, ... | EV, PHEV, HEV, trucks, ... | cranes, boats, trains,... |

- **Intensive validation efforts due to complicated environment**
- **Long project time**
- **Certification w/o references**

- **Fast validation due to references (derivates)**
- **Moderate time to market**
- **Specific certification necessary; easy due to references**

- **Fast Validation due to references.**
- **Fast time to market**
- **Easy certification enhancement**

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*source: draft by Kreisel (M. Theine)*
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MARKET FORECAST
MARKET POTENTIAL & GLOBAL DEMAND

98%

+31% p.a.

2020 2025 2030
CHANGES IN MOBILITY
THE CAR AS A HUB FOR NEW SERVICES

- Autonomous driving
- Sharing Economy
- Convergence of TIME and E-Mobility

*The car will become a third space apart from office and home - TTTech*
CONCLUSION

We are just at the beginning of the world’s electrification.

Transformation and convergence of markets.

As a result, new business models and investment opportunities.