



KREISEL

TECHNOLOGY LEADERSHIP
ELECTRIC MOBILITY INDUSTRY





VIDEO



FOUNDERS

Markus Kreisel
Sales/Marketing



35

Years in the
Electronic
Business

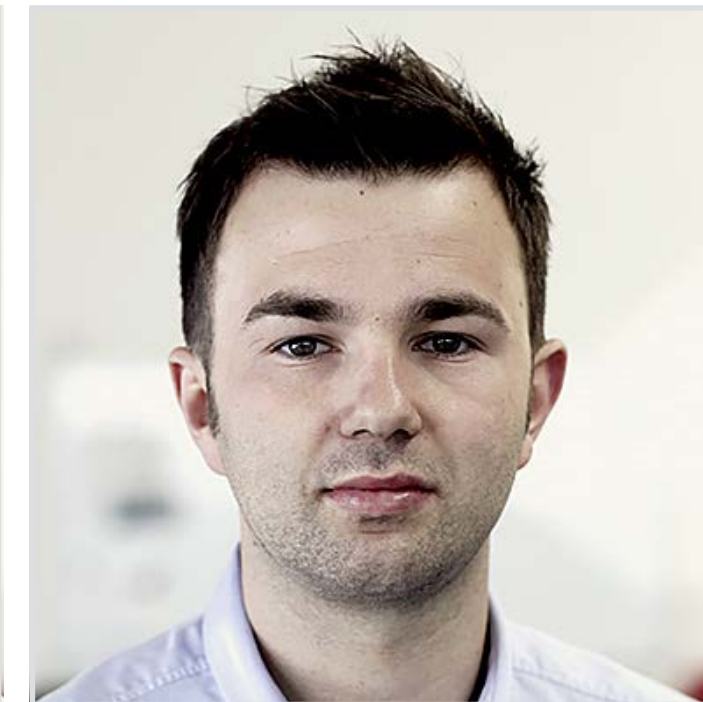
Johann Kreisel
Production



2013

Start Battery
Development

Philipp Kreisel
R&D



2015

Founding of
Kreisel Electric in
Freistadt, Austria

Christian Schlögl
Strategy/M&A

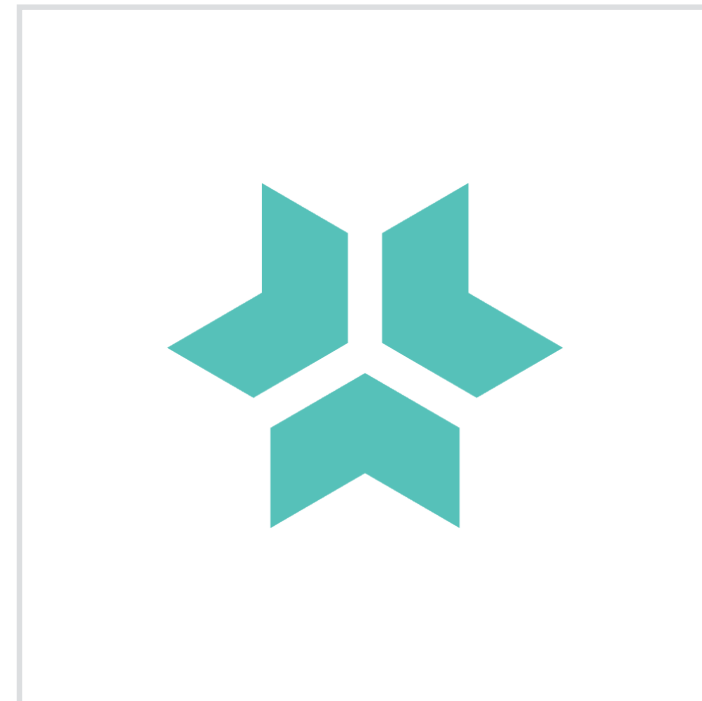




MEMBERS OF THE BOARD



GERNOT
FRIEDHUBER



PATRICK KNAPP-
SCHWARZENEGGER

KREISEL ELECTRIC INC



LOCATIONS

**Sales Office in
LA/California**
open 06/17



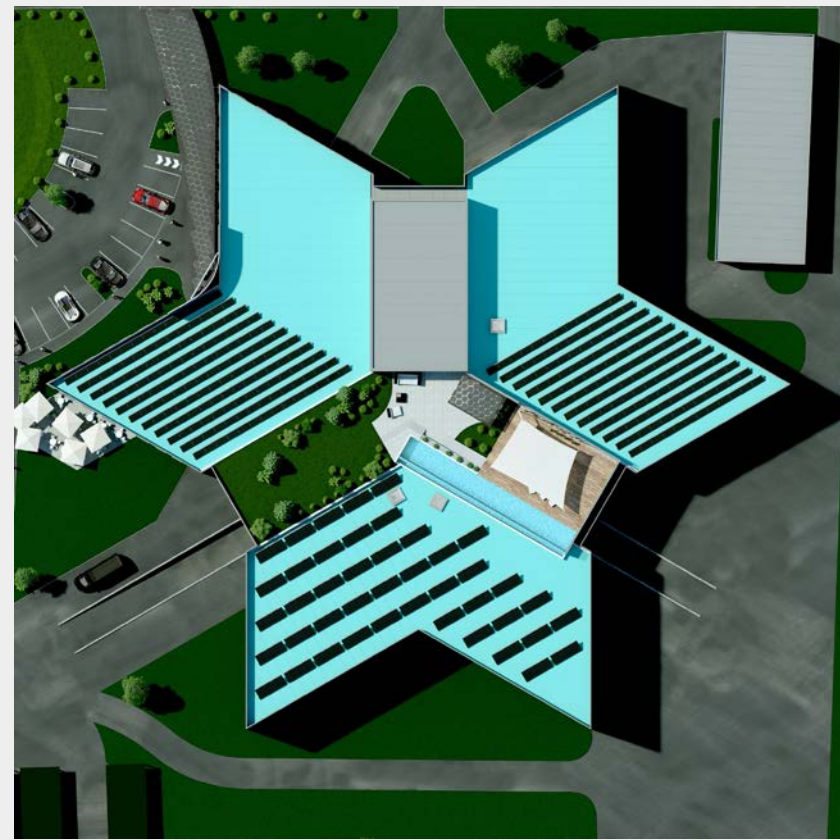
HQ in Freistadt/Austria
Research & Development
Production Capacity pa: 1 GWh in 2017

**Sales Office
Shanghai/China**



HEADQUARTERS RAINBACH

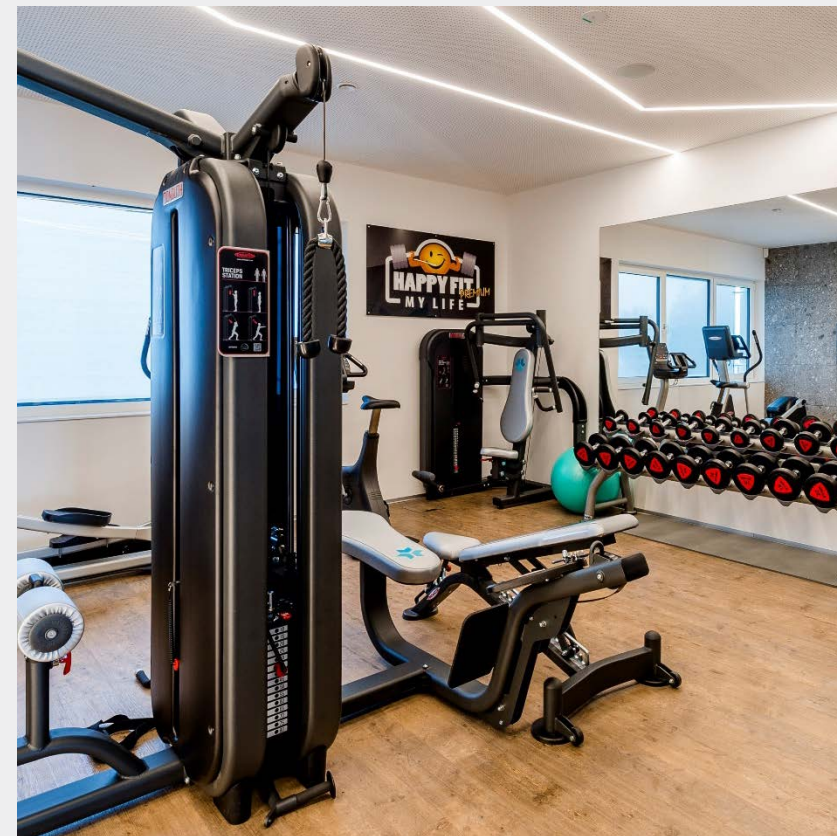
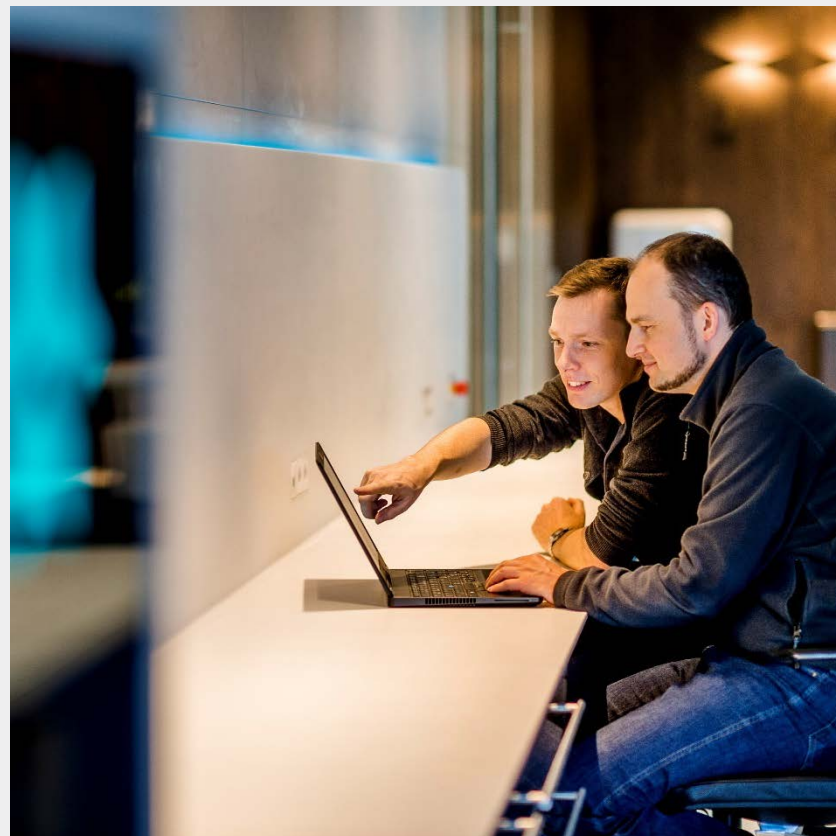
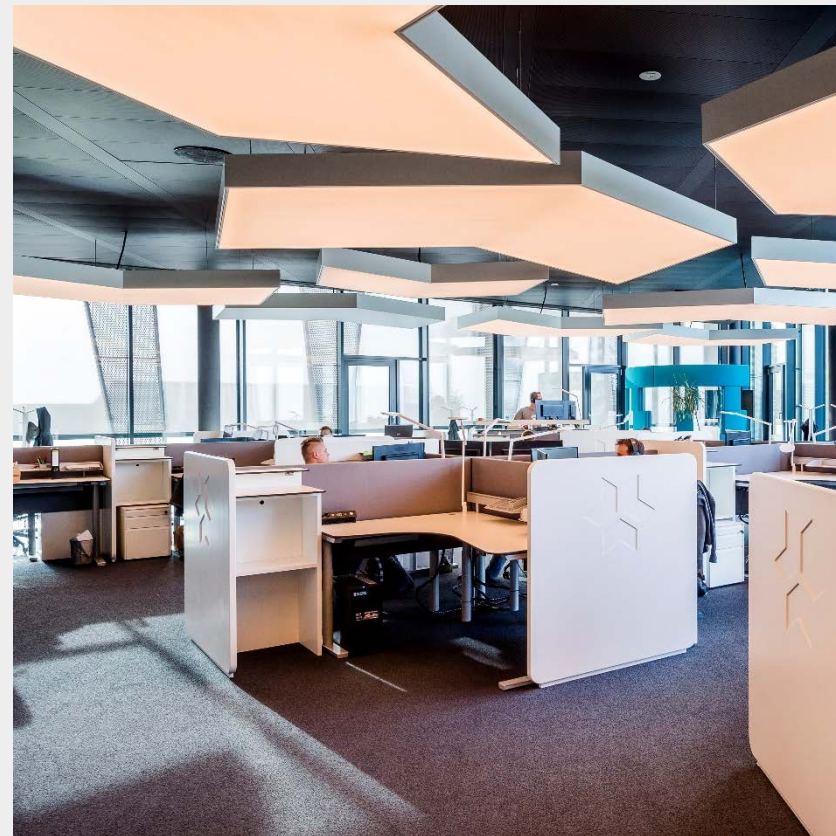
UNIQUE ARCHITECTURE





HEADQUARTERS RAINBACH

WORK / LIFE





HEADQUARTERS RAINBACH

PRODUCTION





COMPETENCES & TECHNOLOGIES



CORE COMPETENCE

SOLUTION PROVIDER



**Battery Development
/ Manufacturing**



**Vehicle Integration &
Testing**



**Prototyping / Series
Production**



**Software
Engineering**

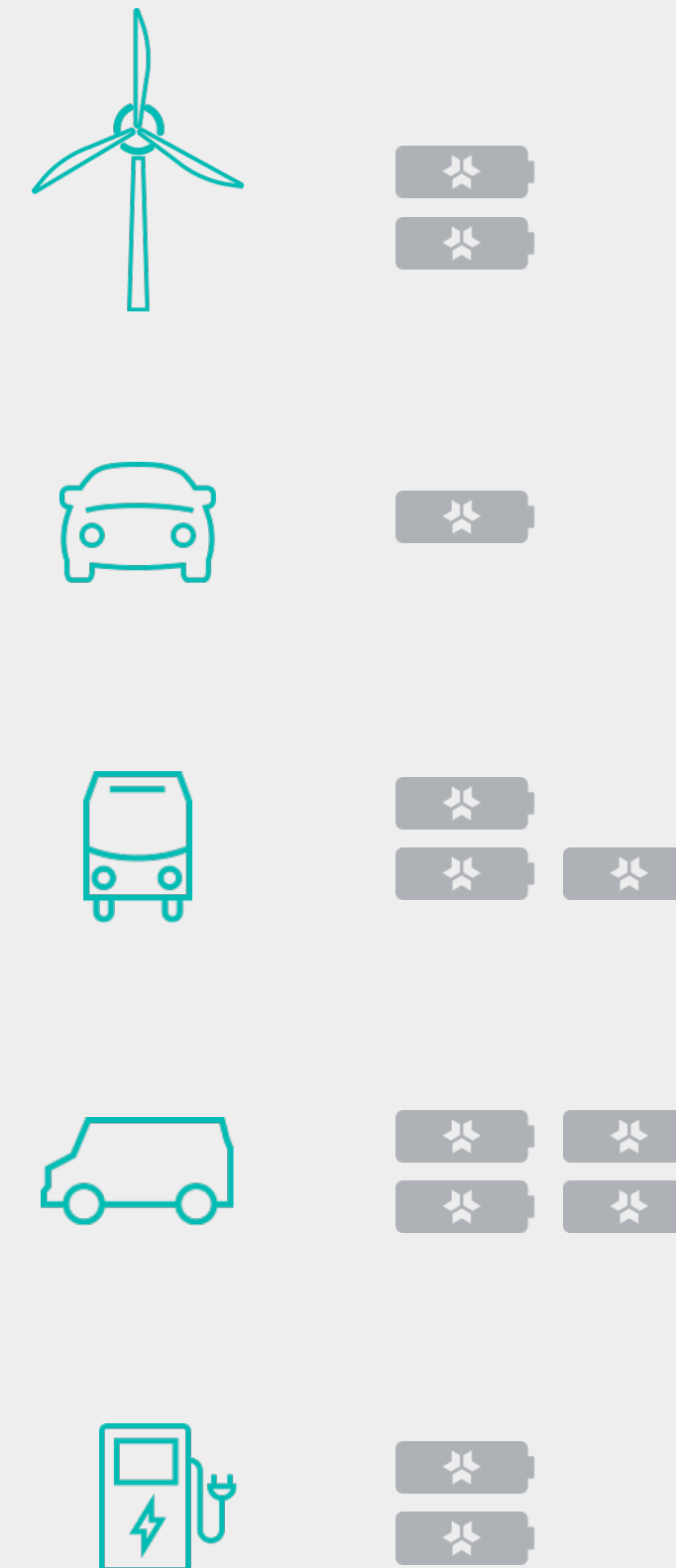


Own Products

HIGH PERFORMANCE ENGINEERING MEETS ELECTRONIC INNOVATION



BATTERY SOLUTIONS FOR AN ELECTRIC WORLD



KREISEL EXPLOITS ITS ENGINEERING STRENGTH TO DEVELOP VARIOUS APPLICATIONS FOR ITS OUTSTANDING MODULAR BATTERY TECHNOLOGY

THE KREISEL BATTERY

OUR UNIQUE APPROACH



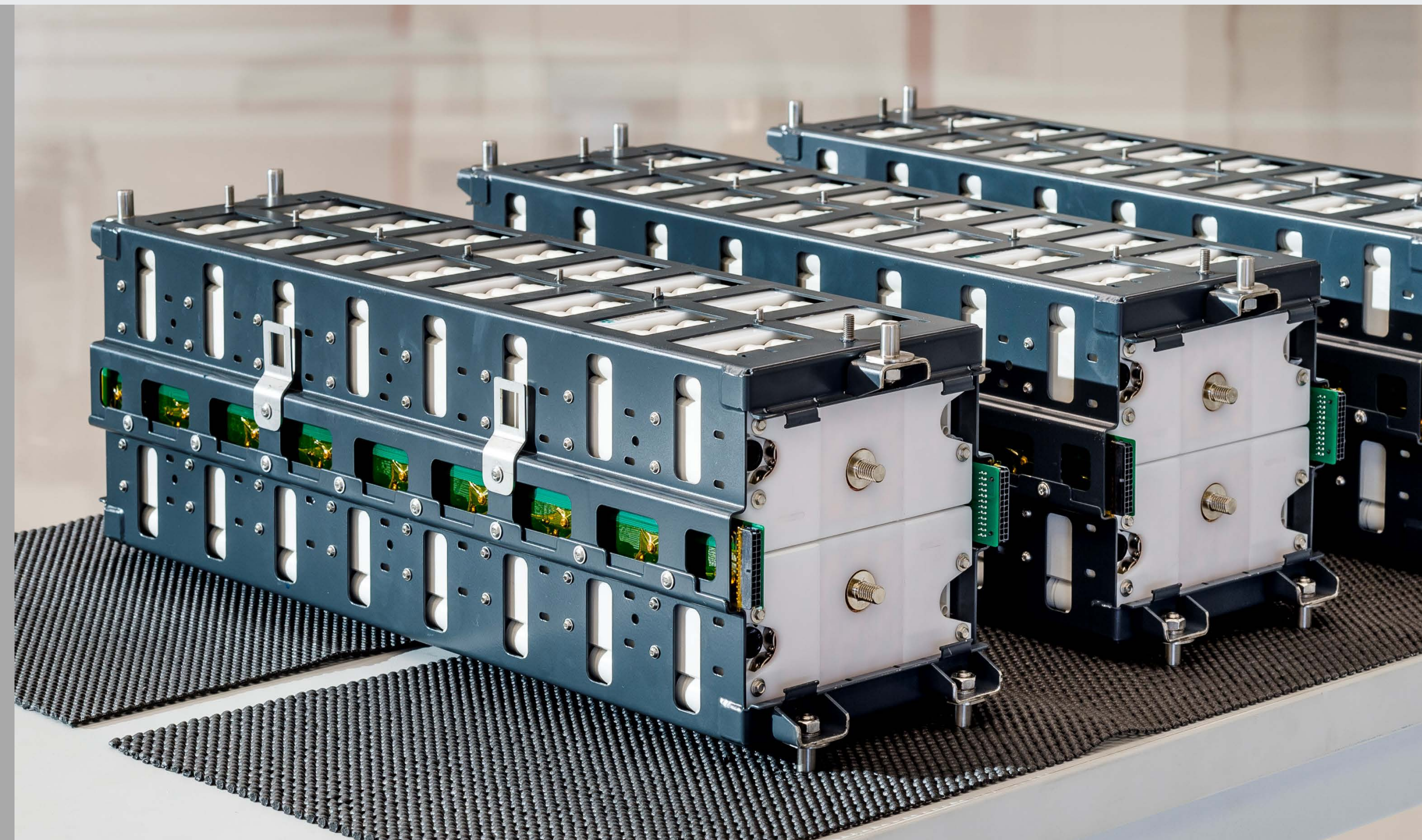
1.95 DM³/KWH
ENERGY DENSITY



4.1 KG/KWH
WEIGHT



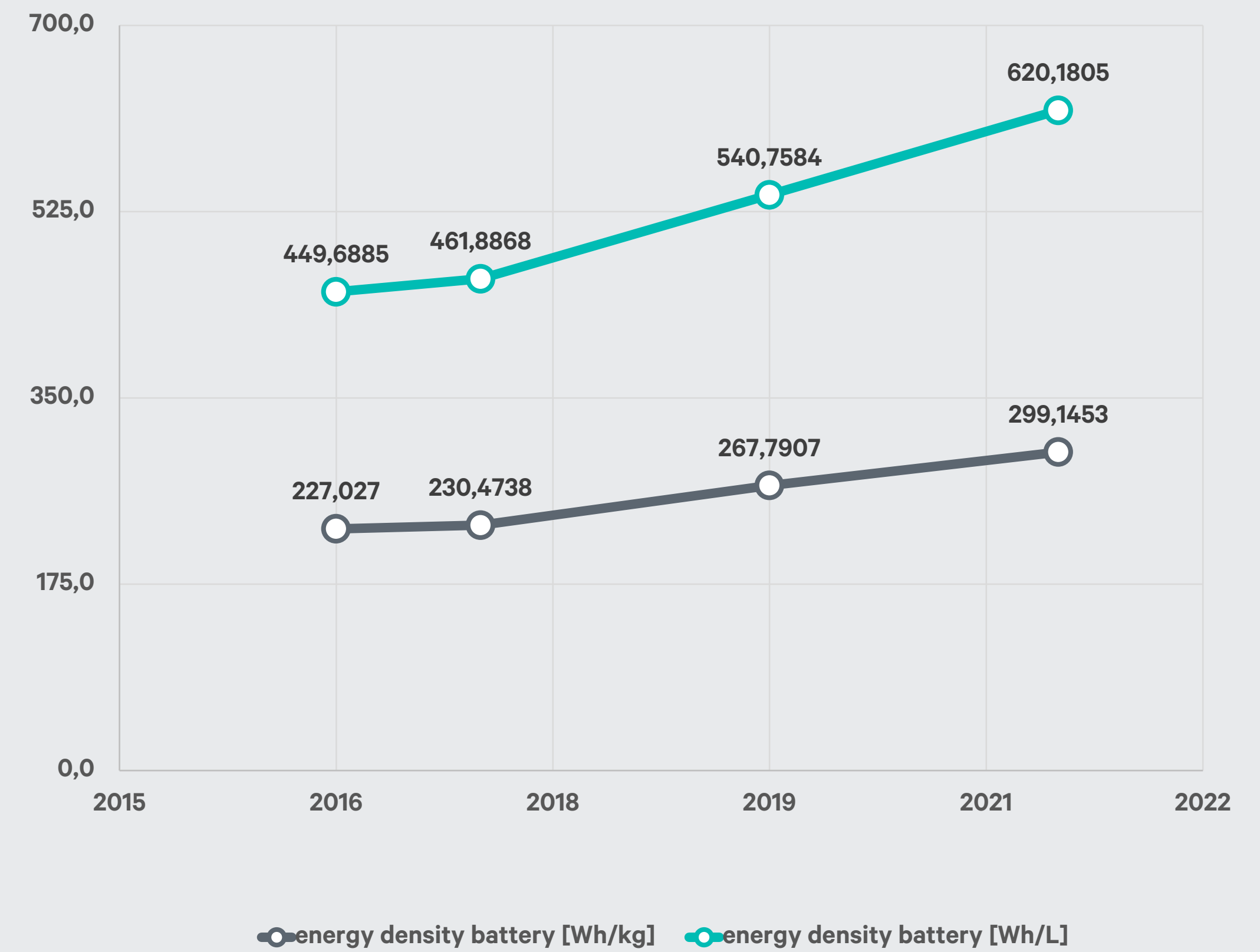
- Cylindrical cells 18650 / 21700
- Patented Assembling and cooling/heating Technology
- Liquid cooled/heated version 4,3 kg/kWh and 1,95dm³/kWh
- Battery operation temperature -20°C - +70°C
- Integrated single cell disconnection in case of short circuit
- Manufacturing time of just 15 seconds per kWh





BATTERY SOLUTIONS

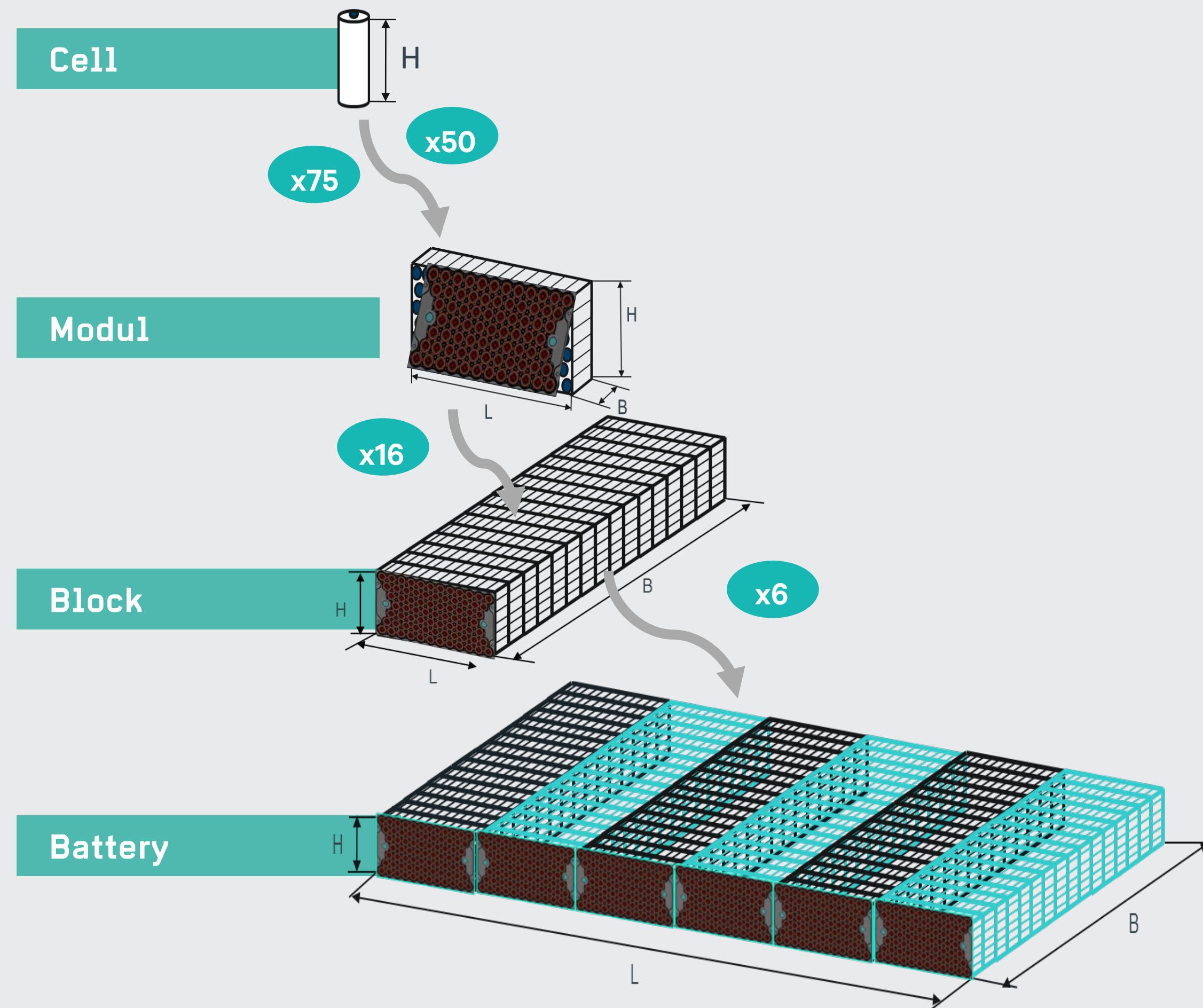
Year	2016	2017	2019	2021
Cell Type	18650	21700	21700	21700
Cell Capacity [Ah]	3,5	5	6	7
Battery capacity [kWh]	98,0	99,144	95,6	98,0
No. of Modul in series	108	108	108	108
No. of cells parallel	72	51	41	36
weight per cell [g]	50	71	74	78
weight cells total [kg]	389	391	328	303
weight Battery (excl.housing, Electronics,...) [kg]	431,6	430,2	357,2	327,5
size Battery X-Axis[mm]	1422	2250	1854	1656
size Battery Y-Axis[mm]	188	106	106	106
size Battery Z-Axis[mm]	815	900	900	900
volume [liters]	217,88	214,65	176,87	157,98
energy density battery [Wh/kg]	227,0	230,5	267,8	299,1
energy density battery [Wh/L]	449,7	461,9	540,8	620,2





BATTERY TECHNOLOGY

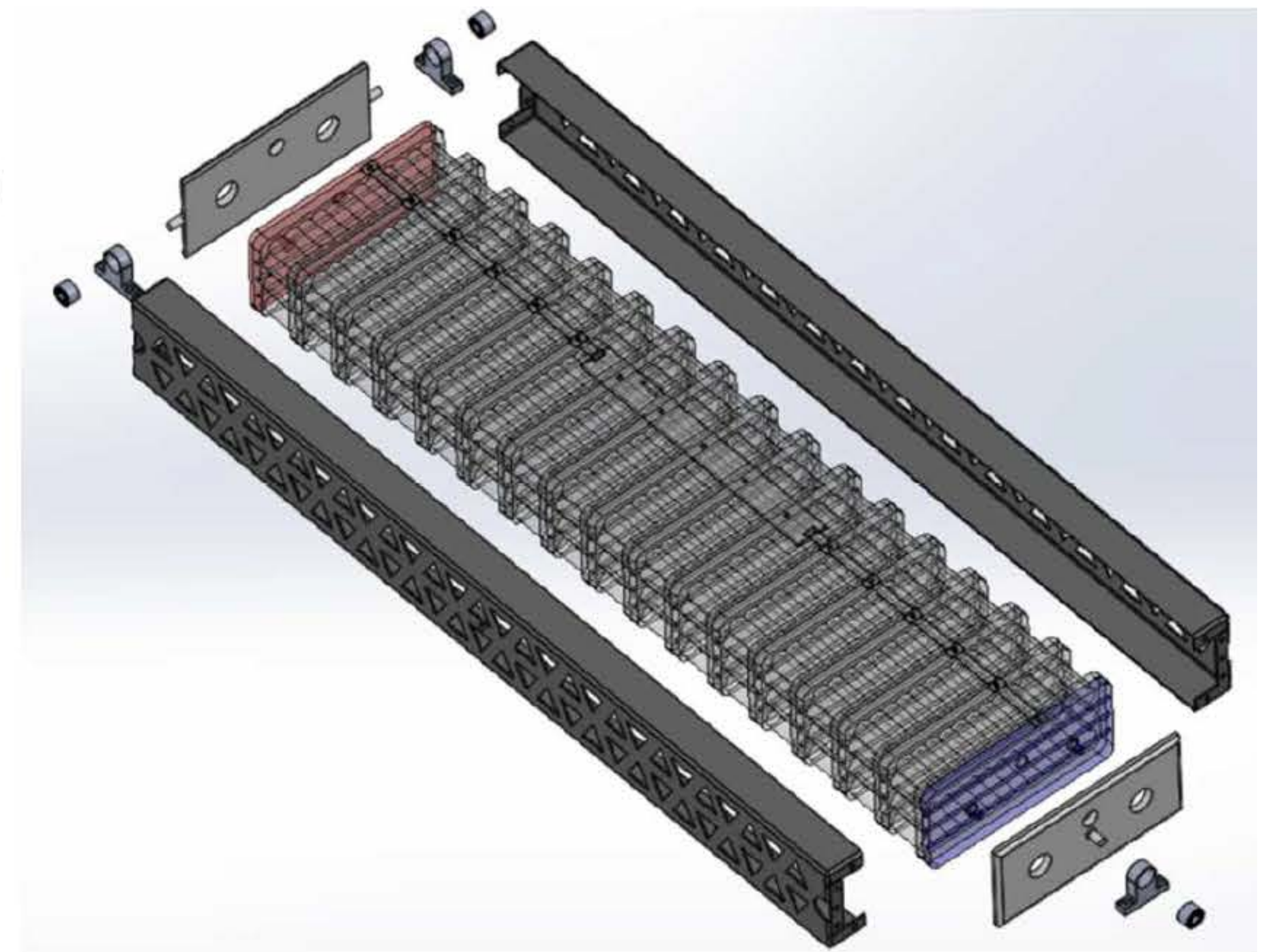
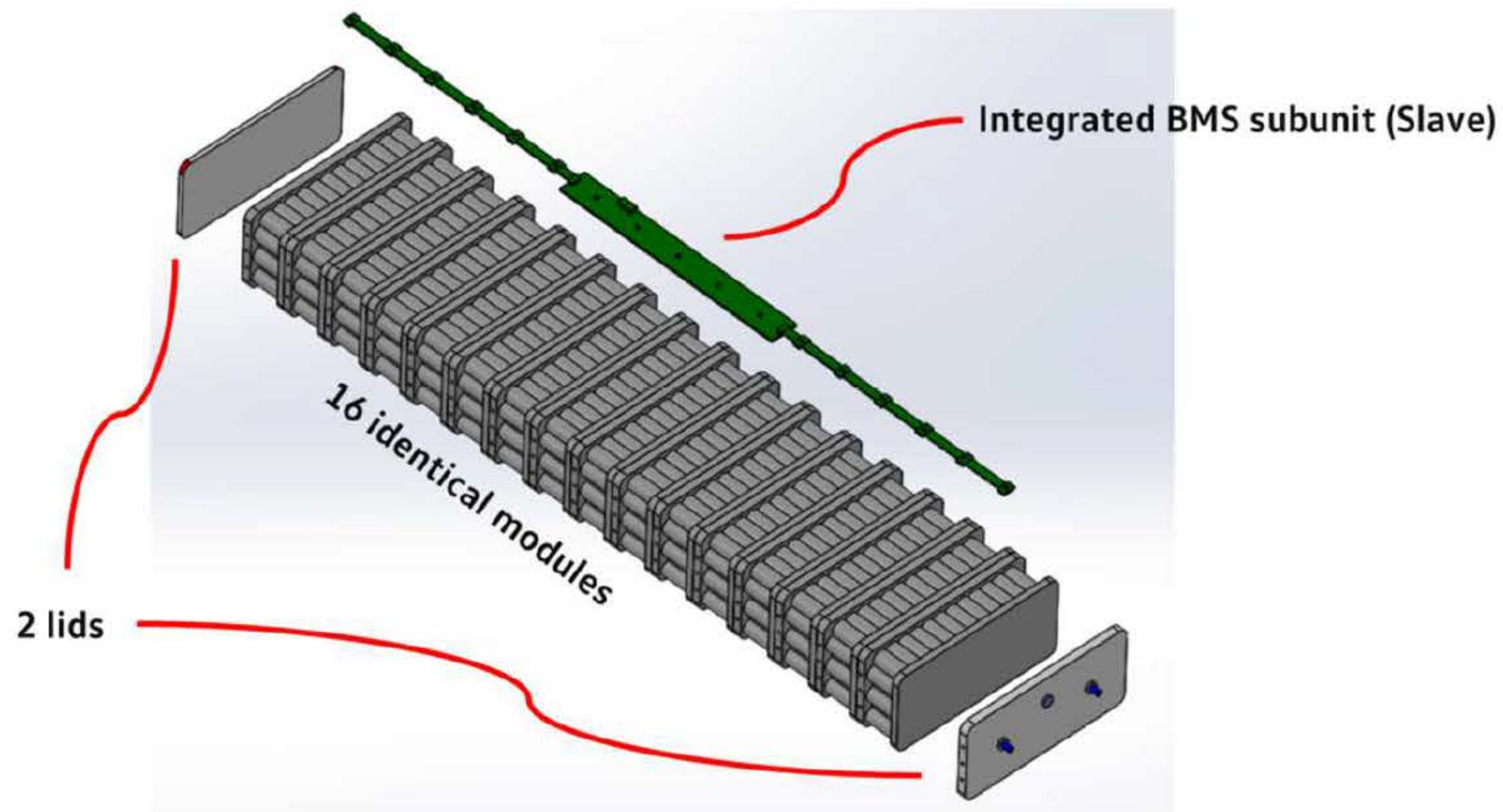
BATTERY STRUCTURE





HV BATTERY

OVERVIEW: BLOCK DESIGN



Simple Aluminium shell (4 parts)

cage design to reduce thermal stress

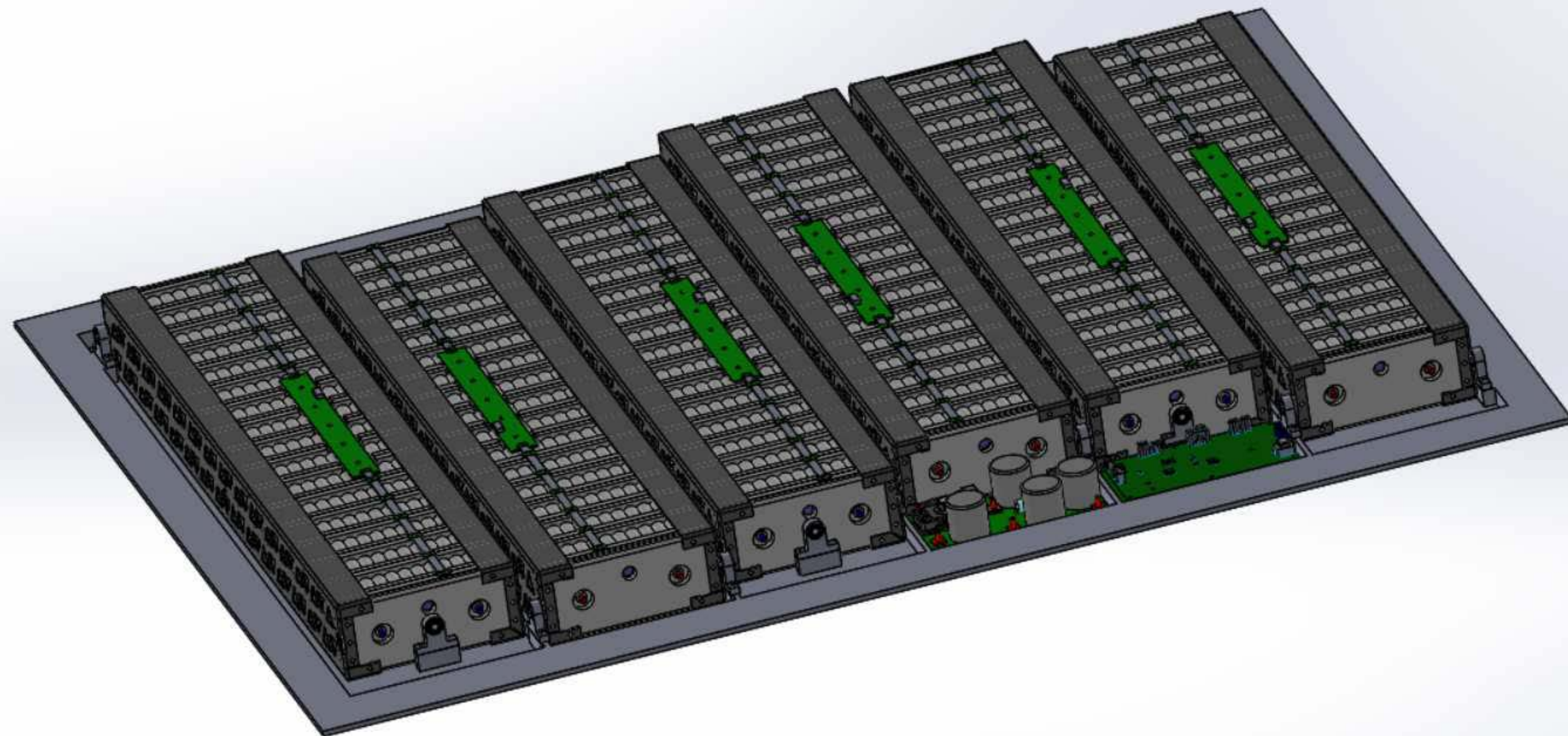
3 point suspension to reduce mechanical stress



HV BATTERY

SAMPLE OF A BATTERY CONCEPT

- Simple, modulare design (6 identical blocks)
- Easy assembly
identical fixtures for 90,7kWh & 60,4kWh
- Compact BMS integrated into box

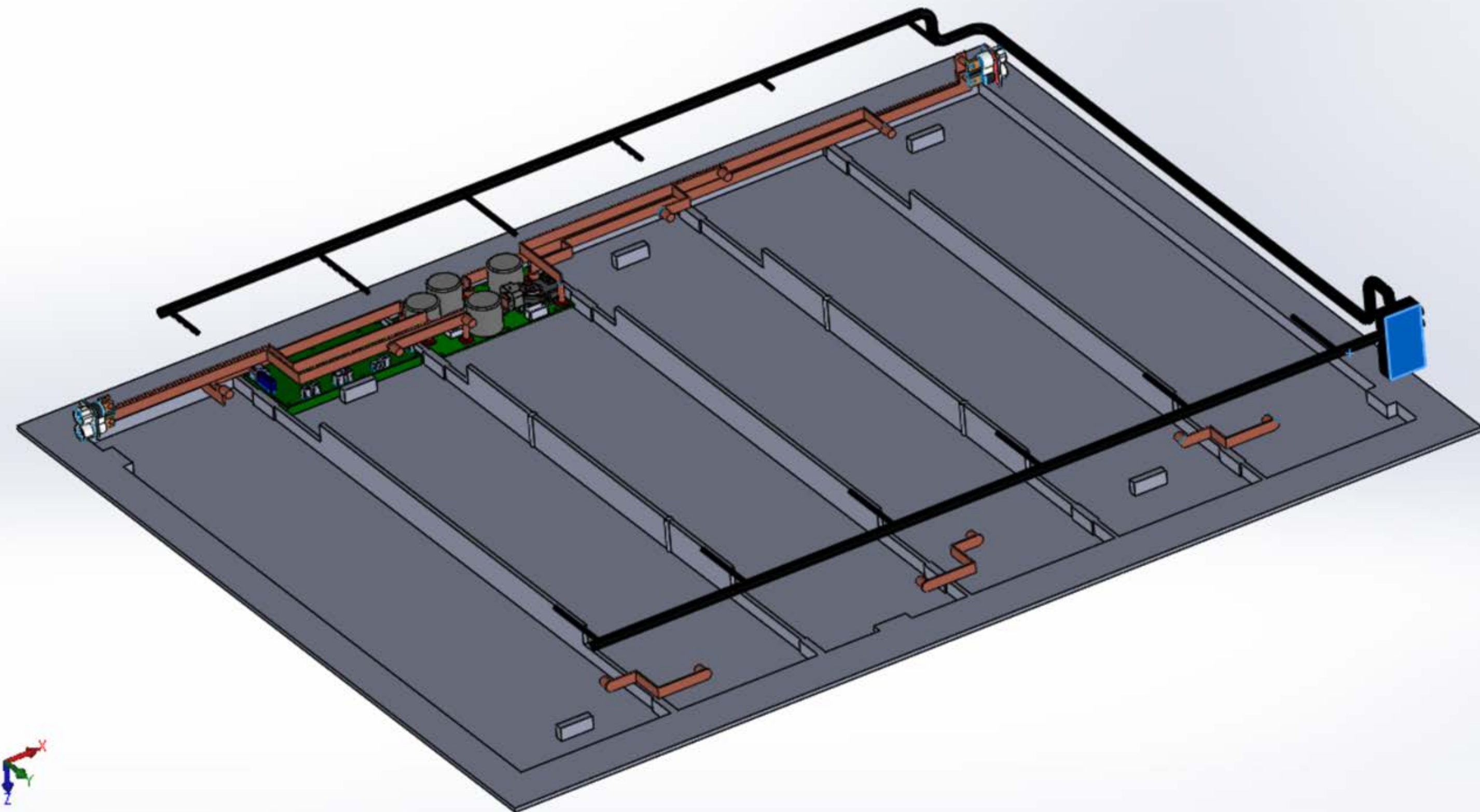




HV BATTERY

COOLING CONNECTION AND HV CONNECTIONS OVERVIEW

- **Safe**
fluid nonconductive, copper rails fully insulated
- **Cost effective**
short connections, less than 2 cent per cell
- **Simple**
easy assembly





THE BATTERY IN DETAIL



3.5 kWh / 15 kg



Cooling inlet

Connector block
12S21P to 12S21P

Battery pole

Cooling inlet &
Battery pole

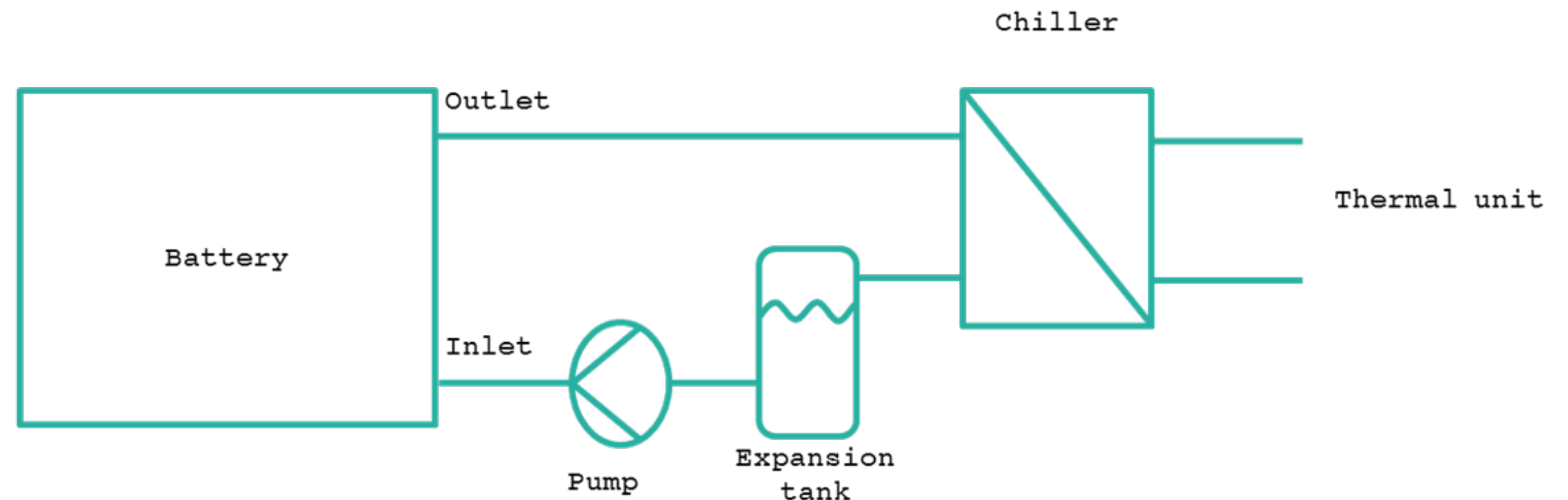
12 pcs. "21-modules" in series form a battery unit (12S21P)



COOLING / HEATING SYSTEM OVERVIEW

Active cooling through dielectric fluid

The battery pack is fitted with an active cooling system which consists of the following components:



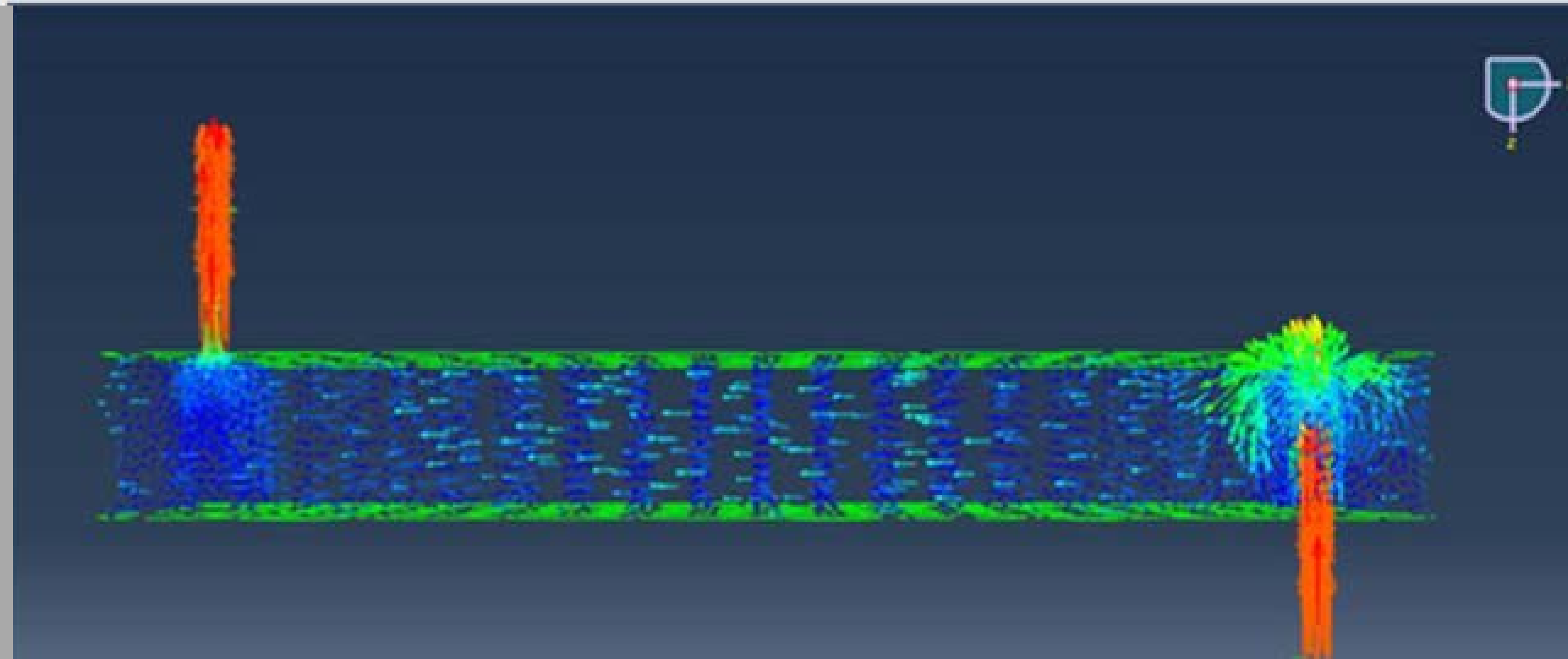


COOLING / HEATING SYSTEM

SIMULATION OF COOLING SYSTEM ON MODULE SIDE

Cooling system consists of a casing (Hollow Block), which is placed between the positive and the negative pole.


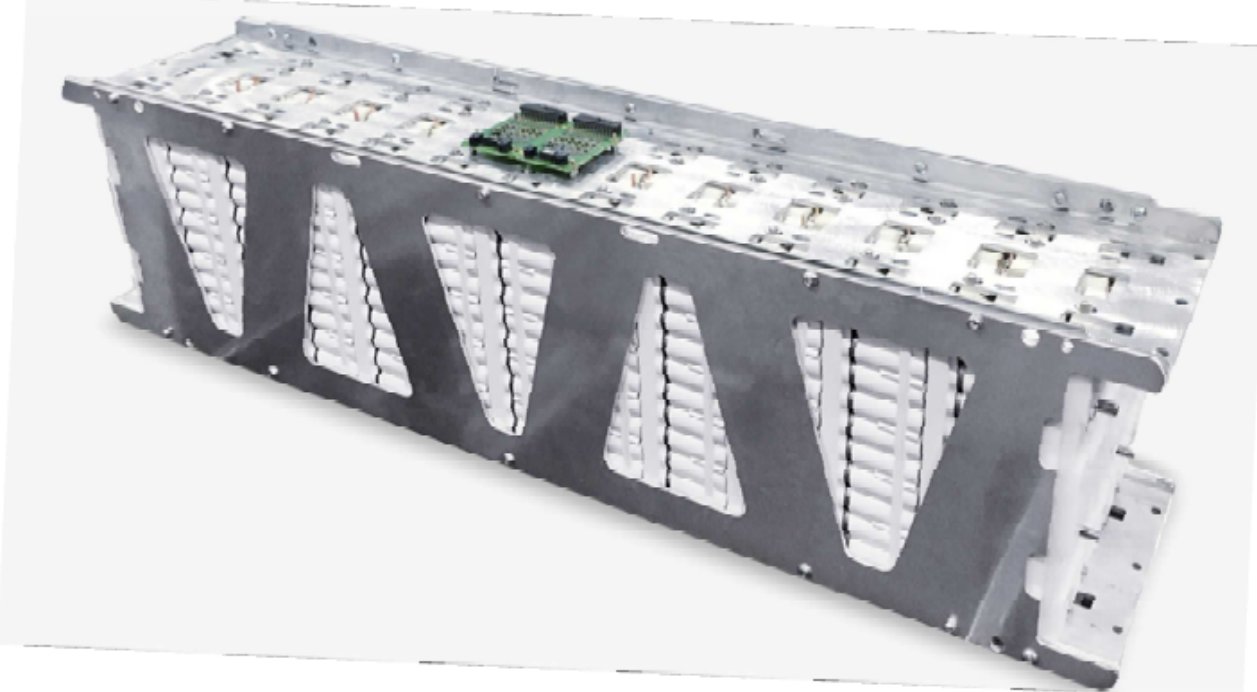
This casing is continuously flushed with dielectric fluid resulting in all cells in the Hollow Block being cooled.





BATTERY CELL

COMPARISON POUCH CELL TO CYLINDRICAL CELL

Sample battery with pouch cells	Pouch	Sample battery with 18650 cells	18650
			
<p>Cooling surface is battery floor and cover 2 x 1,3m x 1,7m</p> <p>4,4 m²</p>		<p>Cooling surface is the cylindrical surface 7200 x 18mm x π x 65mm</p> <p>26 m²</p>	



PROJECTS & SOLUTIONS



VEHICLES

ELECTRIC G-WAGON FOR 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



PROJECTS & SOLUTIONS

VEHICLES

ELECTRIC G-WAGON FOR ARNOLD SCHWARZENEGGER





VEHICLES

KREISEL PORSCHE 910E LIMITED EDITION

- 360 kW Power
- 0-100 km/h in 2,5s
- 1100 kg weight
- 2-speed automated transmission

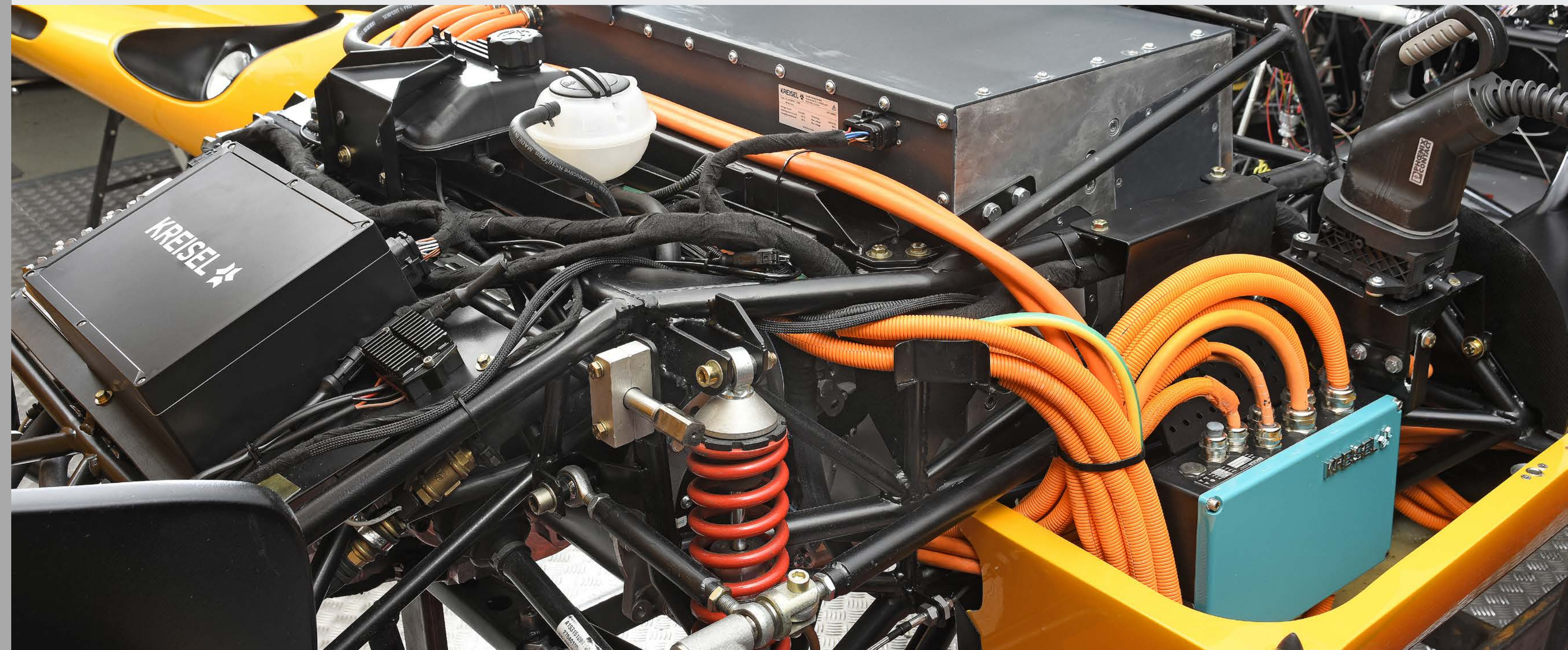




VEHICLES

KREISEL PORSCHE 910E LIMITED EDITION

- 53 kWh battery capacity
- 100 kW DC charging
- 25 min charging 80% SOC

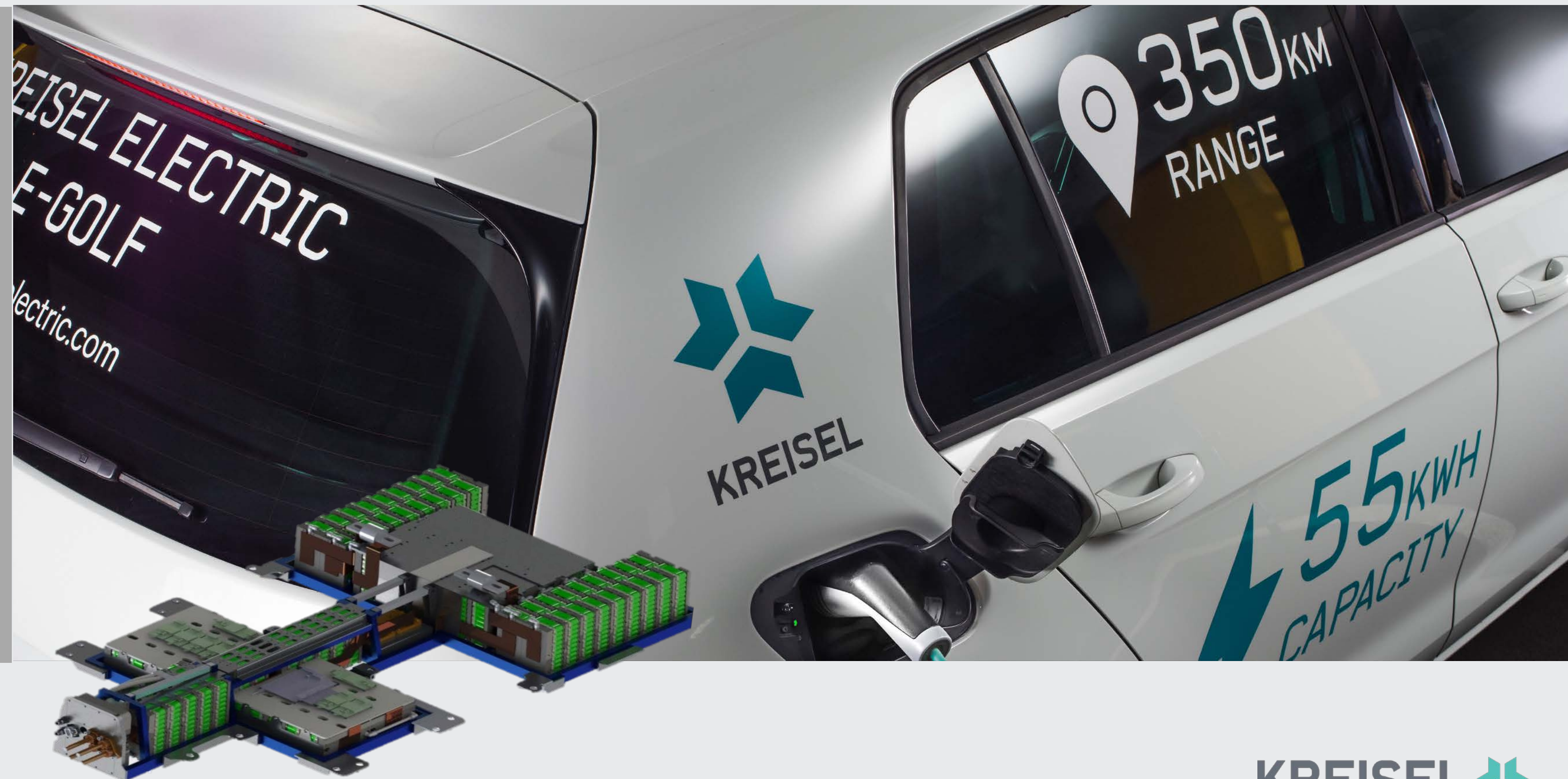




BATTERY PACKS

VW E-GOLF BATTERY PACK

- 55,7 kWh displayed range about 430 km (original 24kWh/200km)
- No additional weight! 330kg
- Liquid cooled/heated battery system





SOLAR STRATOS



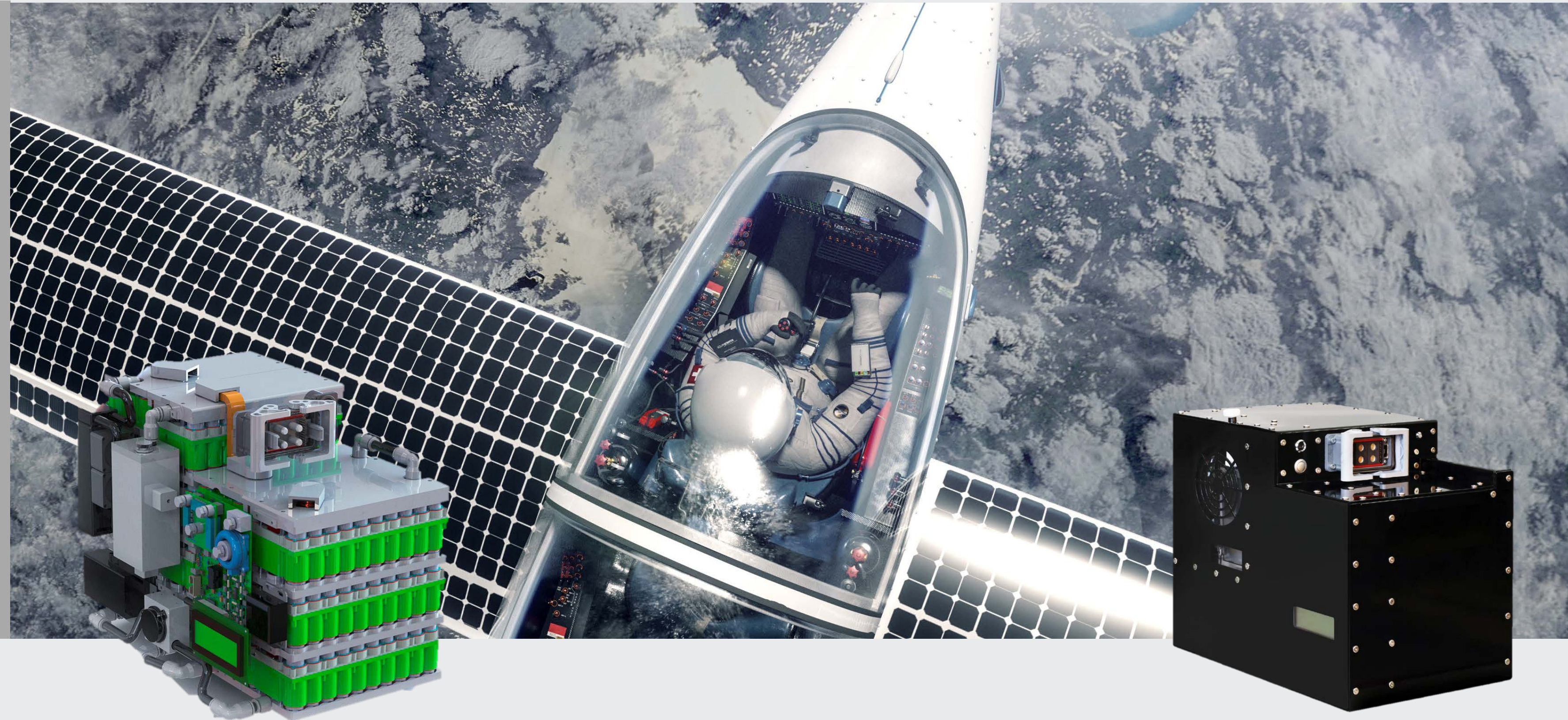
1ST FULL ELECTRIC FLIGHT TO STRATOSPHERE



SOLAR STRATOS

AIRCRAFT BATTERY 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





STATIONARY PRODUCTS

E-MOBILITY CHARGING & STORAGE



MAVERO

HOME ENERGY STORAGE

- Modular Design: 10,14, 20, 28 kWh
- Very high efficiency of 96%
- 10 years warranty
- Power output 4,8 kW
- Can be used as an off-grid system



14 KWH



28 KWH



ENERGY RACK

INDUSTRIAL & COMMERCIAL ENERGY RACK STORAGE

- Modular Design: 104, 208, 416, ... kWh
- 150kVA Power output per rack
- Very high efficiency of 94%
- 10 years warranty
- DC-AC converter already installed
- Can be used as an off-grid system





SMART CHARGER

DESIGN COLUMN WITH LIGHT

- 11 kW or 22 kW Typ 2
- Twincharger
- Optional Cable
- Dynamic Load Management





SUPER FAST CHARGING

300 kW + incl. 100kWh Battery

- Fast charging with up to 300 kW / 800 V
- Incl. 100 kWh battery
- Can be installed on all power connection, very low installation costs and flexible in location
- Energy suppliers can store over capacity from renewable energies and can suck out power if it's necessary





**VIDEO
OPENING**

THANK YOU FOR
YOUR ATTENTION

KREISEL 

www.kreiselectric.com