

1° Congresso Paranaense de Veiculos Elétricos

Battery Requirements

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ITAIPU, 07.12.2011

The Battery is the Core of the Electric Vehicle & an Interesting Option for Stationary Renewable Energy Storage:

OEM View

1. Cost
2. Power [kW, PS]
3. Energy content [kWh]
4. Ambient conditions
5. Liability
6. Materials

→

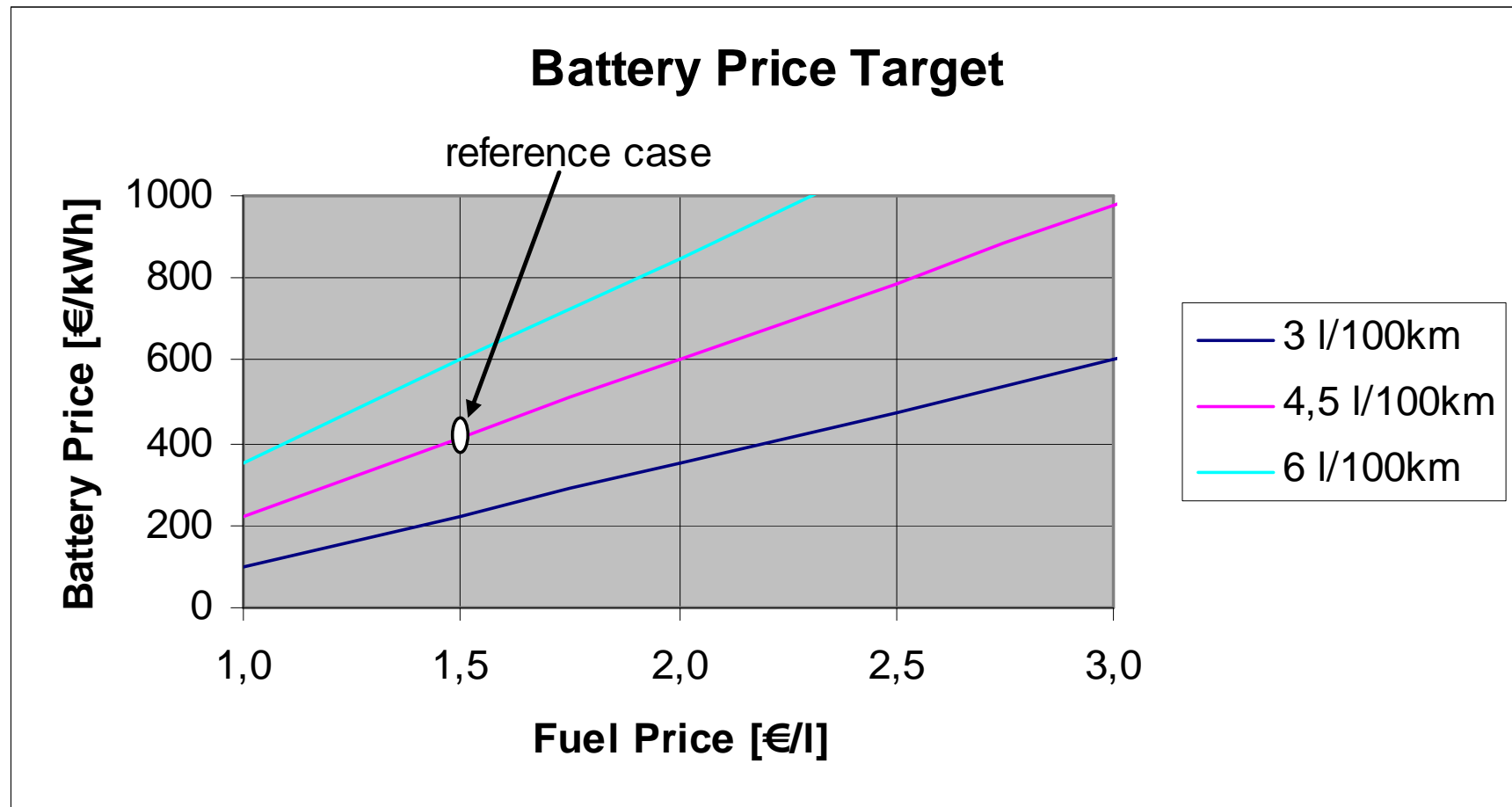
Car Customer View

- Price [€]
- Acceleration, Fun to drive
- Range
- Reliability
- Safety
- Availability, Price,
Recycling

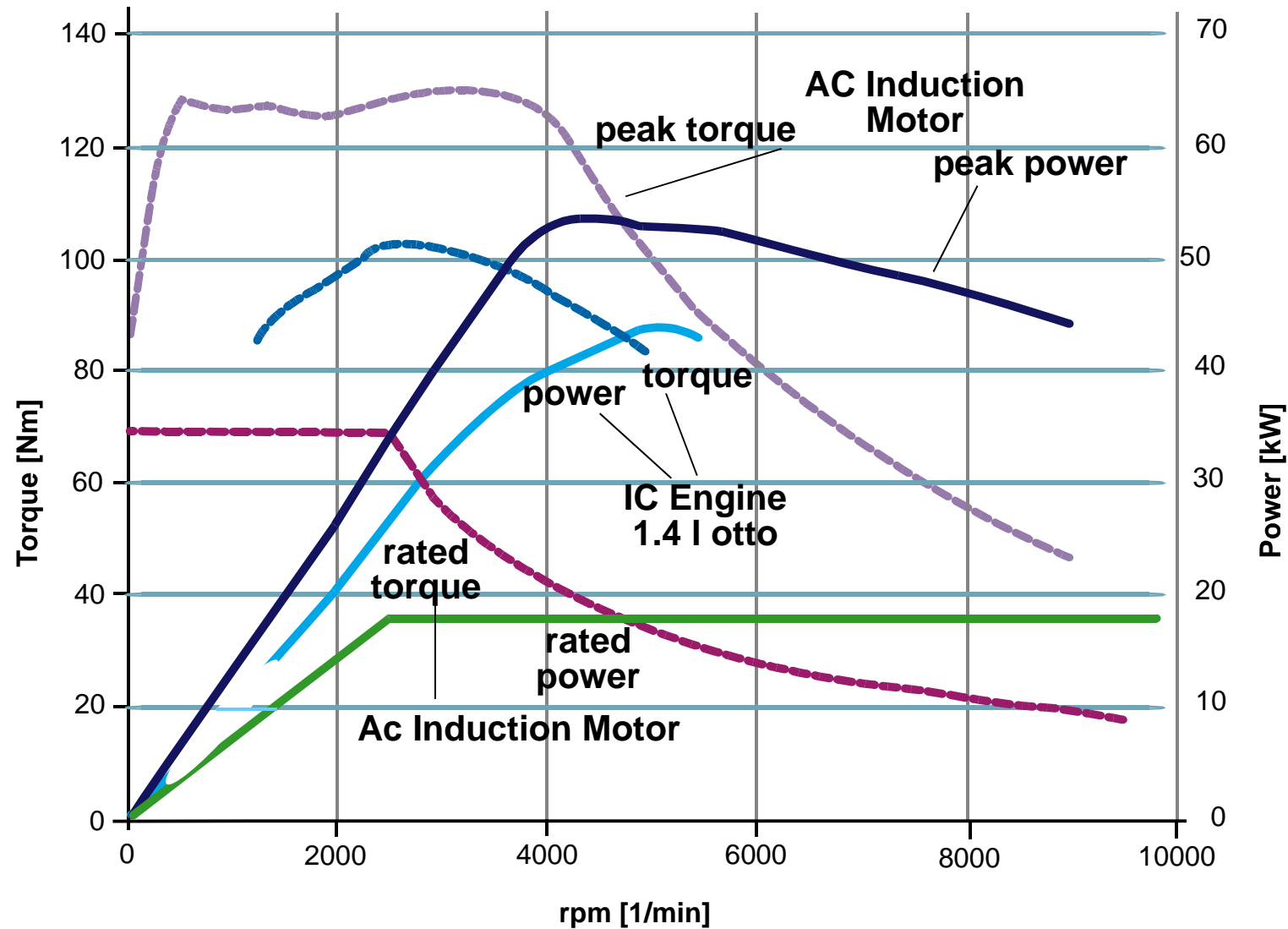
Cost → Price

- EV Cost without Battery = ICE vehicle cost e.g. **10 000 €**
- Battery cost today ca. 500 €/kWh, 20 kWh for 150 km range, 1000 kg GVW
result in 10 000 €, in some years may be **5 000 € = 15 000 total EV cost**
- **EVs** will always be **more expensive** (+ca. 50%) than an equivalent ICE car
- **BUT** the electric energy cost is much lower than fuel cost. For the business case this difference must compensate the battery cost

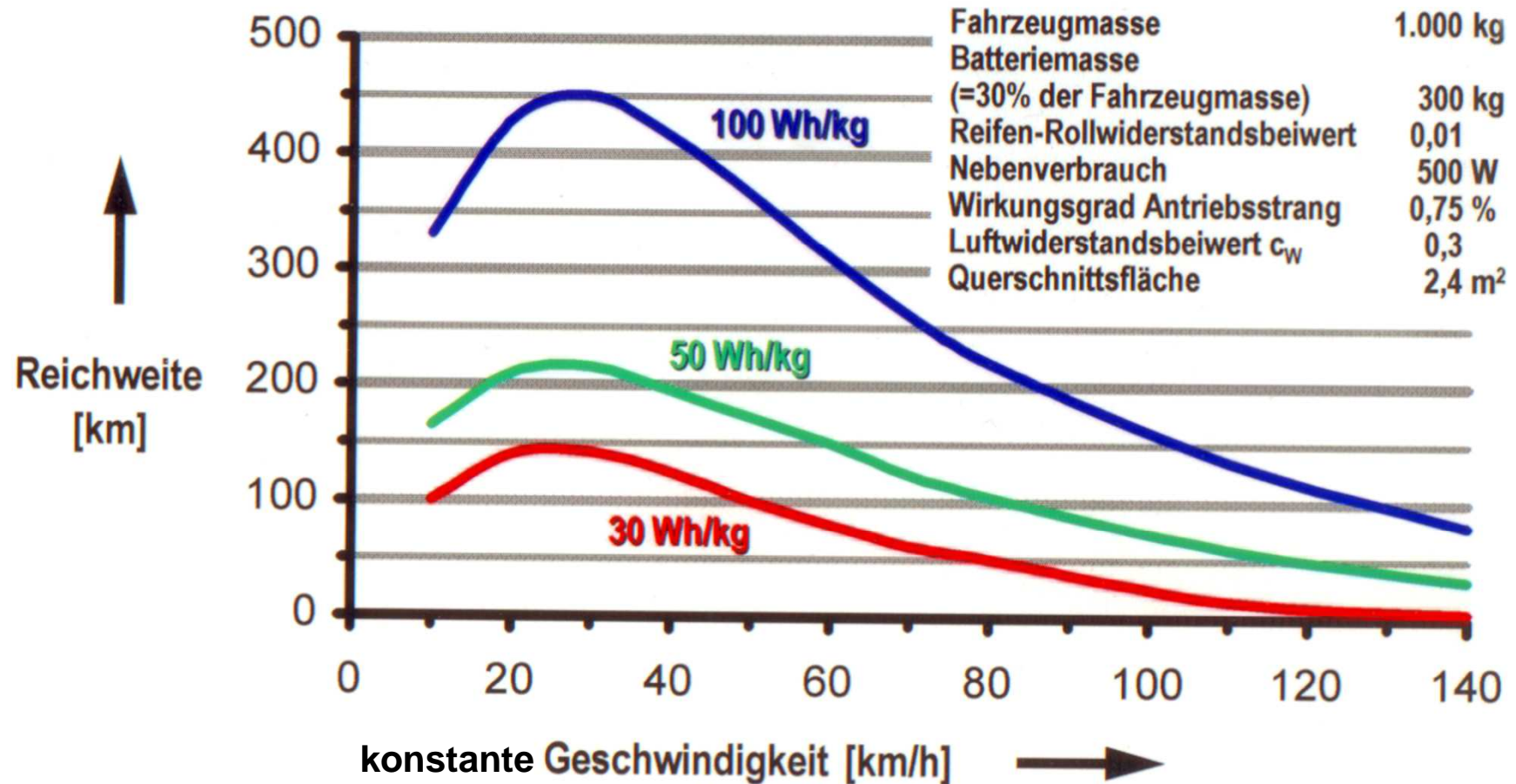
Model: Electricity- + Batteryprice = Fuelprice
 Battery Duration = Vehicle Duration



EV Power 50 kW to 60 kW peak

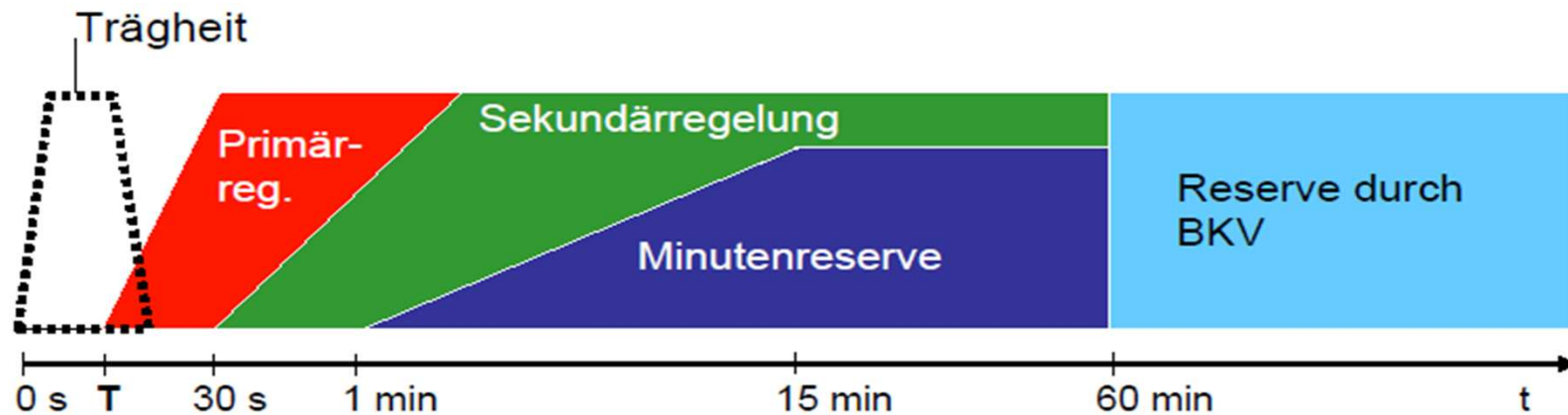


EV Range 30 kWh



Quelle: AEG Anglo Batteries GmbH

Requirements on Grid Storage



Li-Ion → 0,25 h

Salt Battery → 2 h

NAS Battery → 7 h

Battery Cost is proportional to energy

Quelle: AEG Anglo Batteries GmbH

Ambient Conditions and Reliability

	Car	Stationary
Temperature	- 40°C to 80°C	- 10 °C to 60°C
Humidity, Dust	IP67	cabinet
Chemical, Salt Fog	IEC-68-2-11	non
Vibration, Shock	10 Hz to 1 kHz, 30g/14ms	earth quake
Electric Isolation	400VDC, EMI	CE standard
Duration Calendaric/Cycle	12+years/1500 cycles	20 years/8000 cycles
Weight/volume	critically limited	not critical

Safety

No Fire, no Toxic Gases, no Hazardous Material exit

- Short Circuit
- Overcharge
- Aging
- Vibration Load
- Shock and Deformation
- Thermal Cycling
- External Heat

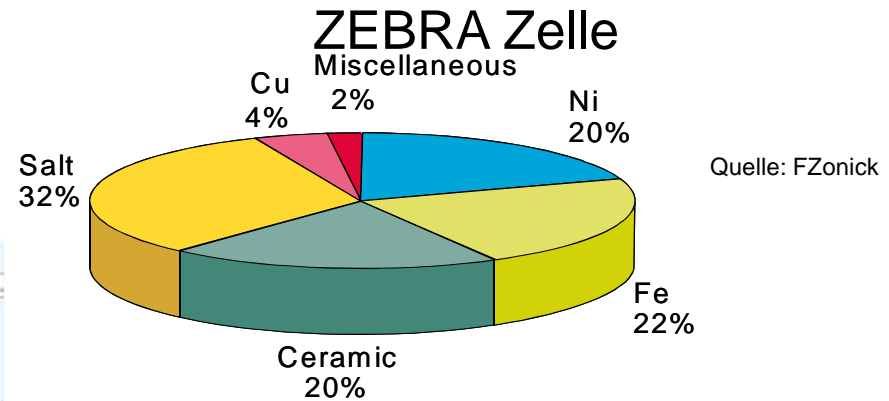
Materials

Li-Ion cell



Tahil: World Lithium Resource (Mton)

14.12.2011



C. Dustmann

Quelle: INCO 10

Material Recycling

Li-Ion

Under development

BATTERY
CONSULT

ZEBRA Zelle

INMETCO®
AN Inco COMPANY

DATE: December 03, 1998

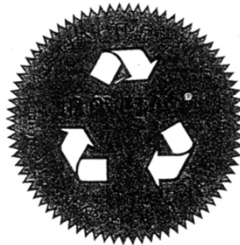
RALF HARTKAMP
GEP mbH
OLYMPIASTRASSE 1
D-26419 SCHORTENS
GERMANY,

Certificate of Waste Material Recycling

Whereas, The International Metals Reclamation Company, Inc. (INMETCO) operates a hazardous/non-hazardous waste reclamation facility under the rules of the Pennsylvania Department of Environmental Resources and the U.S. EPA (ID No. PAD087561015).

Now, therefore, INMETCO does hereby issue this certificate to GEP mbH to evidence the consumption of Sodium Ni Chloride, Dry (Zebra), PAE8269796 on Sales Order Number 104722 received on 6/04/98.

Said Consumption has been completed on or about 11/30/98, in a manner consistent with acceptable engineering standards and in compliance with applicable rules and regulations set forth by the State of Pennsylvania and Federal authorities.



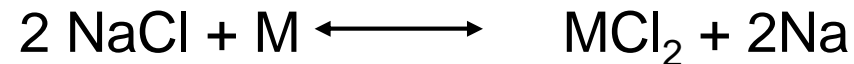
John C. Onuska Jr.
John C. Onuska Jr.
Manager, Environment Health and Safety

William J. Koshut
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Plant Superintendent

Questions, corrections or comments on this document should be directed to INMETCO Marketing and Sales
P.O. Box 720 • 245 Portersville Road • Ellwood City, PA 16117 • (Phone) 724-758-2800

Salt Battery Design

Basic Chemistry



similar to ZEBRA™ of Fiamm Sonick and Durathon™ of GE

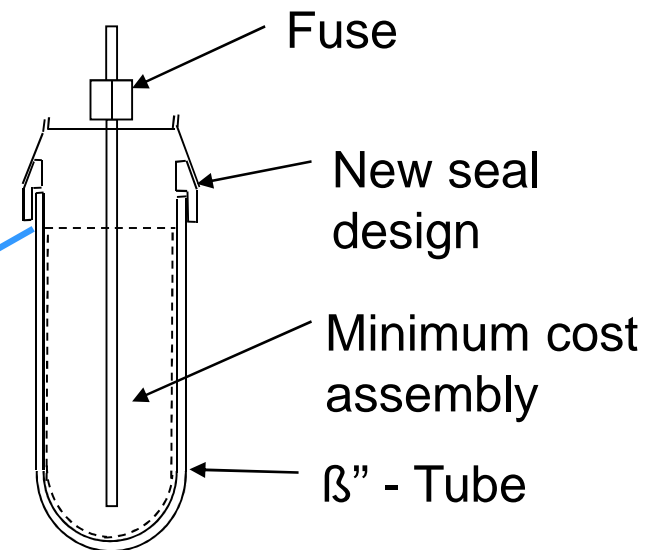
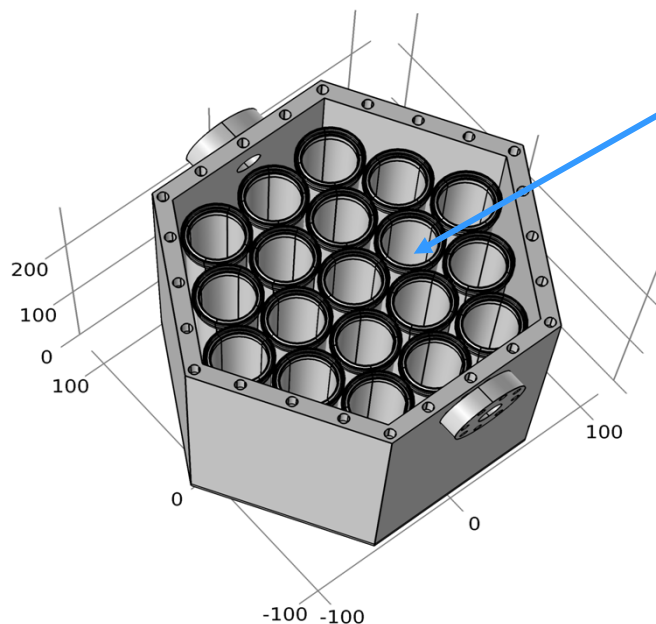
Design Parameters of Pilot Installation

	Symbol	Cell	System
Rated Power	P _o	620 W	105 kW
Rated Energy	E _o	1,2 kWh	209 kWh
OCV	U _o	2,58 VDC	433 VDC
max Voltage	U _{max}	2,67 VDC	448 VDC
min Voltage	U _{min}	2,3 VDC	386 VDC
Rated Capacity	C _o	520 Ah	520 Ah

168 cells in series

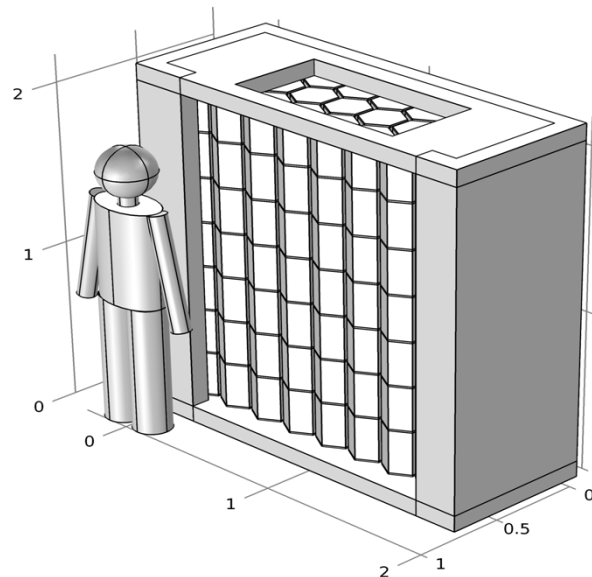
Salt Battery Design

Design optimised for stationary Systems with highest reliability and safety



Each cell has 19 beta-tubes in parallel in one case. For a MW System it would be 61 or 91.

Salt Battery Design



100 kW / 200 kWh / 400VDC Pilot Installation

- 168 Multi Tube Cells in series
- Cabinet dimensions LxWxH = 2.0x0,8x2,2 m including thermal isolation
- Weight ca. 2200 kg
- Overload capability
- Outdoor or indoor cabinet