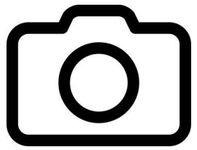
Impulsveranstaltung 11. März 2025

Energiespeicher-Technologien & Ihre Anwendungsmöglichkeiten

its

Hinweis



Wir machen einige Fotos für unsere Kommunikation.

Präsentation wird auf der ITS Website aufgeschaltet.

Programm

▪ Einführung:	Marco Jaggi / ITS
▪ Grundlagenreferat:	Martin Stöck / OST FH
▪ Praxisbeispiel:	Adrian Kummer / Wunderli Electronics
▪ Praxisbeispiel:	Simon Barjasic / SAVVY Telematic Systems
▪ Diskussion mit Q&A	
▪ Apéro & Networking	

Sponsoren

Unabhängige Anlaufstelle für Schaffhauser KMU

Unternehmen

Anlaufstelle

Angebot

Ökosystem

its WIR FÖRDERN TECHNOLOGIE UND INNOVATION.

Anlaufstelle für
Innovations-,
Technologie-
Unternehmensfragen

- Kontaktvermittlung & Vernetzung
- Information & Inspiration
- Methoden & Tools
- Projektförderung

Innosuisse, IBAN, inos Innovationsnetzwerk Ostschweiz, Microtech Booster, ETH zürich, Universität St.Gallen, OST Ostschweizer Fachhochschule, zhaw, n|w, Paul Scherrer Institut PSI, EMPA Materials Science & Technology, WITg, RhySearch Das Forschungs- und Innovationszentrum Rheintal, IGE|IPI, Kompetenznetzwerk Ernährungswirtschaft, Health Tech Cluster Switzerland, act Cleantech Agenda Schweiz, Energie-Agentur der Wirtschaft EnAW, Hightech Zentrum Aargau, Thurgauer Technologie Forum, etc.

its

Werden Sie Teil der ITS Community – neue Benefits!

Exklusive Partner Veranstaltungen.

Kostenlose Expertise & Dienstleistungsangebote in den Bereichen IP, KI, Cyber Sicherheit, Finanzen.

Direkte Zugänge zu Community Mitgliedern.

Sichtbarkeit auf den ITS Kanälen.

its

its.sh.ch/mitglieder

- **Ihr unabhängiger Ansprechpartner für Innovations- & Technologiefragen**

its
WIR FÖRDERN
TECHNOLOGIE
UND INNOVATION.

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Battery as Innovation enabler

Martin Stöck

11. März 2025

OST / EMS / Battery-Lab

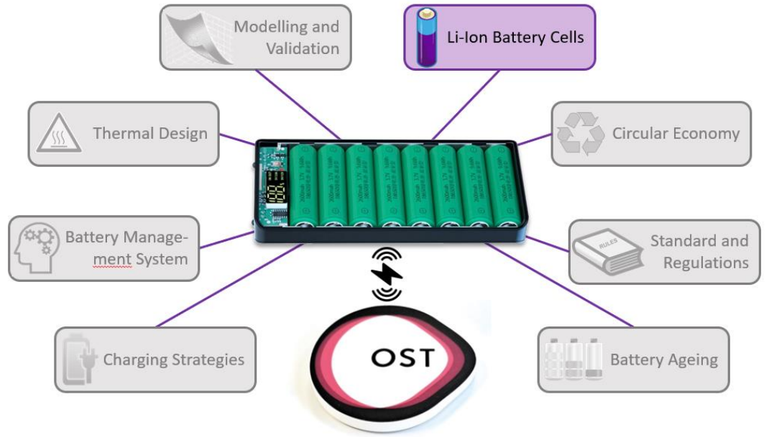
OST
Ostschweizer
Fachhochschule

WO WISSEN WIRKT.

Agenda: Batteries enabling Innovations

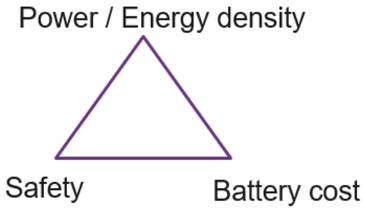
- Intro

- Batteries as enabler of Innovations - History

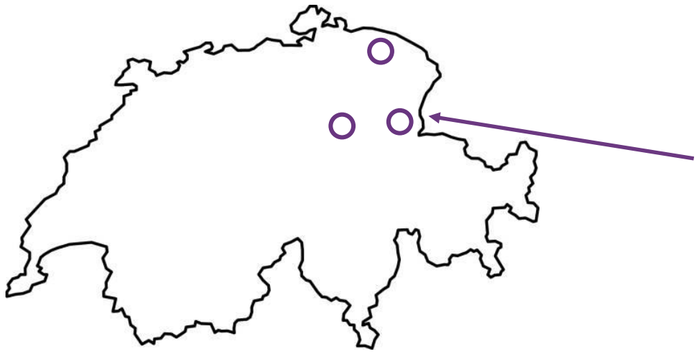


- How to design a Battery-Pack – the most important Steps:

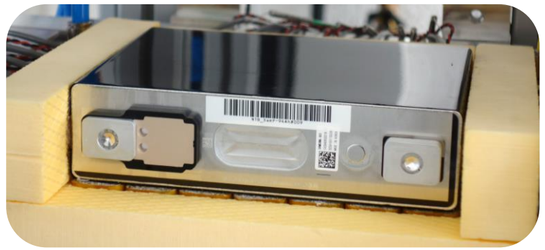
- Future Trends in Batterie Technology

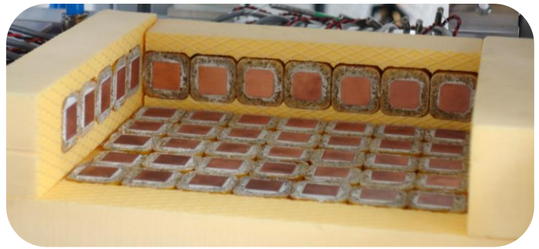


OST & EMS



- **Institut EMS – Entwicklung Mechatronischer Systeme**
  - Batterie
  - Robotik





Head of Battery Research Group OST

- Martin Stöck
- Apprentiship - Physic Laboratory Assistent
- Bachelor & Master in Microtechnic EPFL
- PHD at ETH
- Head of BU – Powertrain at BRUSA
- Vice CTO & Teamleader Motor development at ThyssenKruppPresta AG
- Professor at OST (Team of 5 people)

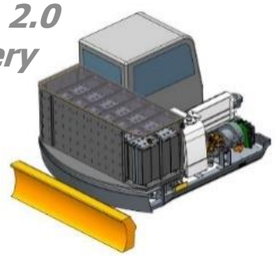
History: EV & Battery of EMS

Batteries

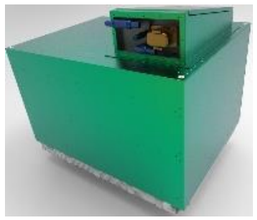
Air-Water cooled

Water cooled, 16 kWh, flat

Bagger-Batterie 2.0 200 kWh Battery



Inductive Charging 22 kW

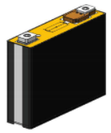


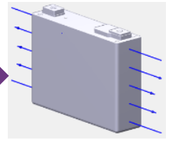
E-Dumper Batt.

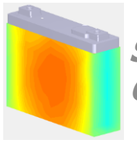
133 kWh LKW Battery

Water cooled

sccer mobility







SCCER Cell-Test-Rig

2007 — 2010 — 2014 — 2015 — 2017 — 2019 — 2020 — 2022

New Prof. Martin Stöck since 2.2022

Applications

Brusa Spider

SUNCAR → ETH Zürich

Skoda Octavia

Solar-preis 2015

16t Solar 8h autonomous

E-Dumper

Range-Extender

Lotus Evora

BMW SUV with Steer-by-Wire

E-Traktor

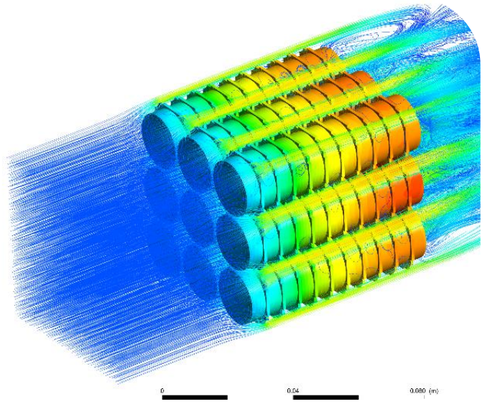
E-Motorrad

Start of 100% Battery focus

Skills

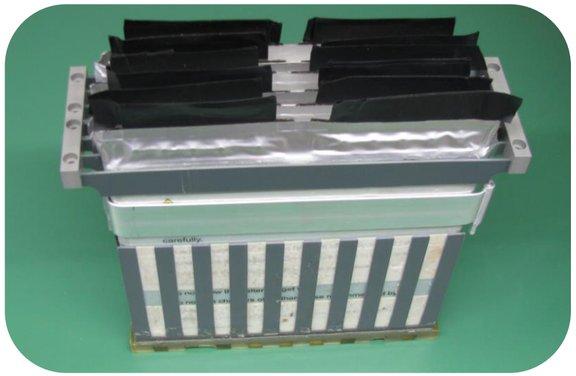
Thermal Simulation FEM

- Thermal CFD Simulation
- Thermal FEM Simulation



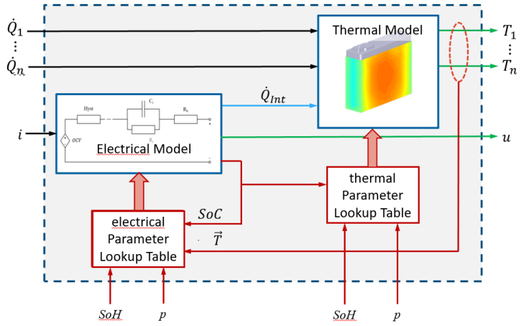
Battery Prototyping

- Prototyping capability of battery backs
- BMS
- Safety features for battery



Digital Twin of Battery

- Thermal electrical digital twin of battery cell
- Digital Twin in Simulink

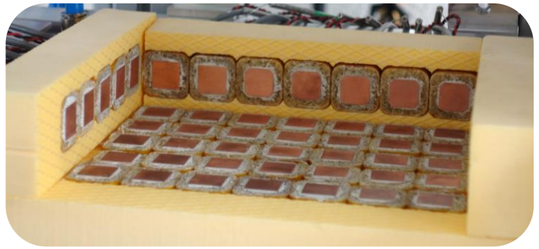


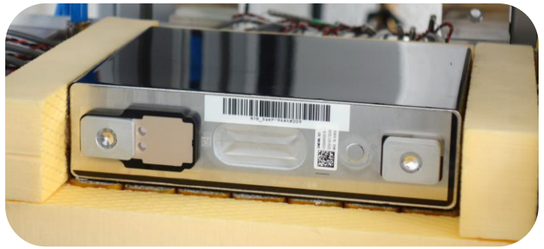
Measurement Equipment

- Large amount of measurement equipment
- Acquisition systems
- A lot of Sensors

Equipment for battery tests / prototyps

CTR 2: Thermal & Electrical Characterisation of pouch cell



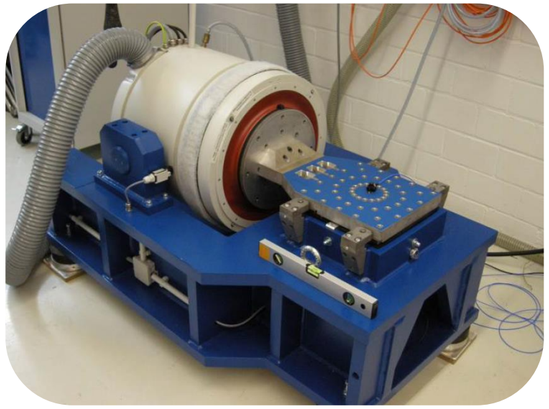


Climatic chambers

- Climatic chambers with special safety equipment for battery tests
- Up to 1800A

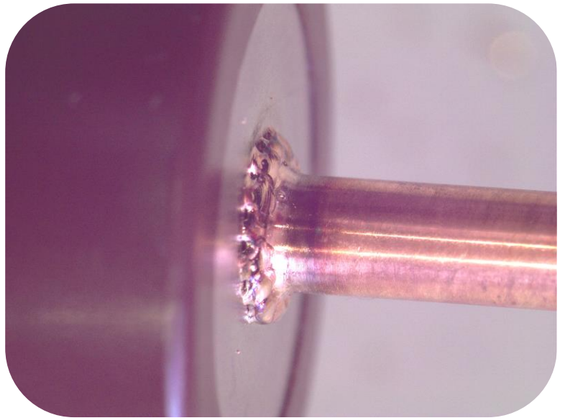
Mechanical testing

- Shaker for mechanical cell aging tests
- Shaker for batter pack validation



Welding

- Development of welding process with "no" heat impact into cell
- Fully automised for quality assurance
- For research purpose



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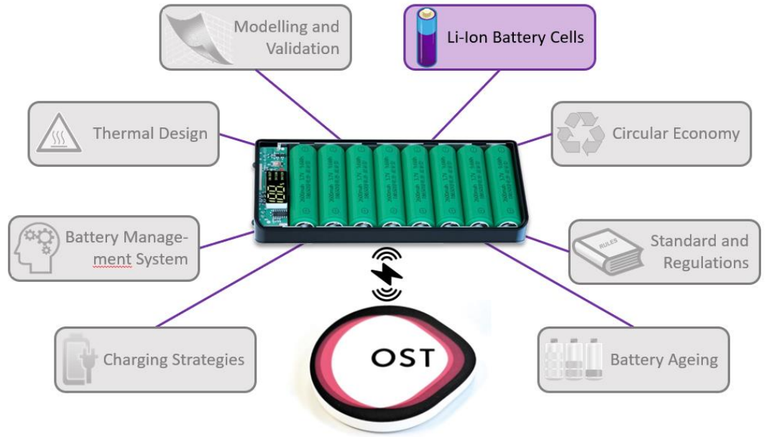
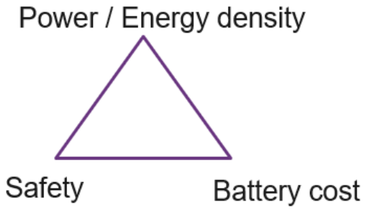
- Batteries as enabler of Innovations - History
- How to design a Battery-Pack – the most important Steps:

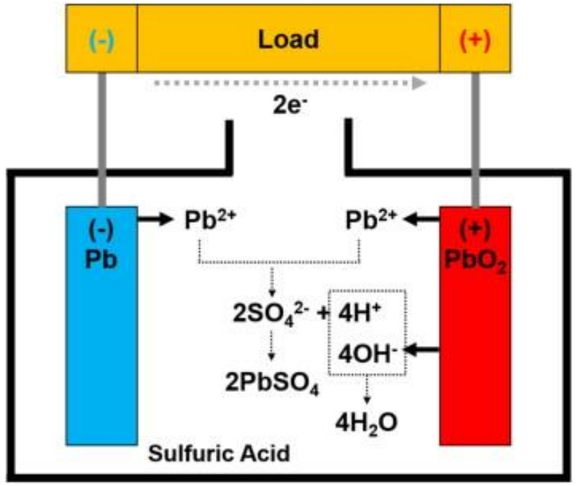


- Future Trends in Batterie Technology



Source: https://www.youtube.com/watch?v=3CCG7__rQqU
https://doi.org/10.1016/j.pecs.2015.01.002

1859 First recharable battery – lead acid battery 60Wh/l



Oxyd.	Red.	E^0(V)
PbO_2	Pb^{2+}	1,46

Negative electrode:

$Pb \rightleftharpoons Pb^{2+} + 2e^-$

$Pb^{2+} + SO_4^{2-} \rightleftharpoons PbSO_4$

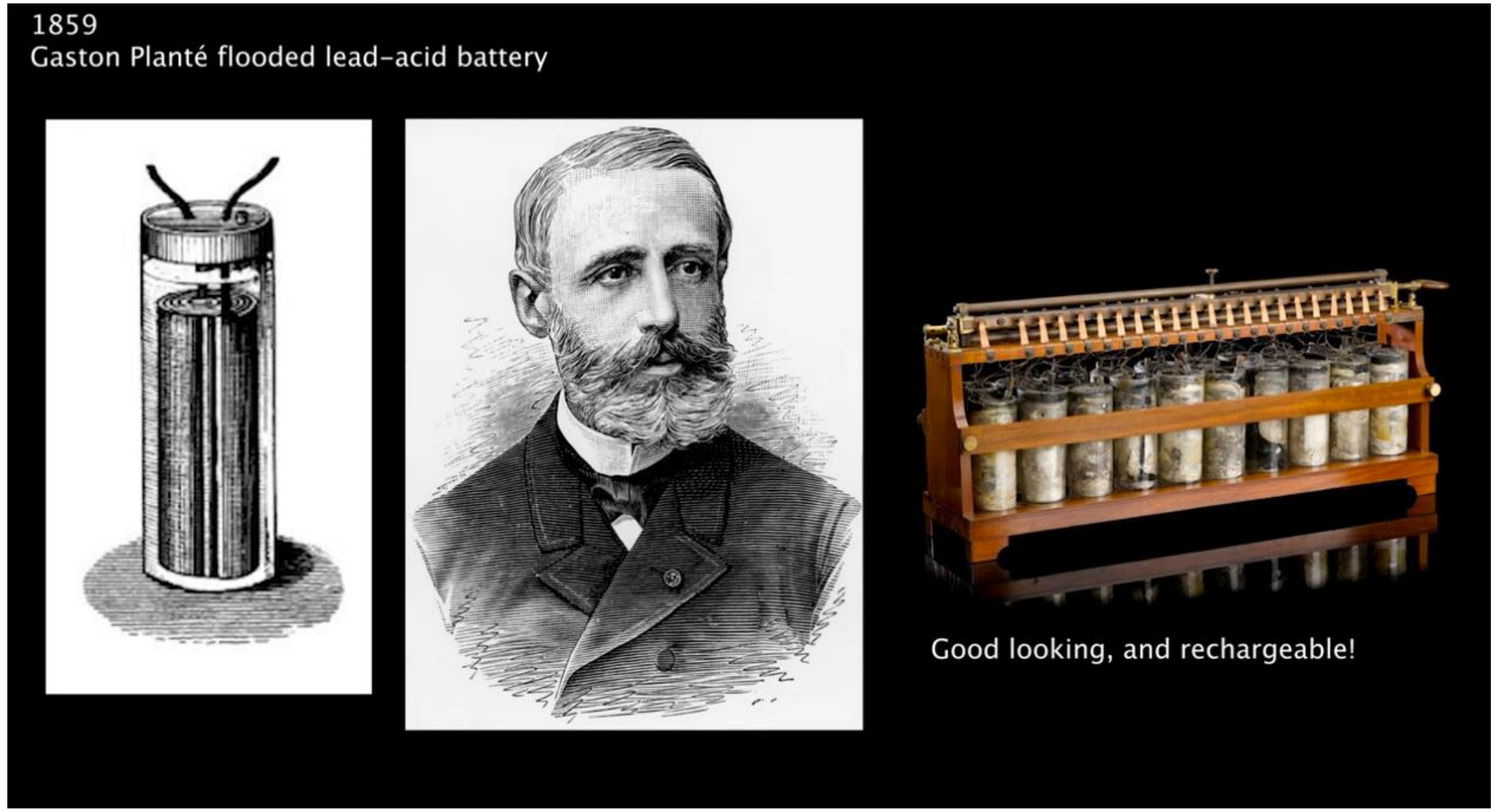
Positive electrode:

$PbO_2 + 4H^+ + 2e^- \rightleftharpoons Pb^{2+} + 2H_2O$

$Pb^{2+} + SO_4^{2-} \rightleftharpoons PbSO_4$

Overall reaction:

$Pb + PbO_2 + 2H_2SO_4 \rightleftharpoons 2PbSO_4 + 2H_2O$



OST

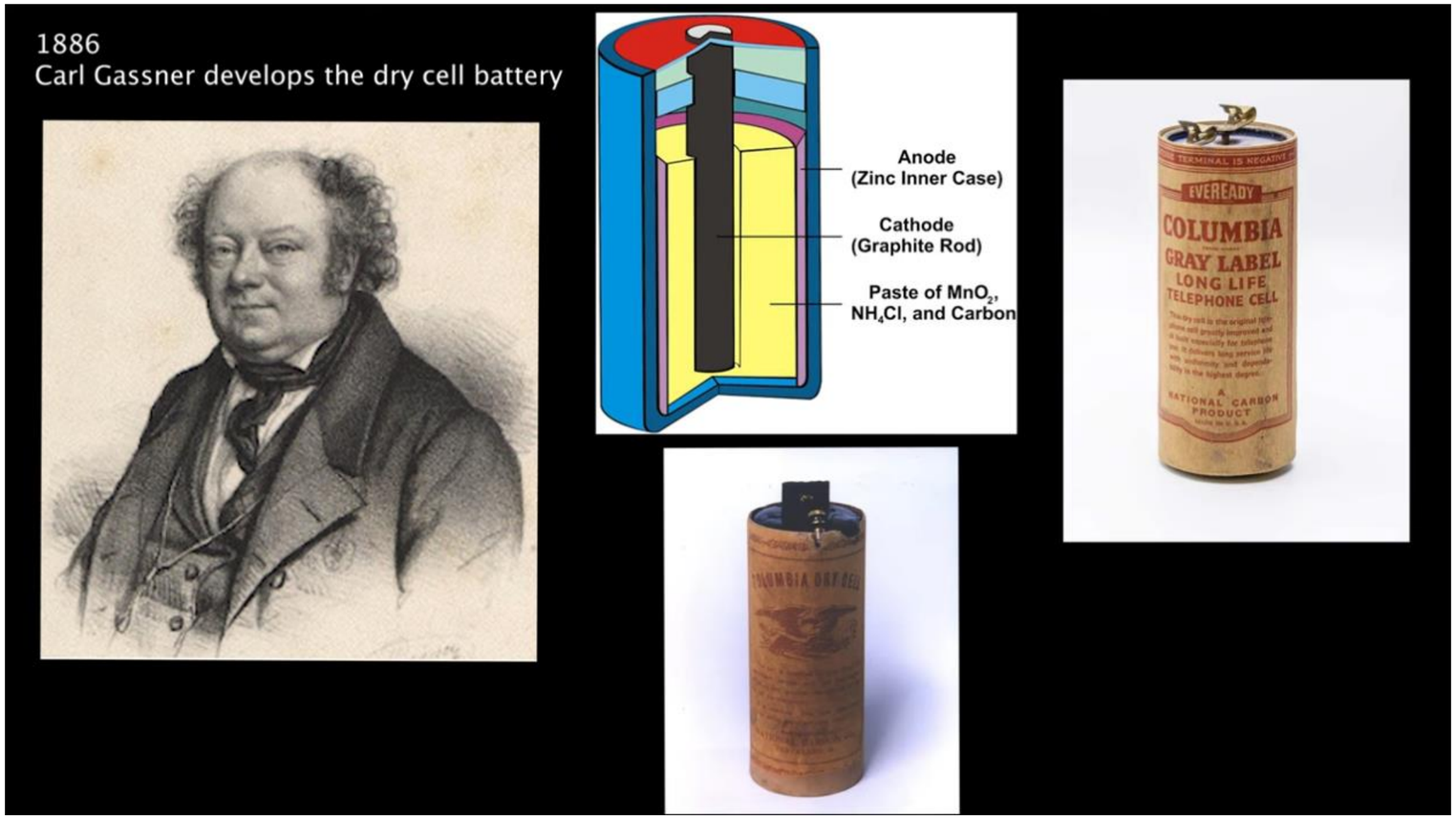
Lead Acid battery as enabler for telegraph & telephones

- Electric generators as we know them today were not yet developed, telegraph systems primarily relied on batteries for power
- No Grid developed yet or unstable

Source: https://www.youtube.com/watch?v=3CCG7__rQqU

1886 Zn-Graphite Battery (100Wh/l)

- First battery without fluid, could be used in any position.
- No maintenance
- Smaller sizes than Lead-acid



Source: https://www.youtube.com/watch?v=3CCG7__rQqU

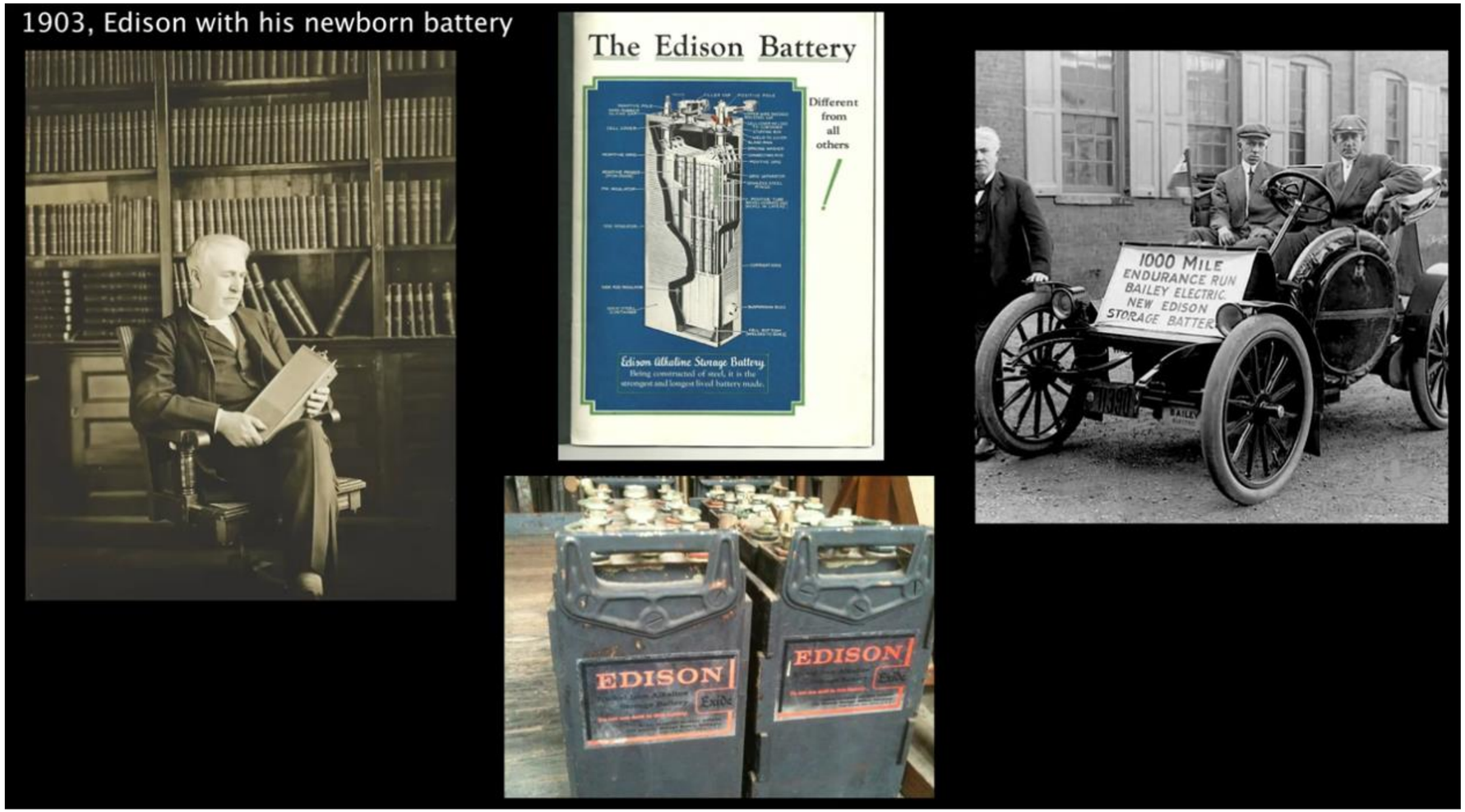
1899 The dry cell enabled the flash light

- 1899: First Flashlight

Source: https://www.youtube.com/watch?v=3CCG7__rQqU

1903: Nickel-Iron Battery (80Wh/l)

- NiFe batteries are known for their robustness
- Reliable
- High durability and lifespan
- Generally high safety



OST

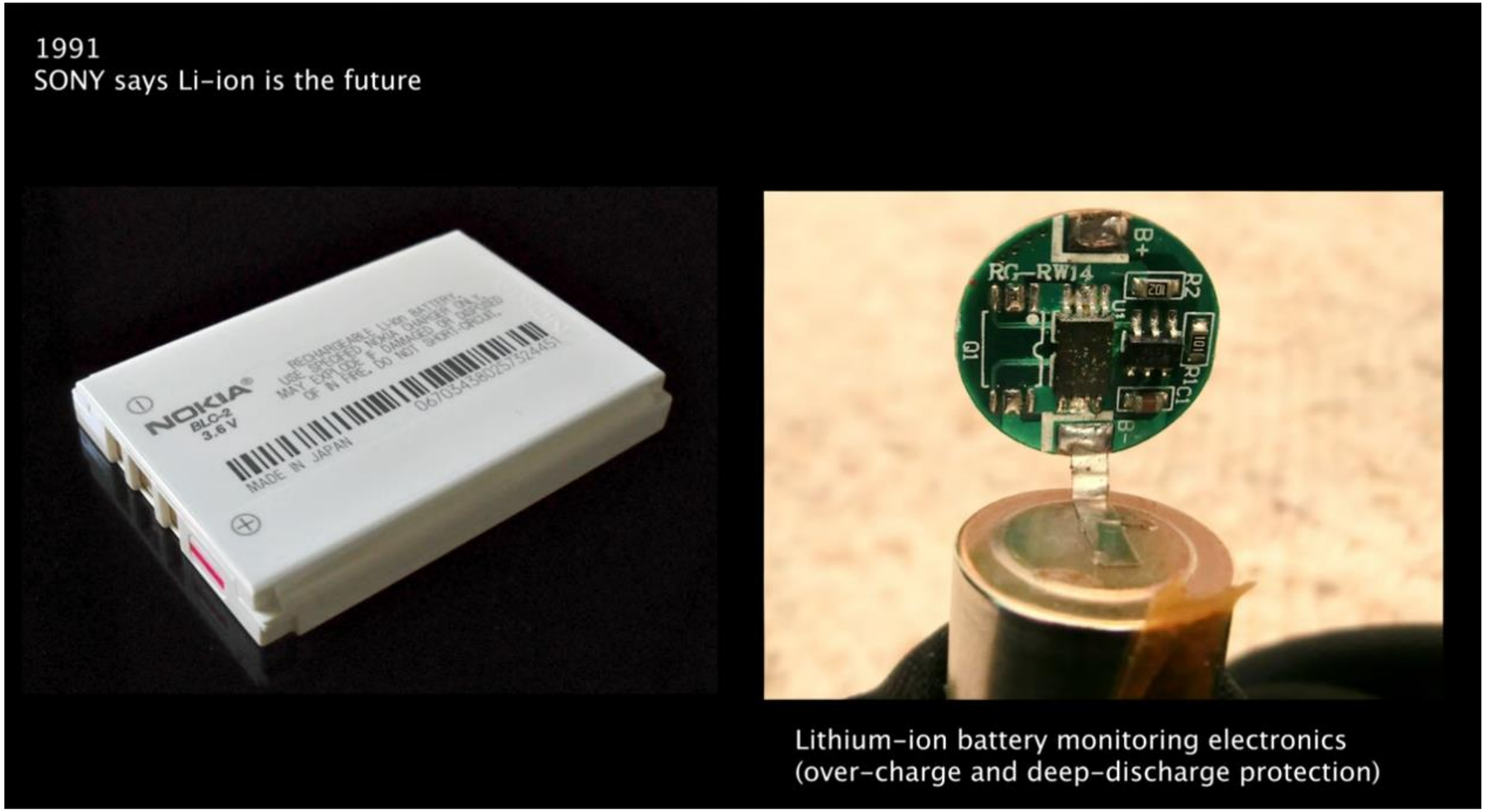
Nickel-Iron Battery Applications

- Railroad Signalling and Communications
- Emergency Lighting and Power Systems
- Mining and Heavy Industry
- Stationary Power Storage

Source: https://www.youtube.com/watch?v=3CCG7__rQqU

1991: Li-Ion (250 to 680Wh/l)

- High Energy - or Power - Density



https://physicsworld.com/a/lithium-io
batteries-break-energy-density-reco

Energy density vs time

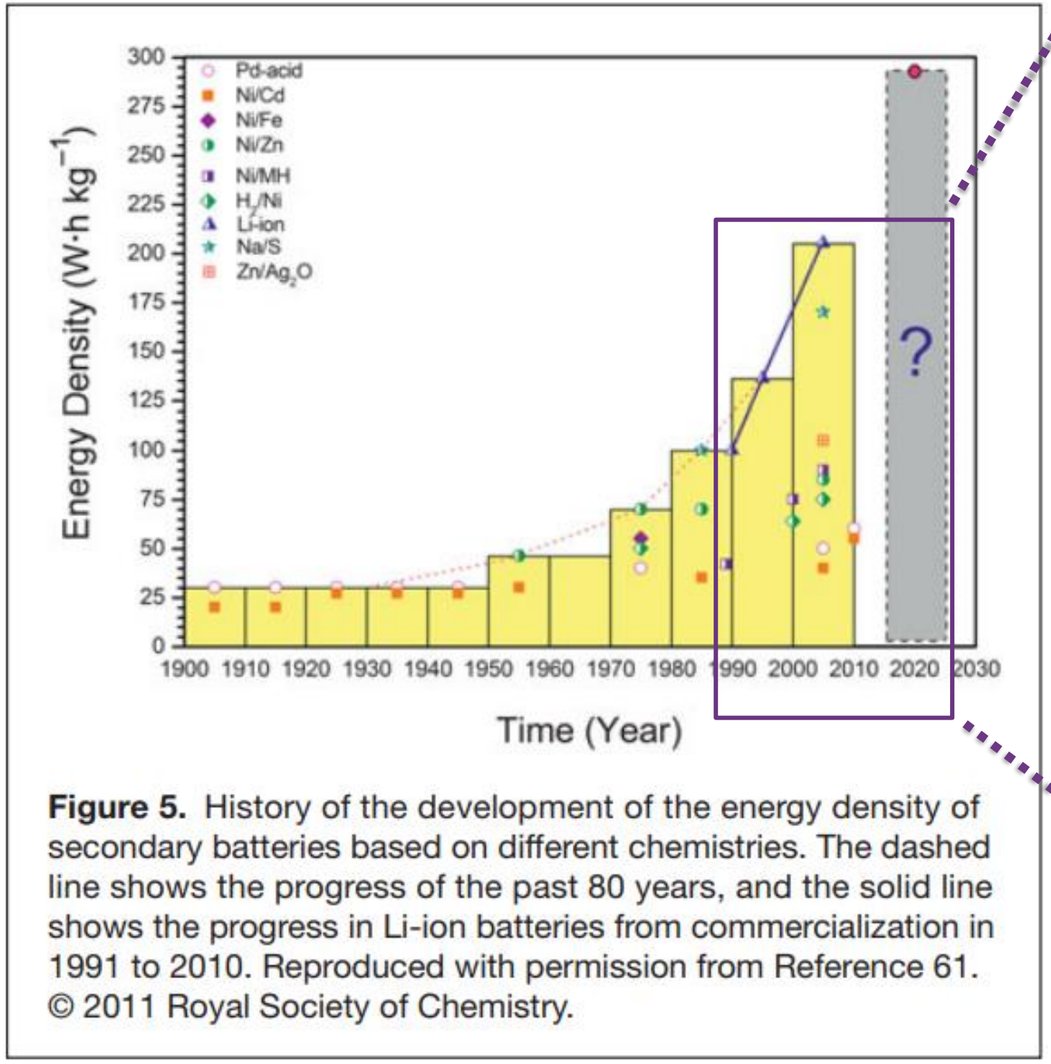
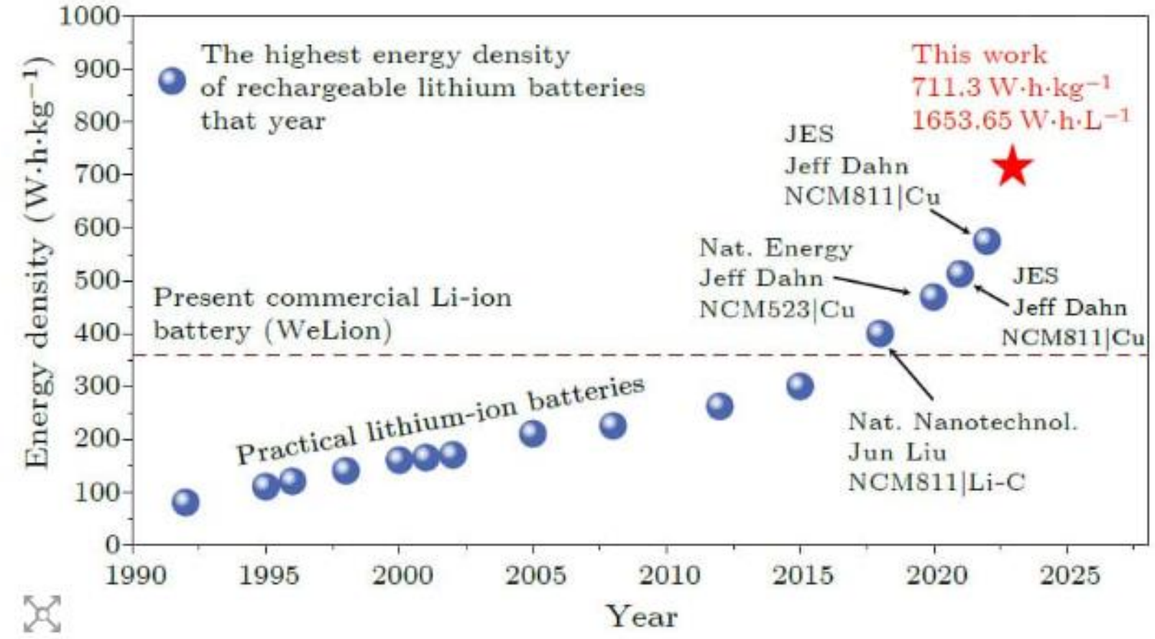


Figure 5. History of the development of the energy density of secondary batteries based on different chemistries. The dashed line shows the progress of the past 80 years, and the solid line shows the progress in Li-ion batteries from commercialization in 1991 to 2010. Reproduced with permission from Reference 61. © 2011 Royal Society of Chemistry.

Lithium-ion batteries break energy density record

21 Apr 2023 Isabelle Dumé



Technology advances: the energy density of lithium-ion batteries has increased from 80 Wh/kg to around 300 Wh/kg since the beginning of the 1990s. (Courtesy: B Wang)

https://brassicgamer.blogspot.com/2018/11/toshiba-t1000-part-one-profile-history.html
https://www.cultofmac.com/apple-history/first-generation-ipad-unveiled

Li-Ion Applications

- 1985 - Nickel-cadmium

- Toshiba-t1000

- 1991 - Li-Ion

- Apple PowerBook 100

- 2010 - Li-Ion

Patent 2004

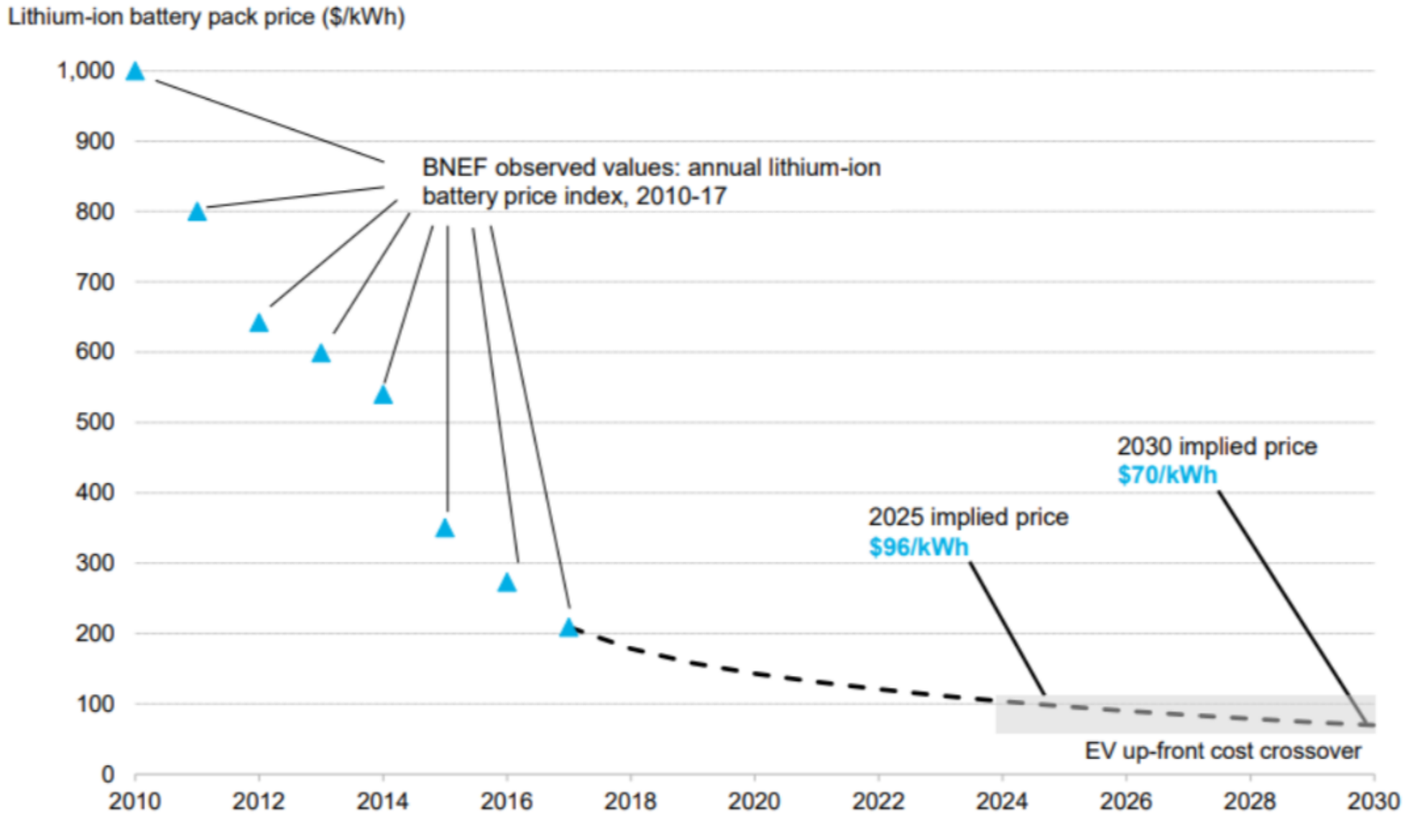
- First I Pad

https://www.researchgate.net/publication/350690343_Carbon_Purchase_Agreements_Dactories_and_Supply-Chain_Innovation_What_Will_It_Take_to_Scale-Up_Modular_Direct_Air_Capture_Technology_to_a_Gigatonne_Scale

Li-Ion mass production – enabler for EV

- Every Week a Giga-Factory opens in China!
- Giga = 10^9 Wh => 100 Mio. 18605 Zellen => 3 per second!

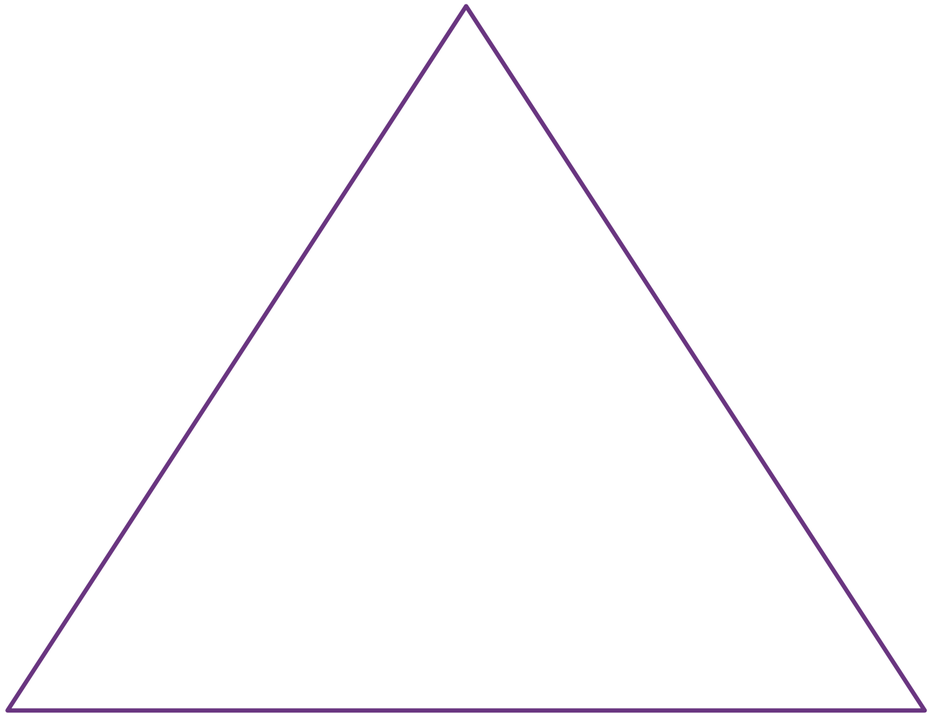
10Wh



Source: Bloomberg New Energy Finance

Summary

- Power / Energy density



- Safety
- Battery cost

Innovation potential in your company?

Agenda: Batteries enabling Innovations

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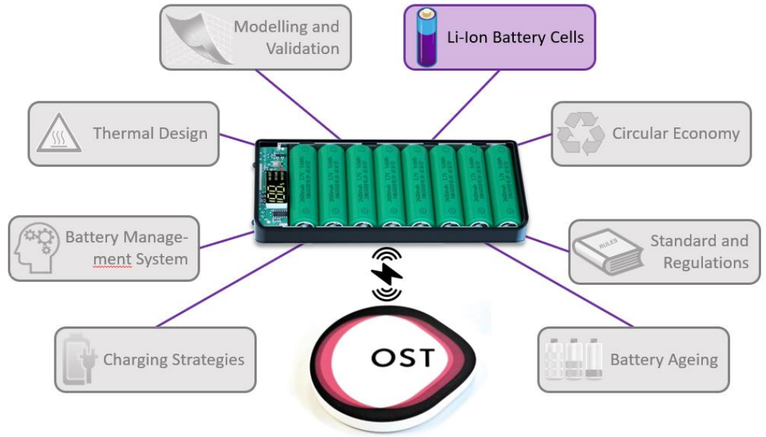
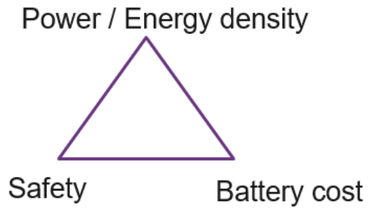
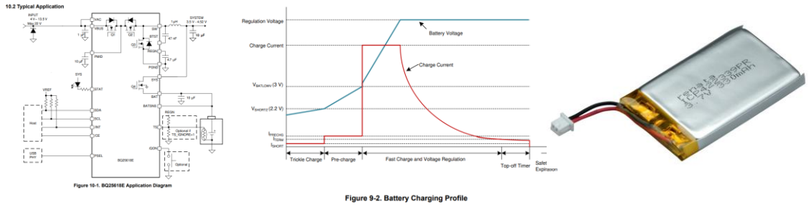
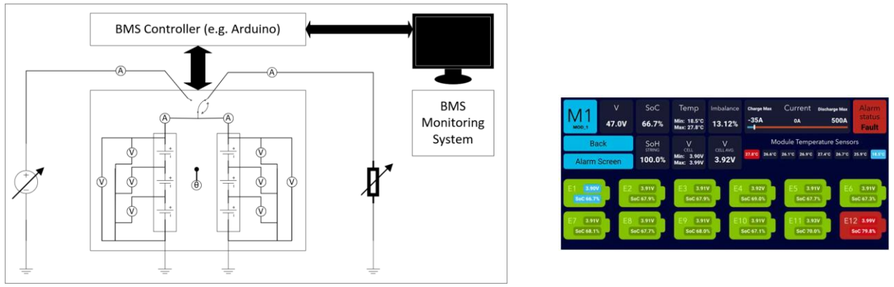
- How to design a Battery-Pack – the most important Steps:



- Future Trends in Batterie Technology

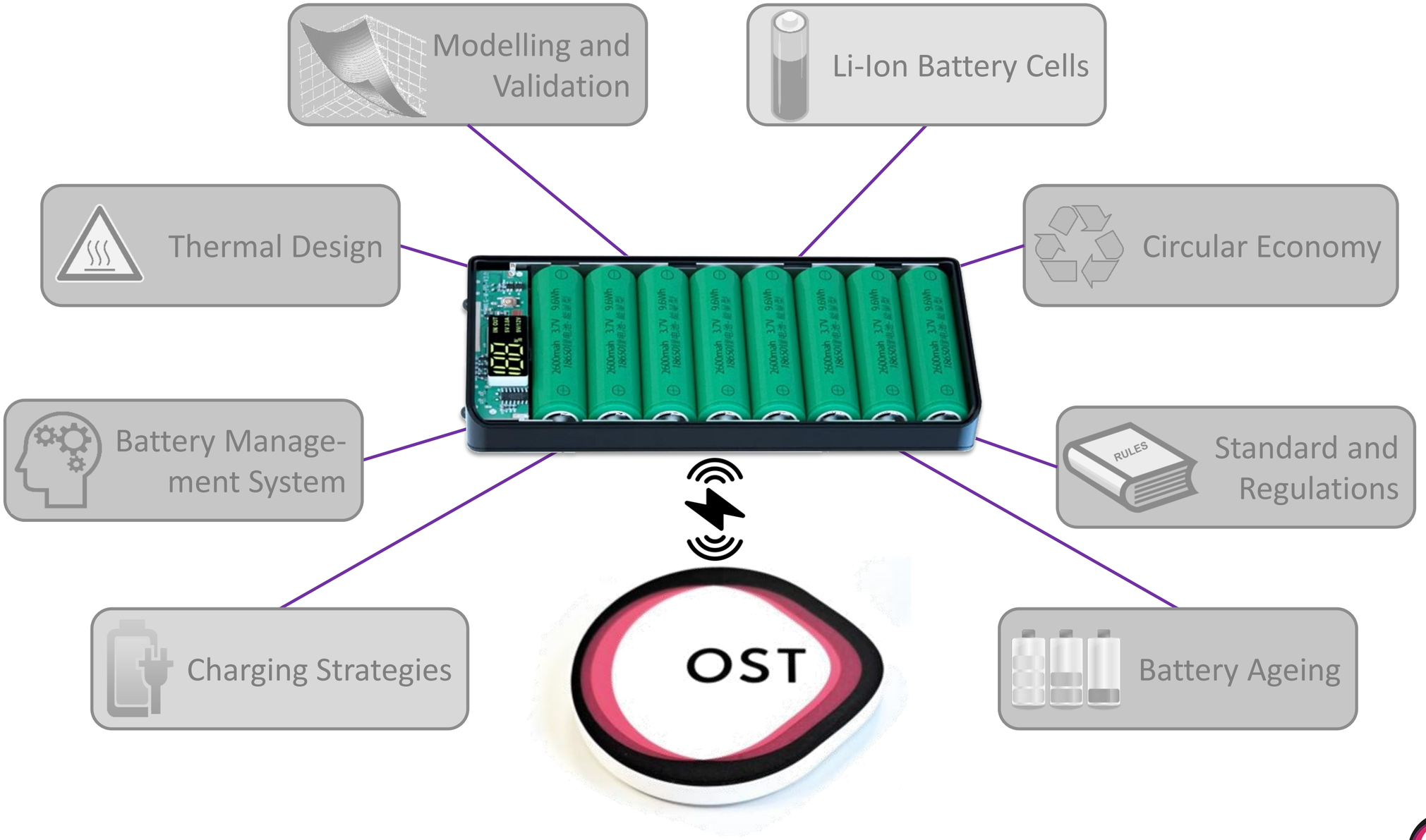


Wir bieten einen Batterie Kurs & Praktikum an

Woche	Kurs (2CP)	Praktika
1	Battery Course 01 - Li-Ion Battery Cells (Part 1)	Mobile Spannungsversorgung für USB-Applikationen 
2	Battery Course 01 - Li-Ion Battery Cells (Part 2)	
3	Battery Course 02 - Modelling of Li-Ion Batteries (Part 1)	
4	Battery Course 02 - Modelling of Li-Ion Batteries (Part 2)	
5	Battery Course 03 - Model Validation	
6	Battery Course 04 - Thermal Design of Battery Packs (Part 1)	
7	Battery Course 04 - Thermal Design of Battery Packs (Part 2)	Batteriesystem für grössere Applikationen 
8	Battery Course 05 - Battery Management Systems (Part 1)	
9	Battery Course 05 - Battery Management Systems (Part 2)	
10	Battery Course 06 - Charging Strategies for Li-Ion Batteries	
11	Battery Course 07 - Battery Aging (Part 1)	
12	Battery Course 07 - Battery Aging (Part 2)	
13	Battery Course 08 - Standards and Regulation	Repetition
14	Battery Course 09 - Circular Economy and Sustainability	

Li-Ion Battery Course

Metrohm
Metrohm Stiftung



OST

Case study - machine

Task 3: How many cells are required for the battery of an application?

Energy => Roughly estimate how many lithium-ion cells are required for the floor grinding machine battery.

Energy requirement of the application: $E_{ges} = 2200\,W \cdot 4\,h = 8800\,Wh$

Capacity of the single cell:

$$E_{zelle} = nom.\,cell\ capacity\,[Ah] \cdot nom.\,voltage\,[V]$$

$$E_{zelle} = 3.3\,Ah \cdot 3.6\,V = 12.06\,Wh$$

$$\text{number of cells} = \frac{Energy\ requirement}{Capacity\ of\ single\ cell} = \frac{8800\,Wh}{12.06\,Wh} \sim 730\,pcs.$$

Power: How much power can these cells produce?

Power delivered of one Cell at 1C: $P_{cell} = 3.3\,A \cdot 3.6\,V = 12.06\,W$

$$730\,pcs * 12.06W = 8800\,W$$

Li-Ion Battery Course

Modelling and Validation

Li-Ion Battery Cells

Thermal Design

Circular Economy

Battery Manage-ment System

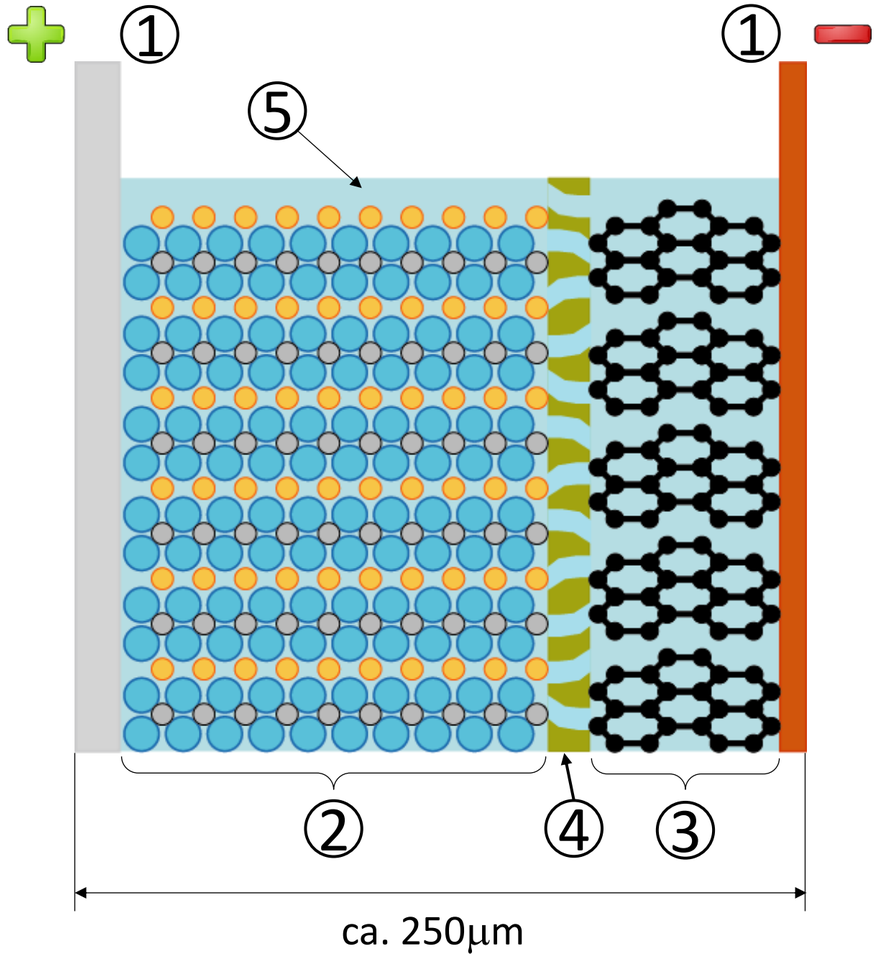
Standard and Regulations

Charging Strategies

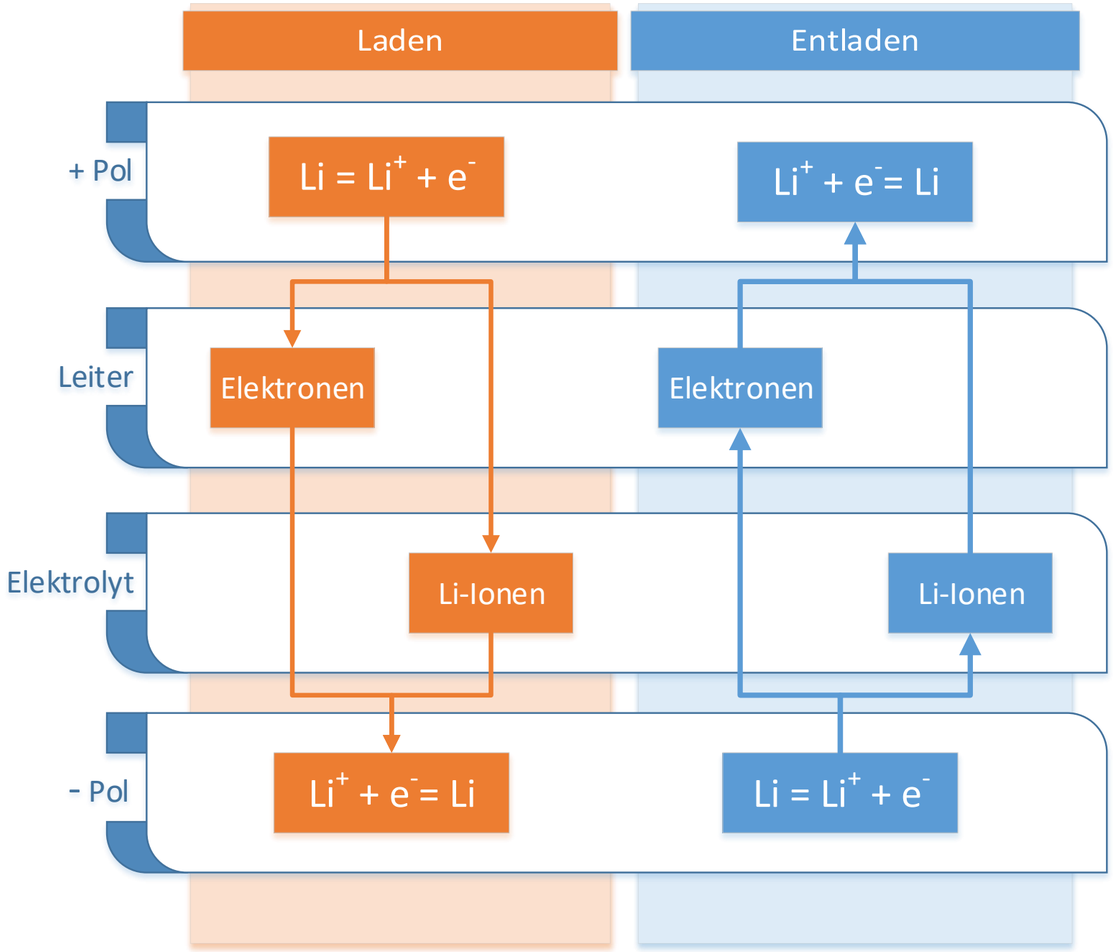
Battery Ageing

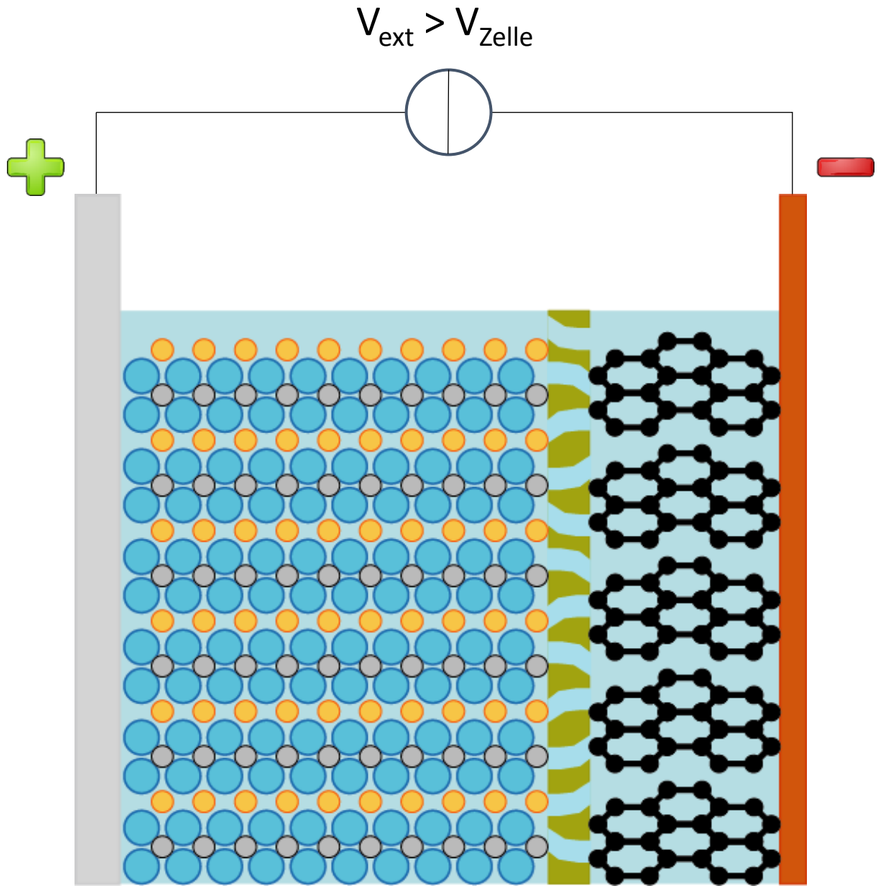
02 – Aufbau einer Li-Ionen-Zelle

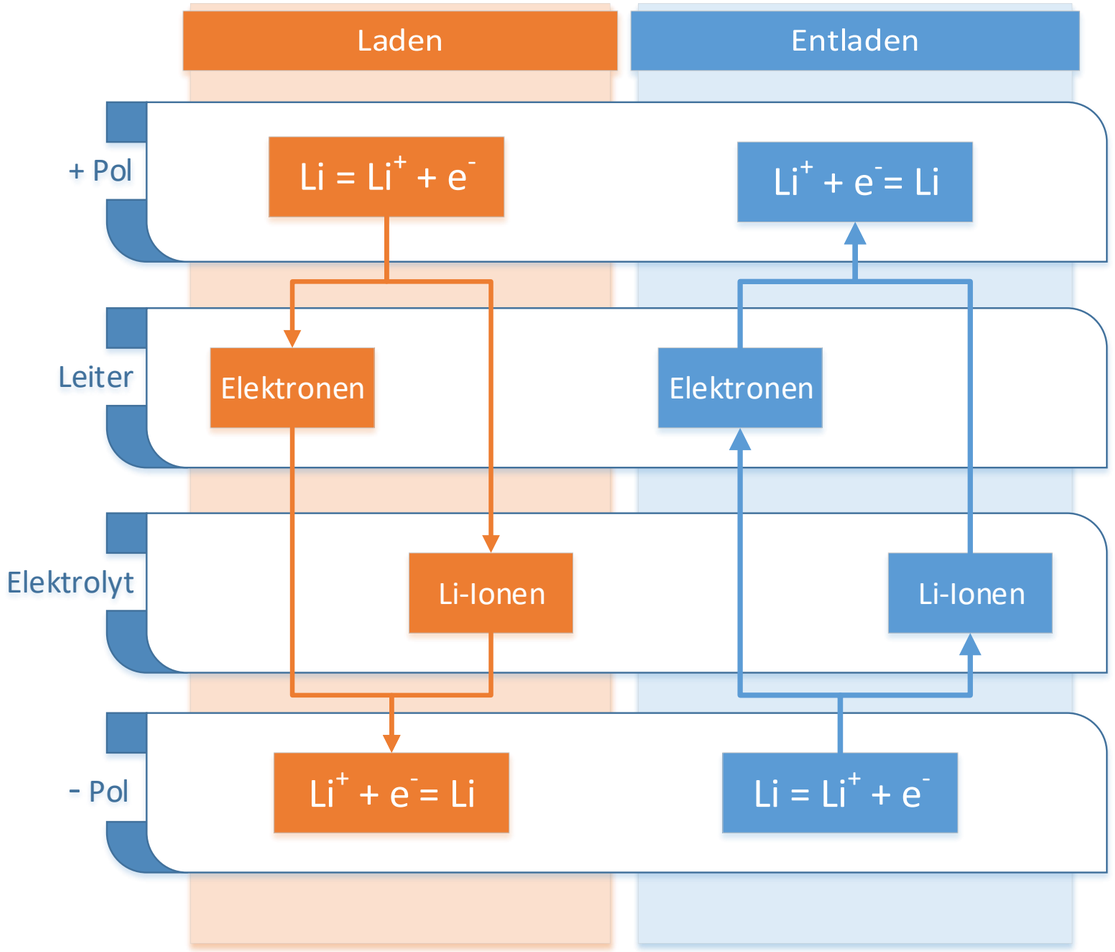
1. **Stromableiter**
   - Aluminium resp. Kupfer
2. **Kathode (pos. Elektrode, z.B. $LiCoO_2$)**
   - Struktur aus Metalloxid mit «variablem» Anteil an Li-Atomen
3. **Anode (neg. Elektrode z.B. C_6)**
   - Geschichte Kohlenstoff Struktur
4. **Separator (PP, PE oder Keramik)**
   - Micro-Poröse Schicht
   - Ionendurchlässig
5. **Elektrolyt (z.B. $LiPF_6$)**
   - Ionenleiter
   - NICHT wässerige Lösung
   - Elektrisch NICHT leitend

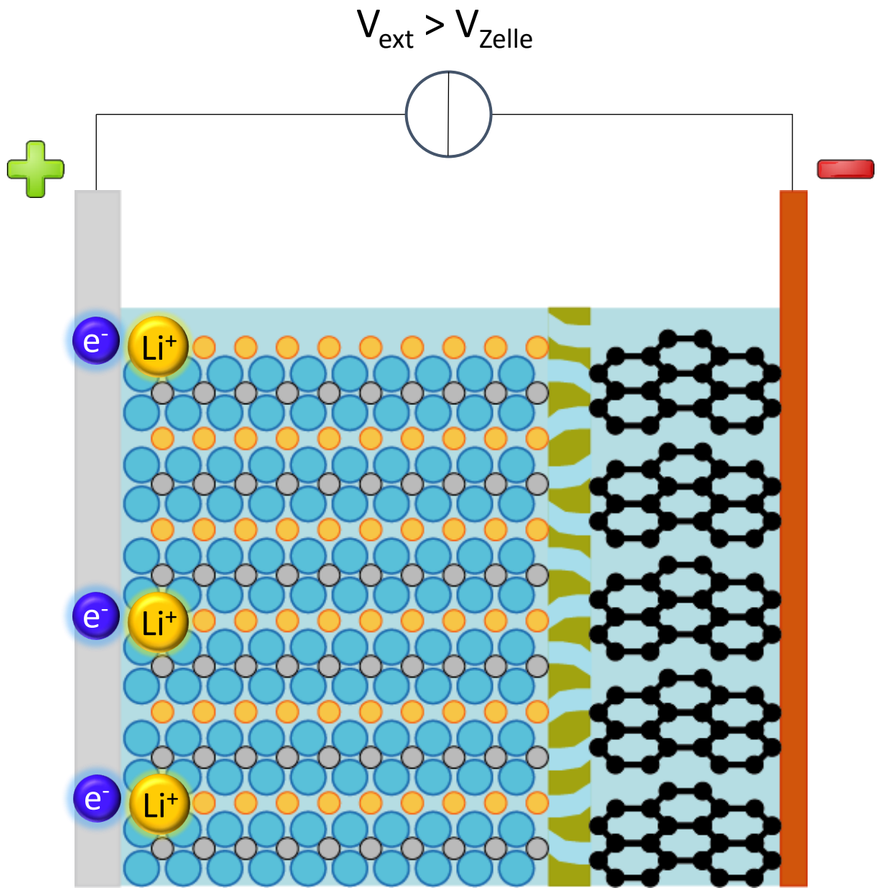


02 – Funktionsweise

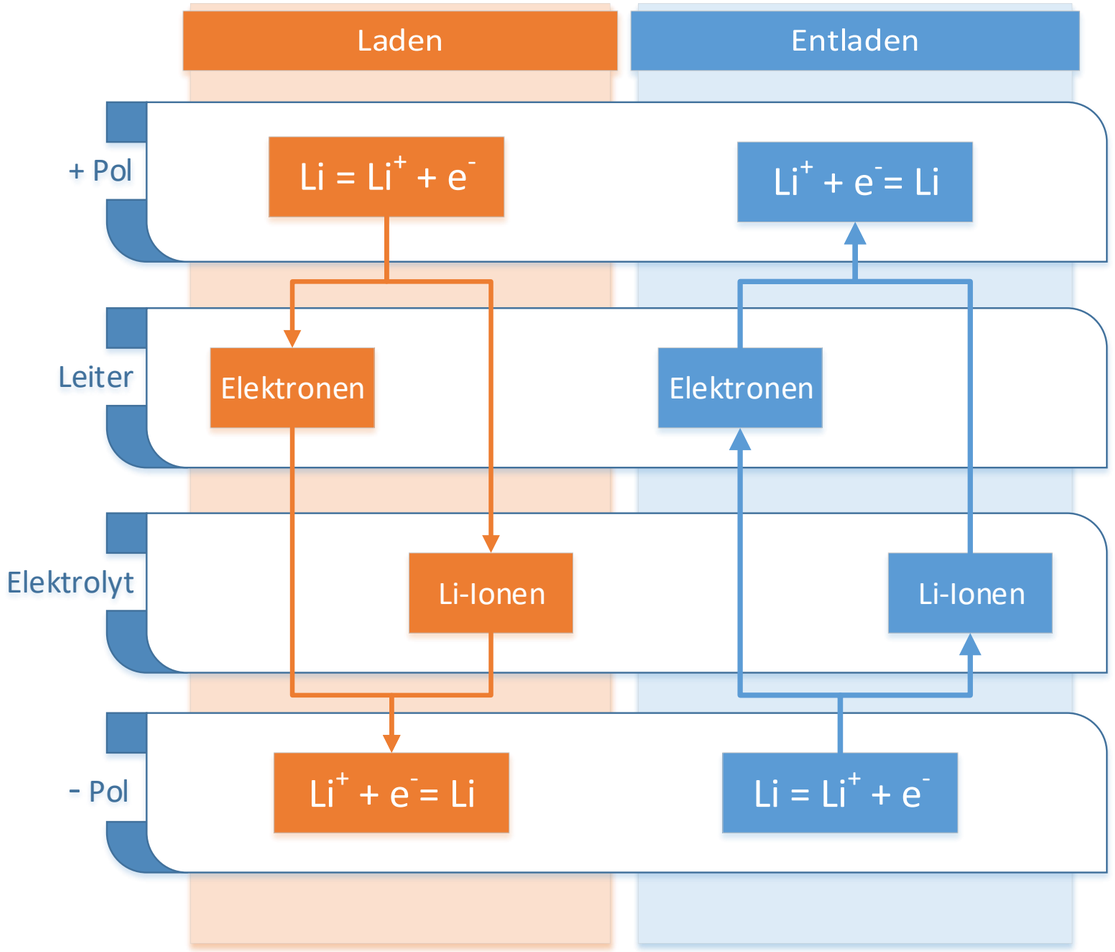


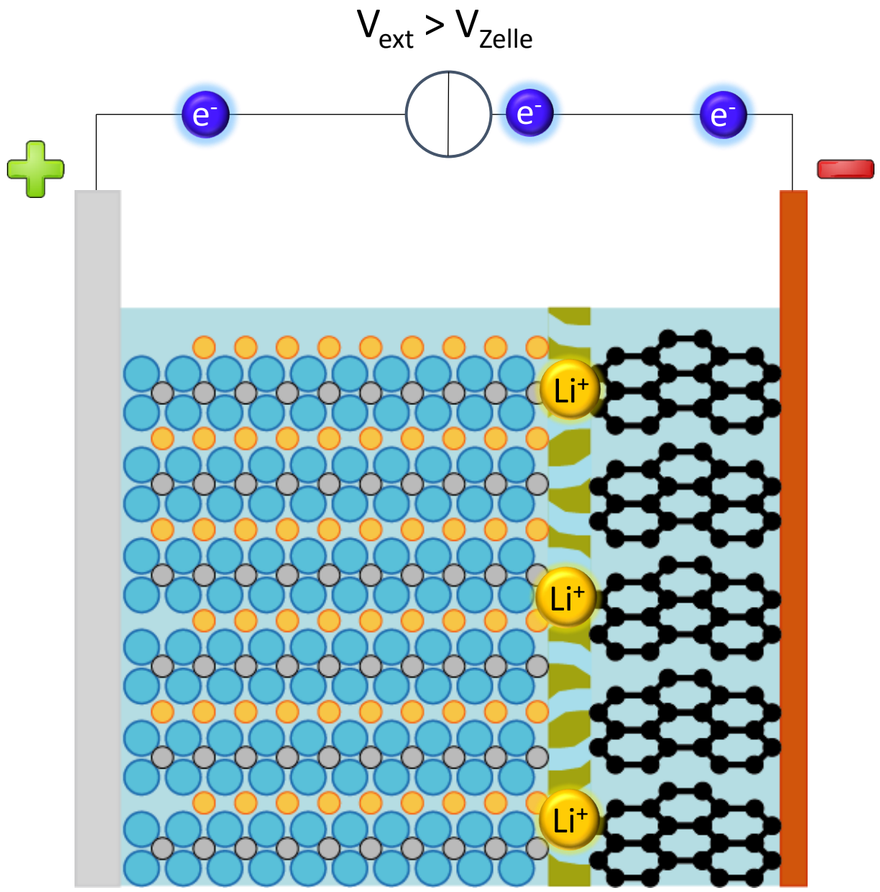



Laden
Entladen
+ Pol
Li = Li+ + e-
Li+ + e- = Li
Leiter
Elektronen
Elektronen
Elektrolyt
Li-Ionen
Li-Ionen
- Pol
Li+ + e- = Li
Li = Li+ + e-

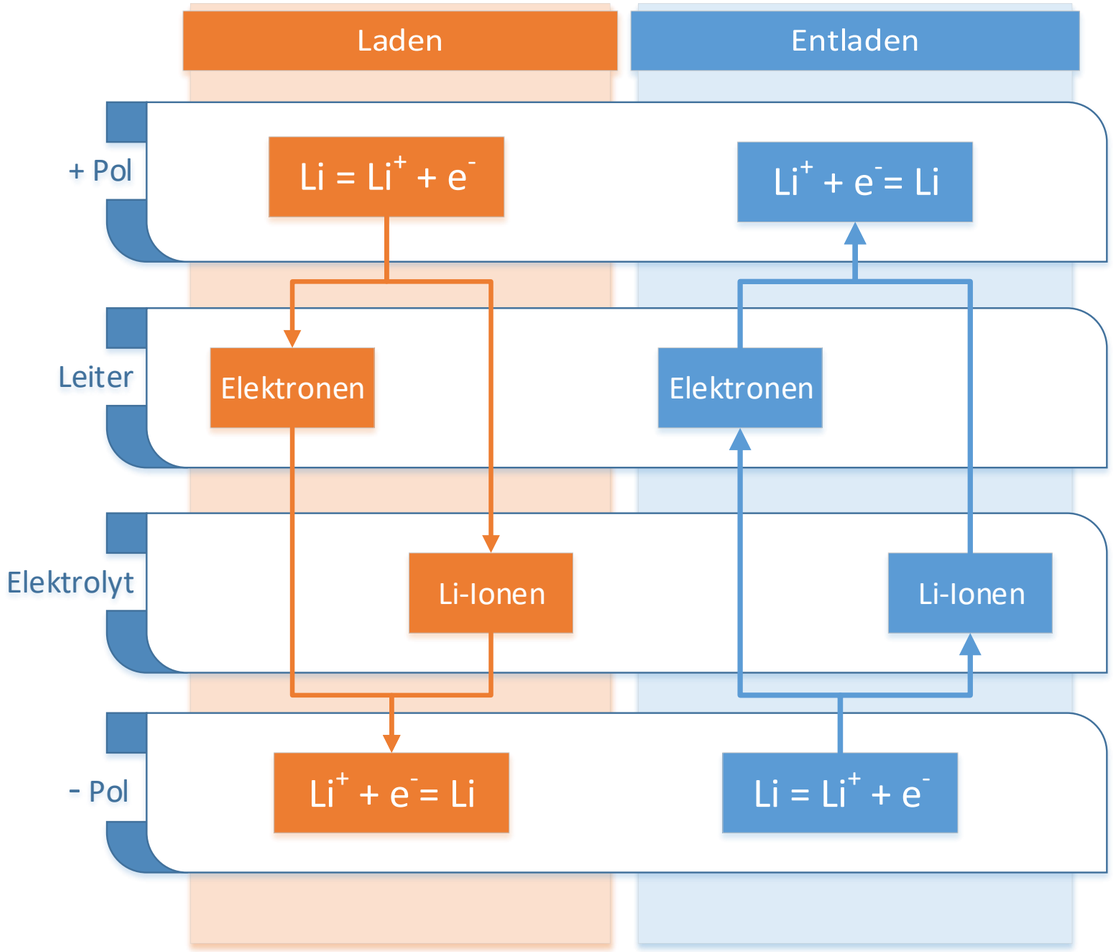

Vext > VZelle
e-
Li+
e-
Li+
e-
Li+

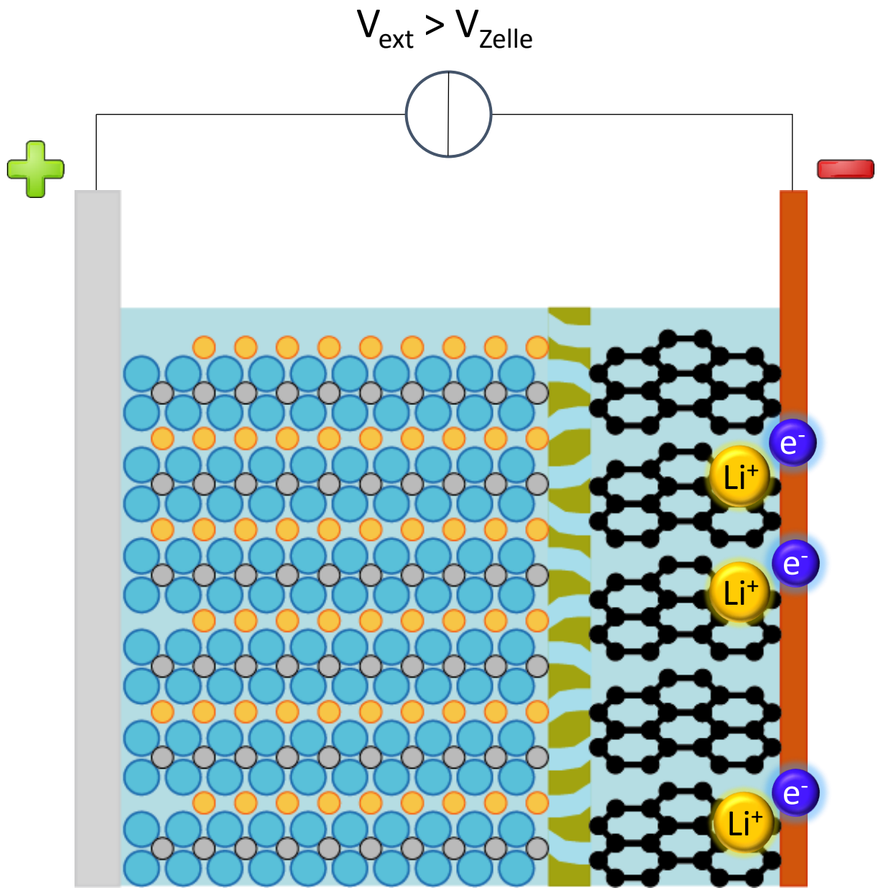
02 – Funktionsweise



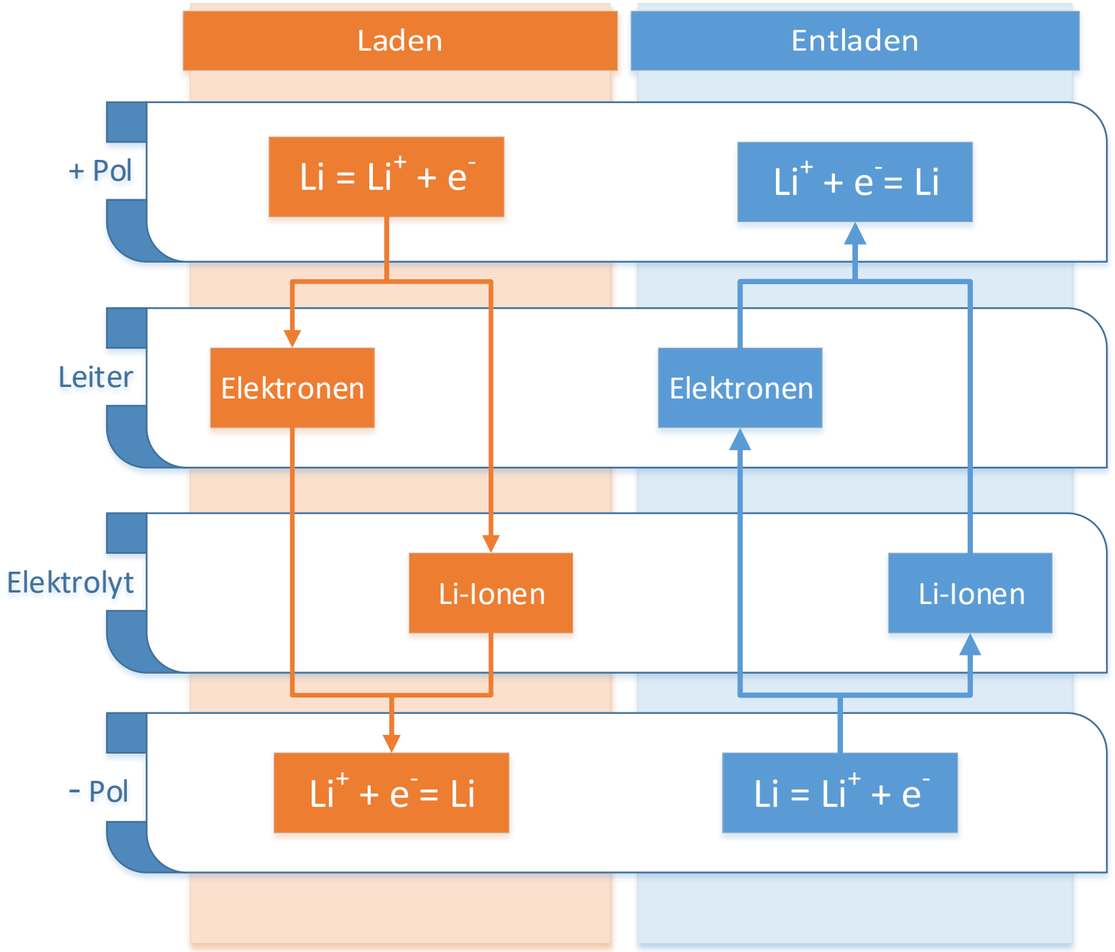


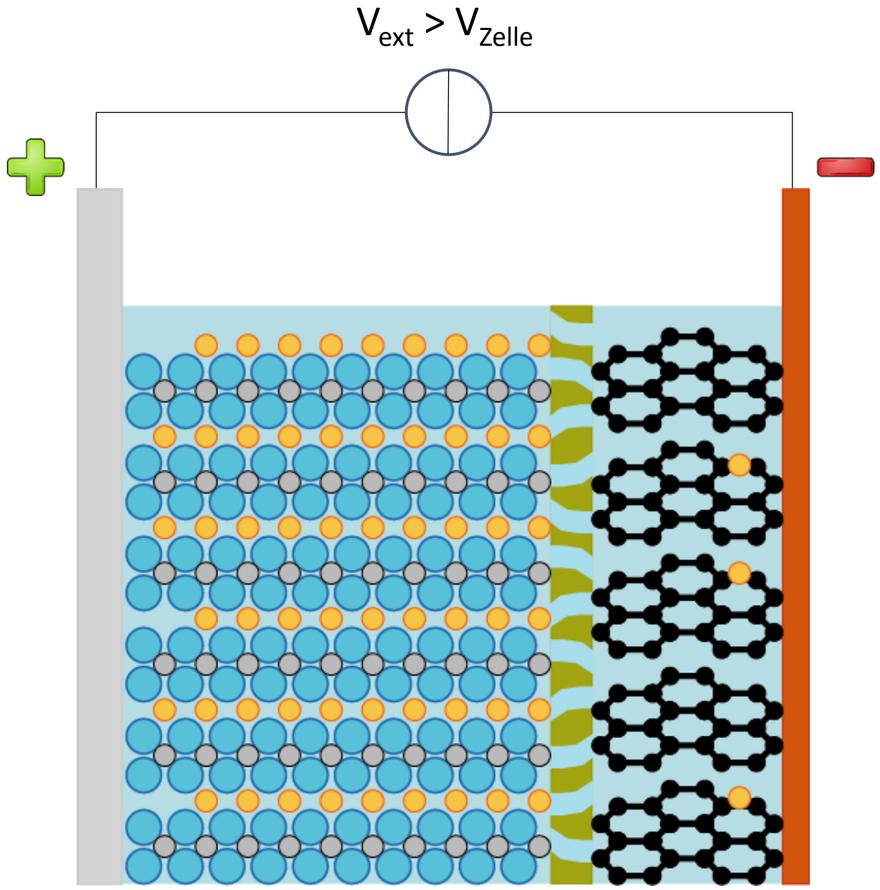
02 – Funktionsweise



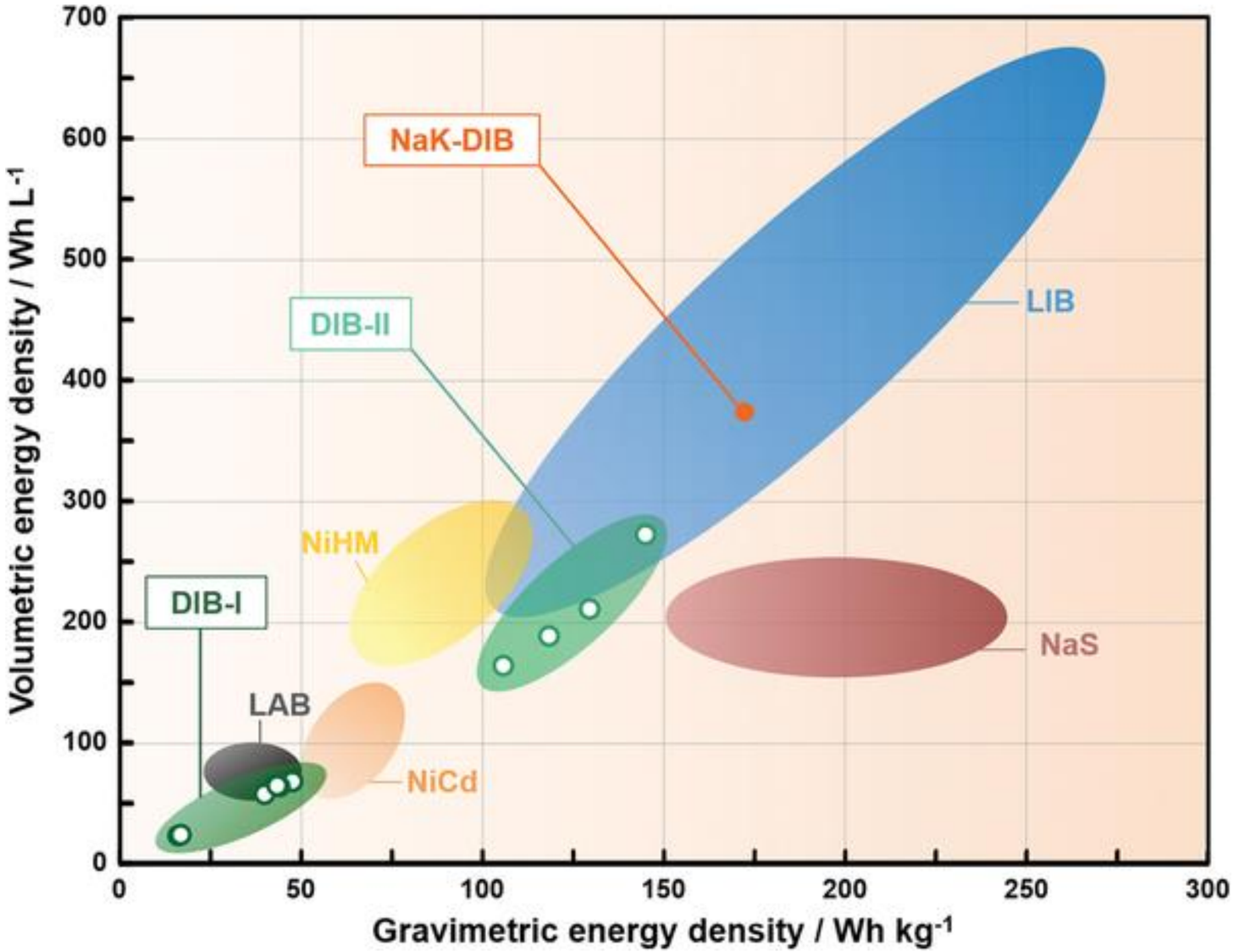


02 – Funktionsweise





- Source: https://www.researchgate.net/figure/Energy-density-comparison-of-different-battery-chemistries-Volumetric-energy-density_fig4_343340778



02 – Vergleich von Kathodenmaterialien

$LiMn_2O_4$ (LMO)

- Tiefer Innenwiderstand
- Billiger als LCO

$LiNiCoAlO_2$ (NCA)

- Hohe spez. Energie
- Geringere Stabilität
  → Sicherheit

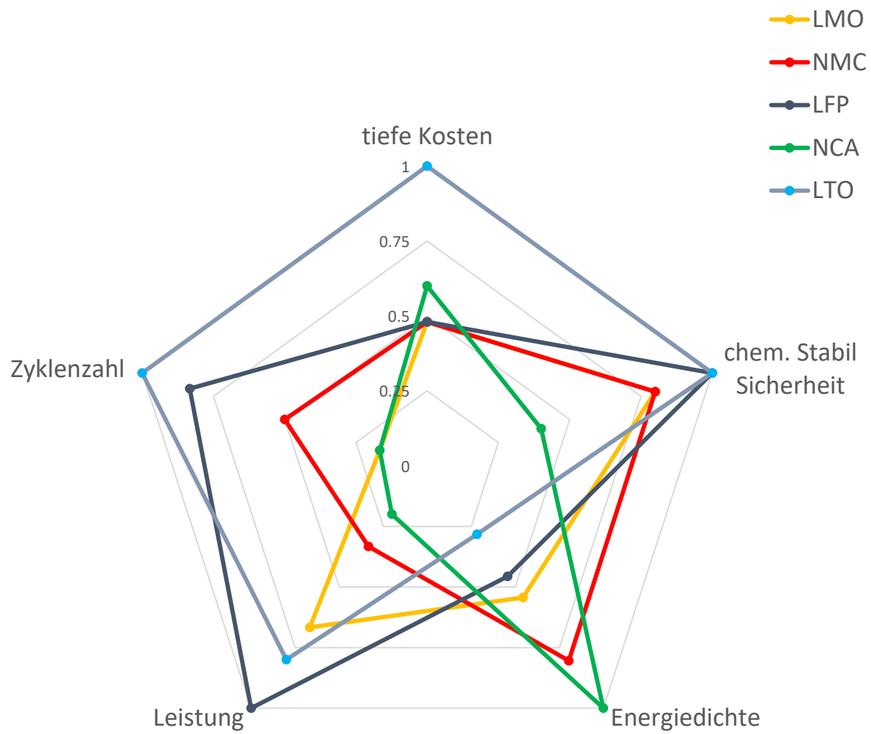
Li-Ionen Zellen

$LiNiMnCoO_2$ (NMC)

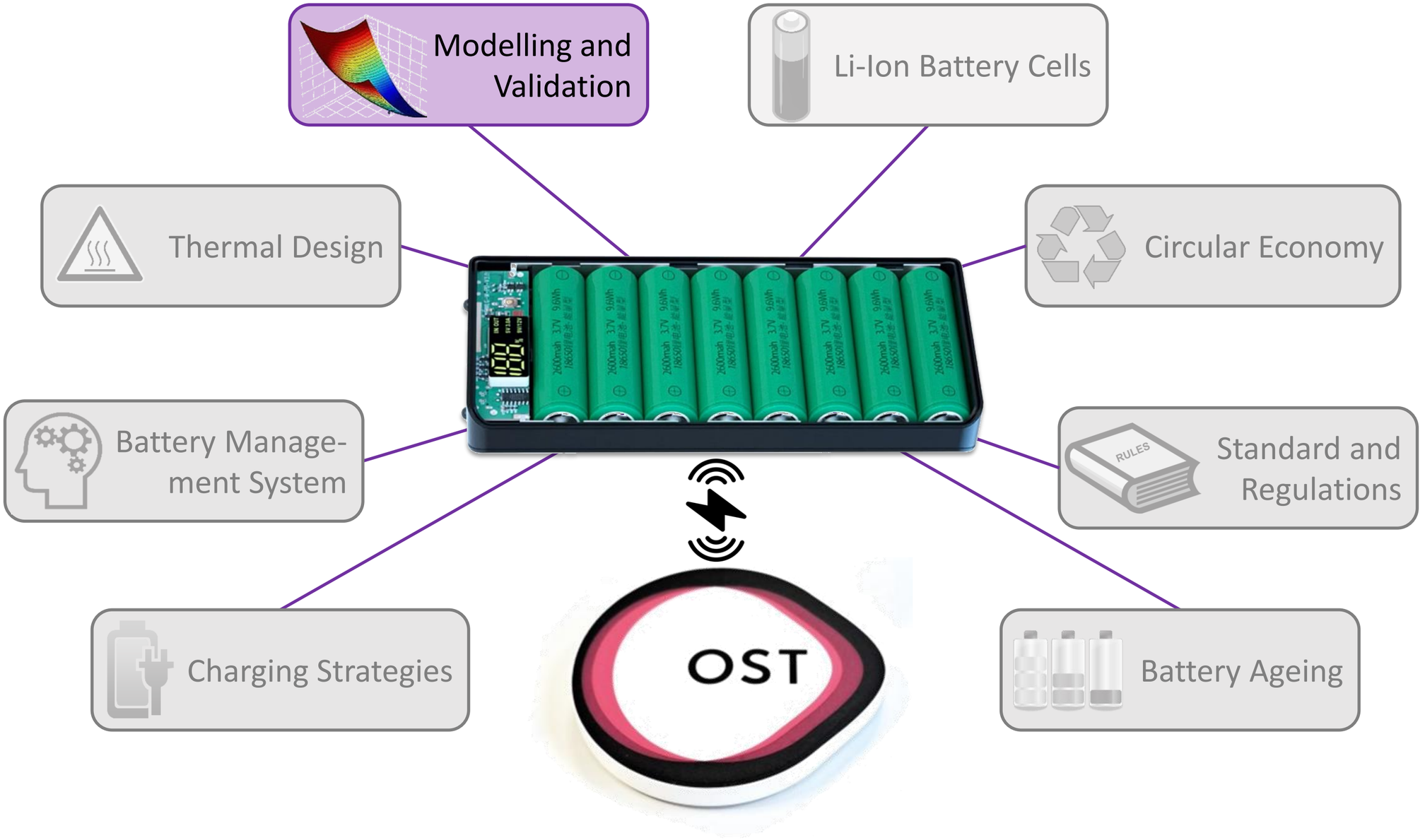
- Power Tools / E-Bikes
- Sicherer als NCA

$LiFePO_4$ (LFP)

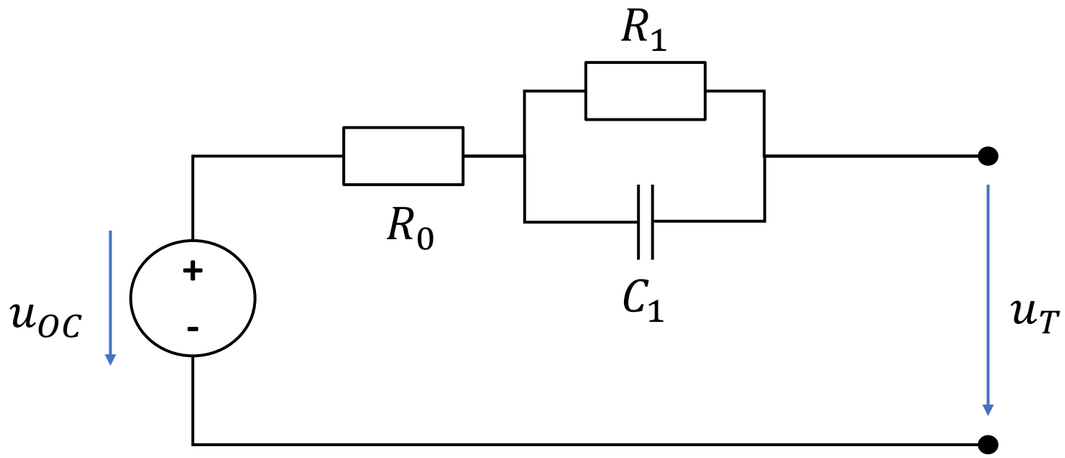
- Stabiles Spannungsprofil
- Tiefere spez. Energie



Li-Ion Battery Course



2. Improved internal resistance model



The HPPC reveals transient phenomenon on various time scales, which can be modelled by **one or more RC parallel circuits**.

Li-Ion Battery Course

Modelling and Validation

Li-Ion Battery Cells

Thermal Design

Circular Economy

Battery Manage-ment System

Standard and Regulations

Charging Strategies

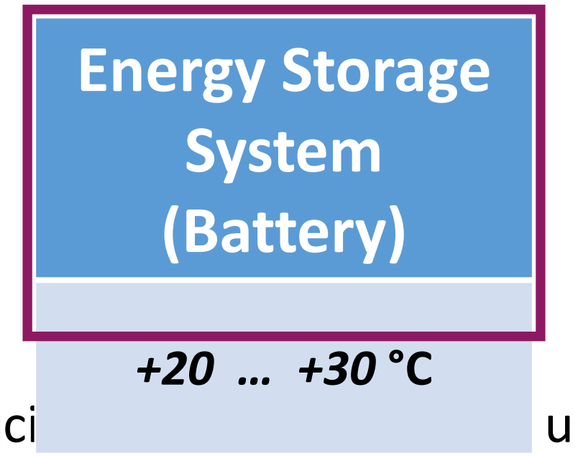
Battery Ageing

Operating temperature range

Operating temperature range of the energy storage system

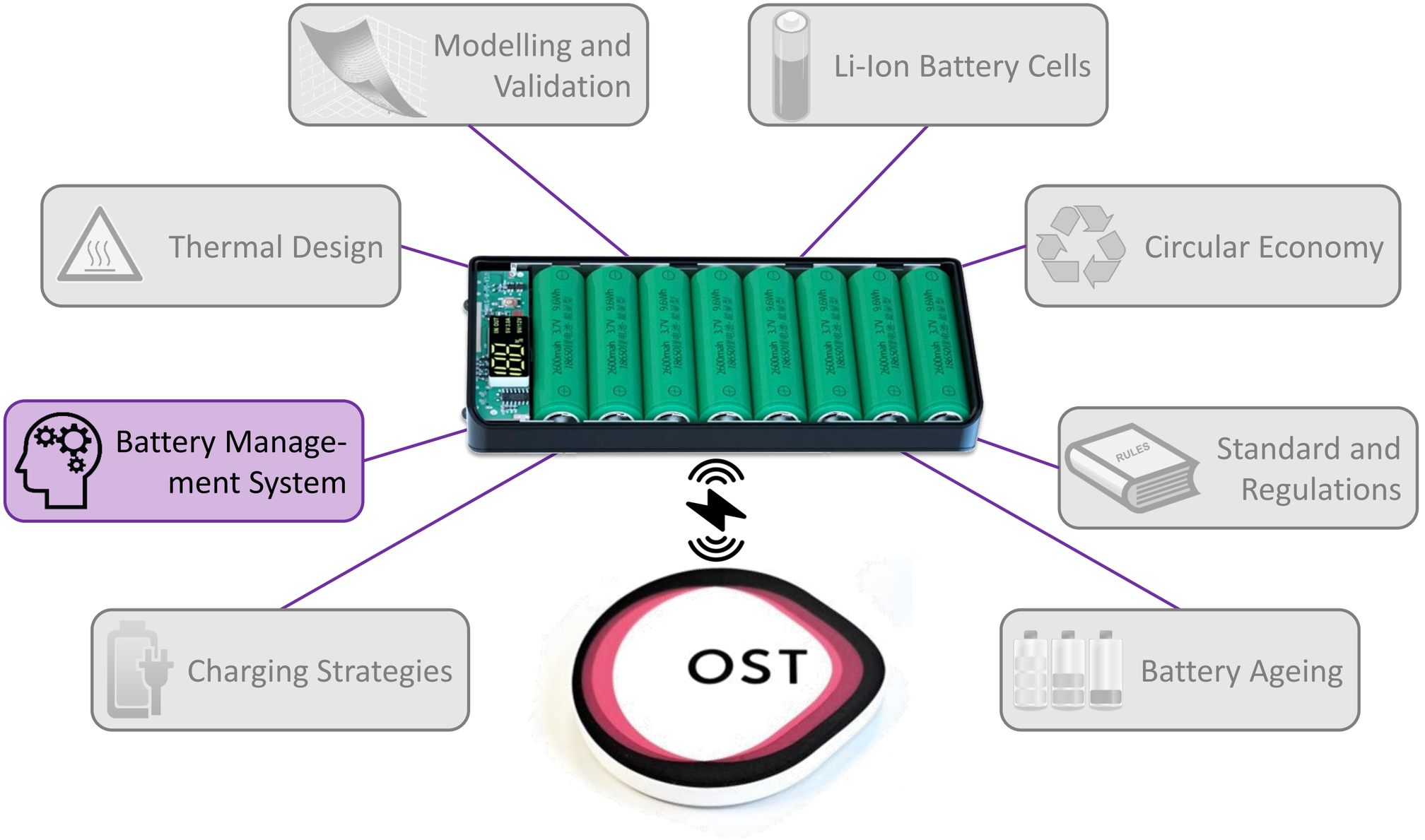
The operating temperature must not be exceeded at any time.

In most cases, this can only be ensured by actively cooling or heating the battery storage system.



If active cooling is not sufficient, heating is used in some cases to prevent overheating.

Li-Ion Battery Course

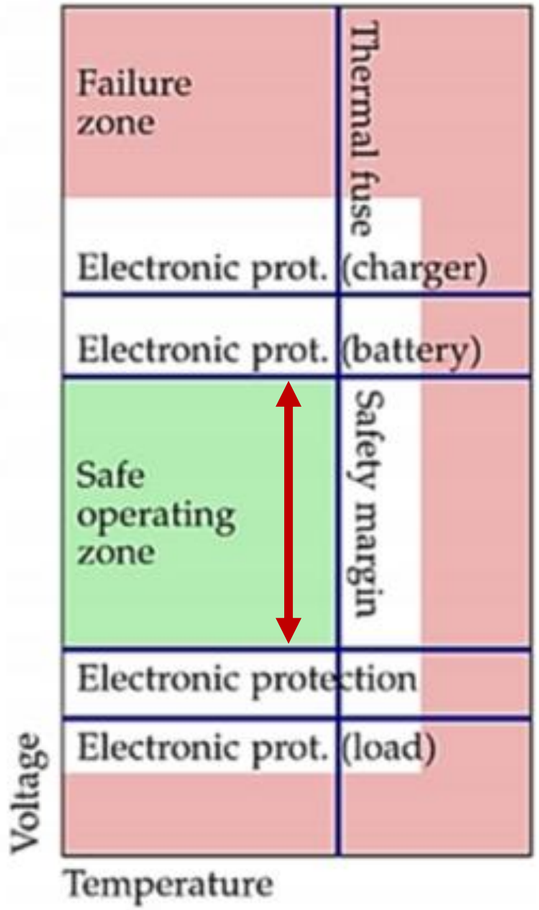


Battery System

Thermal Runaway (I)

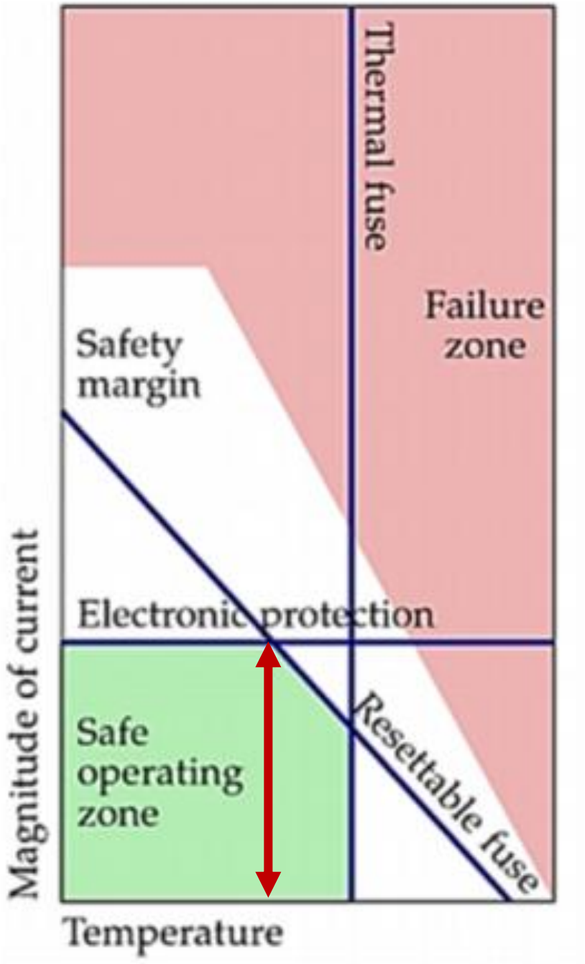
Voltage Monitoring

- Voltage Monitoring is needed to prevent over- and undervoltage. Therefore all cell voltages must be measured
- IC’s for measuring multiple cell voltages or analog to digital converters are used
- Required for the derivation of other parameters like SOC, SOH and cell balancing

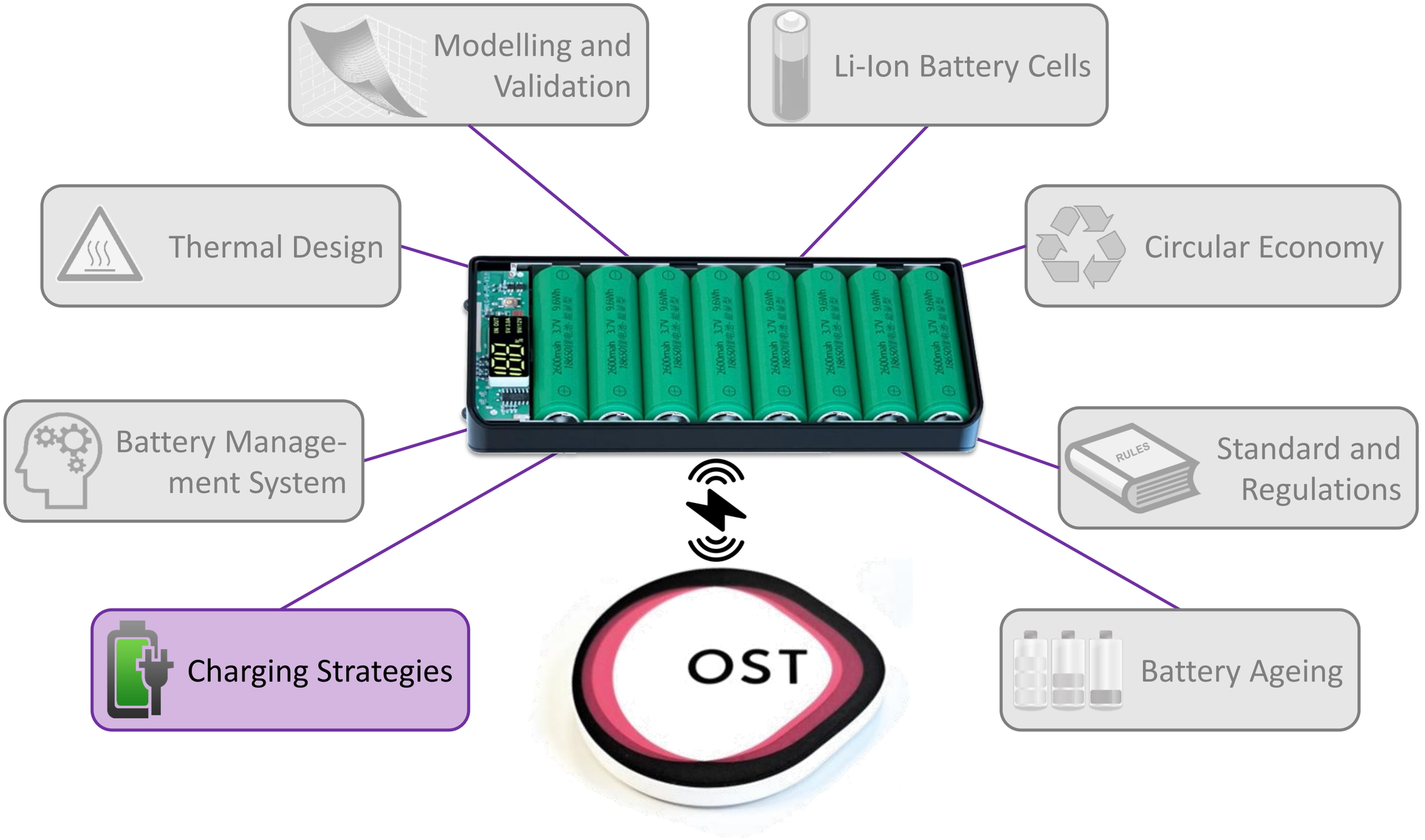


Current Monitoring (I)

- Is needed to detect overcurrent, or short circuit and correct charge/discharge rates.
- Mainly done over shunt or Hall effect
- Required for the derivation of other parameters like SOC, SOH

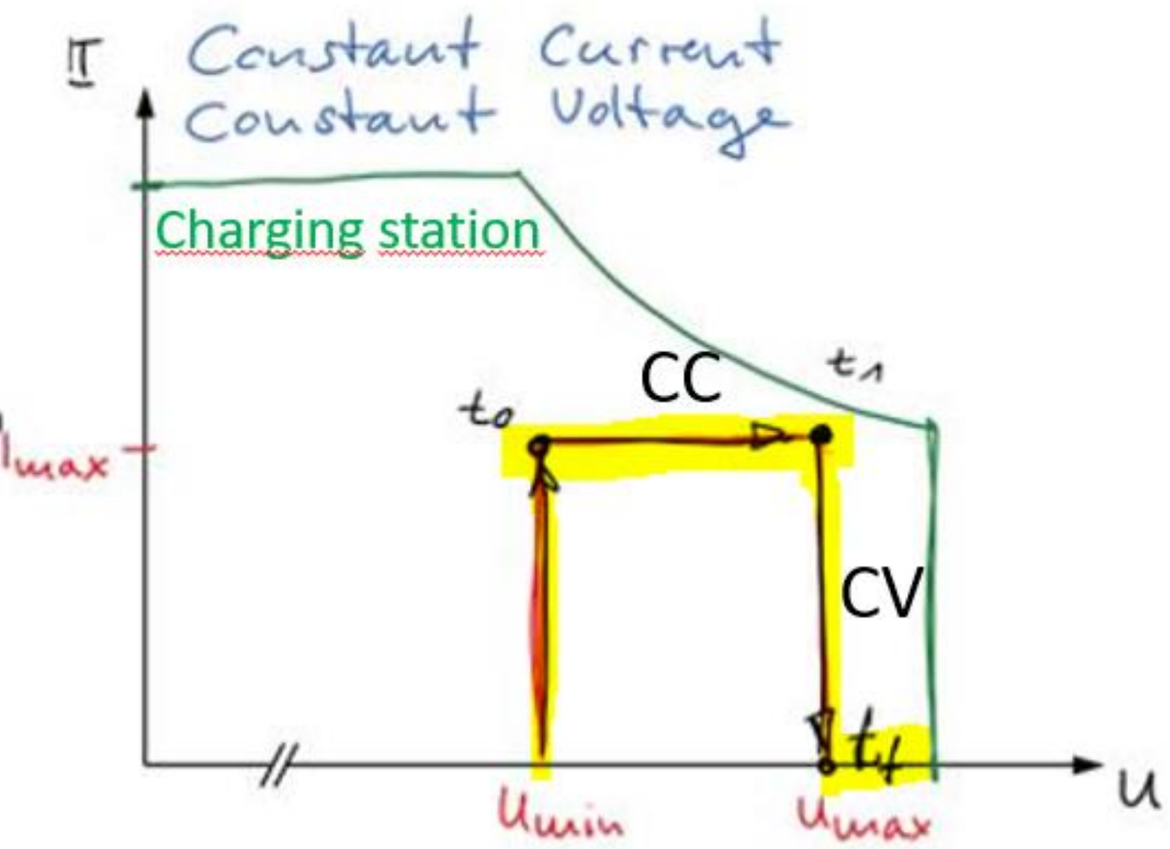


Li-Ion Battery Course

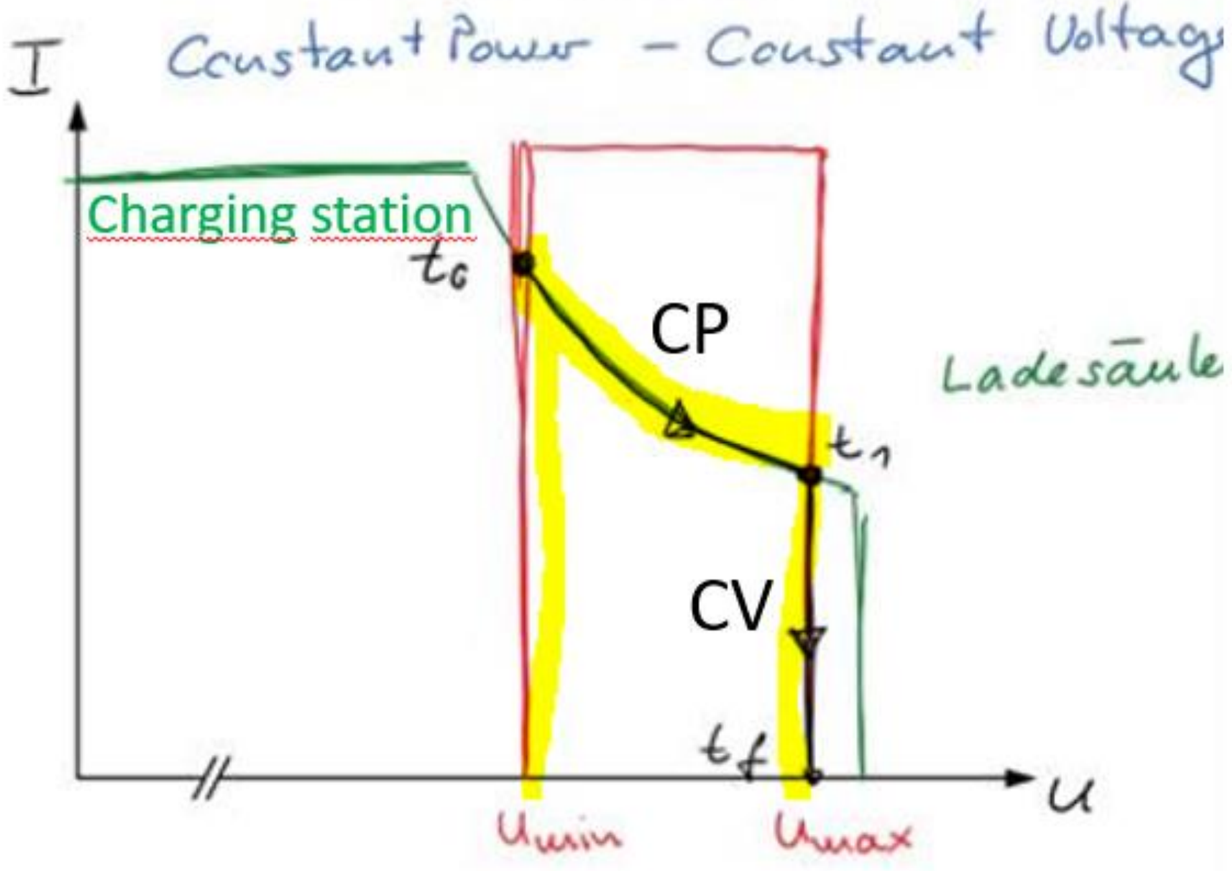


Charging Profiles

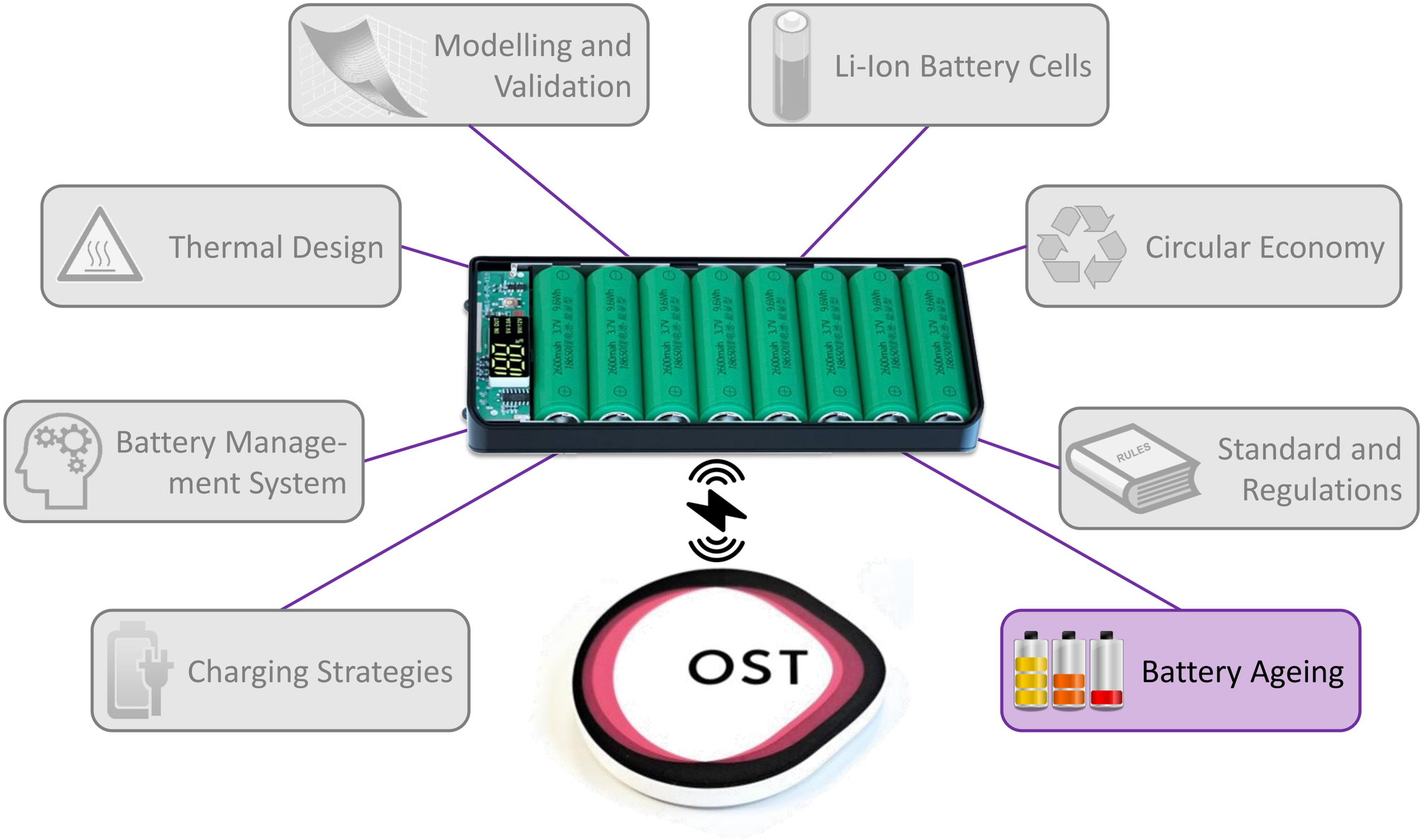
CC-CV Modus



CP-CV Modus

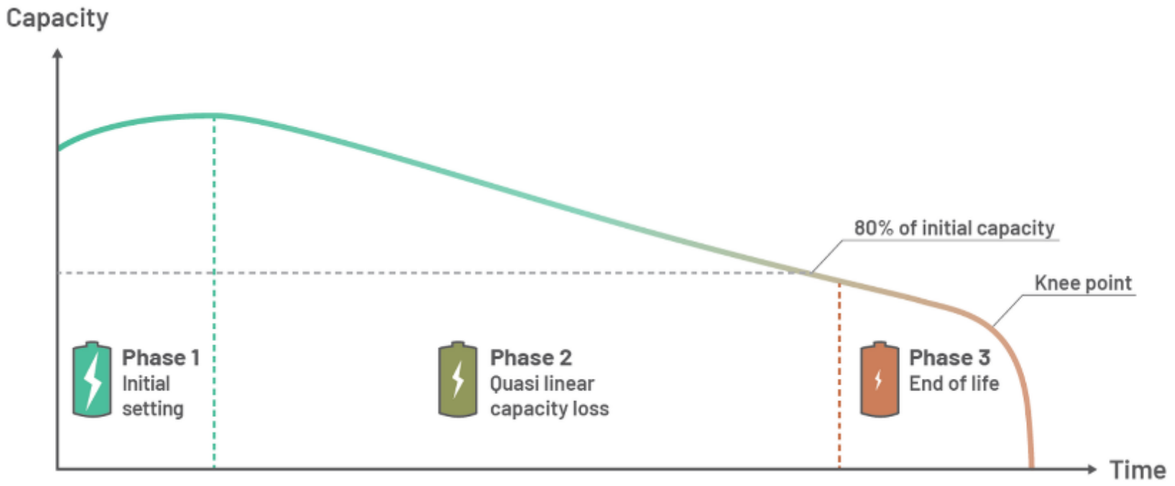


Li-Ion Battery Course



Phenomenological battery ageing

Phases of the consumption curve of the storage capacity Q

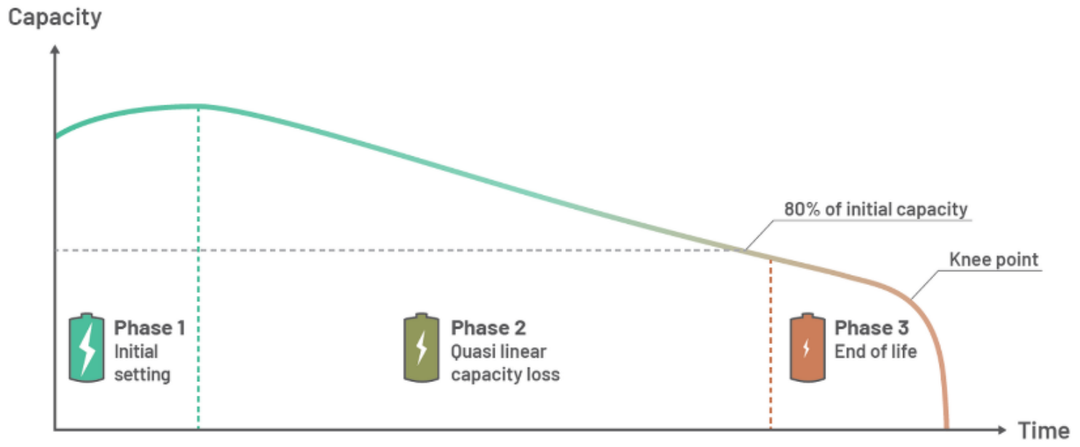


1. Initial Settling

At the beginning of a battery's service life, various chem. processes take place. This can temporarily increase the capacity even though the battery is being used. One reason for this increase is the anode overhang effect. Lithium, which is stored in the part of the anode that is slightly wider than the cathode and does not participate directly in the chem. reactions, is relocated and thus increases the number of Li-ions that can be stored.

Phenomenological battery ageing

Phases of the consumption curve of the storage capacity Q



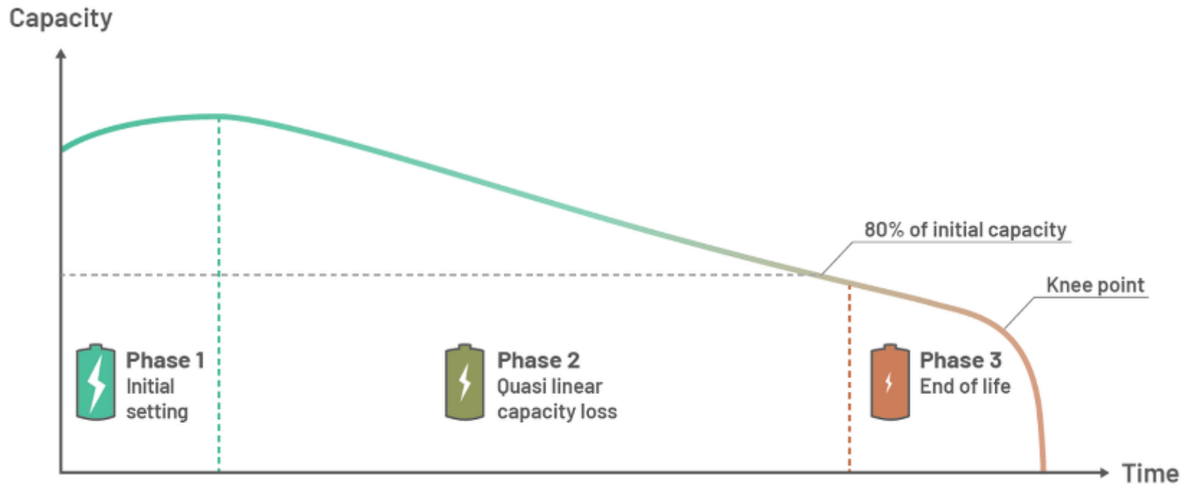
2. Quasi-linear capacity loss

In the second phase, there is a strong correlation between the capacity loss and the use of the battery. As a rule of thumb, the relationship between the two is more or less linear if the battery is used under more or less constant operating conditions.

Phenomenological battery ageing

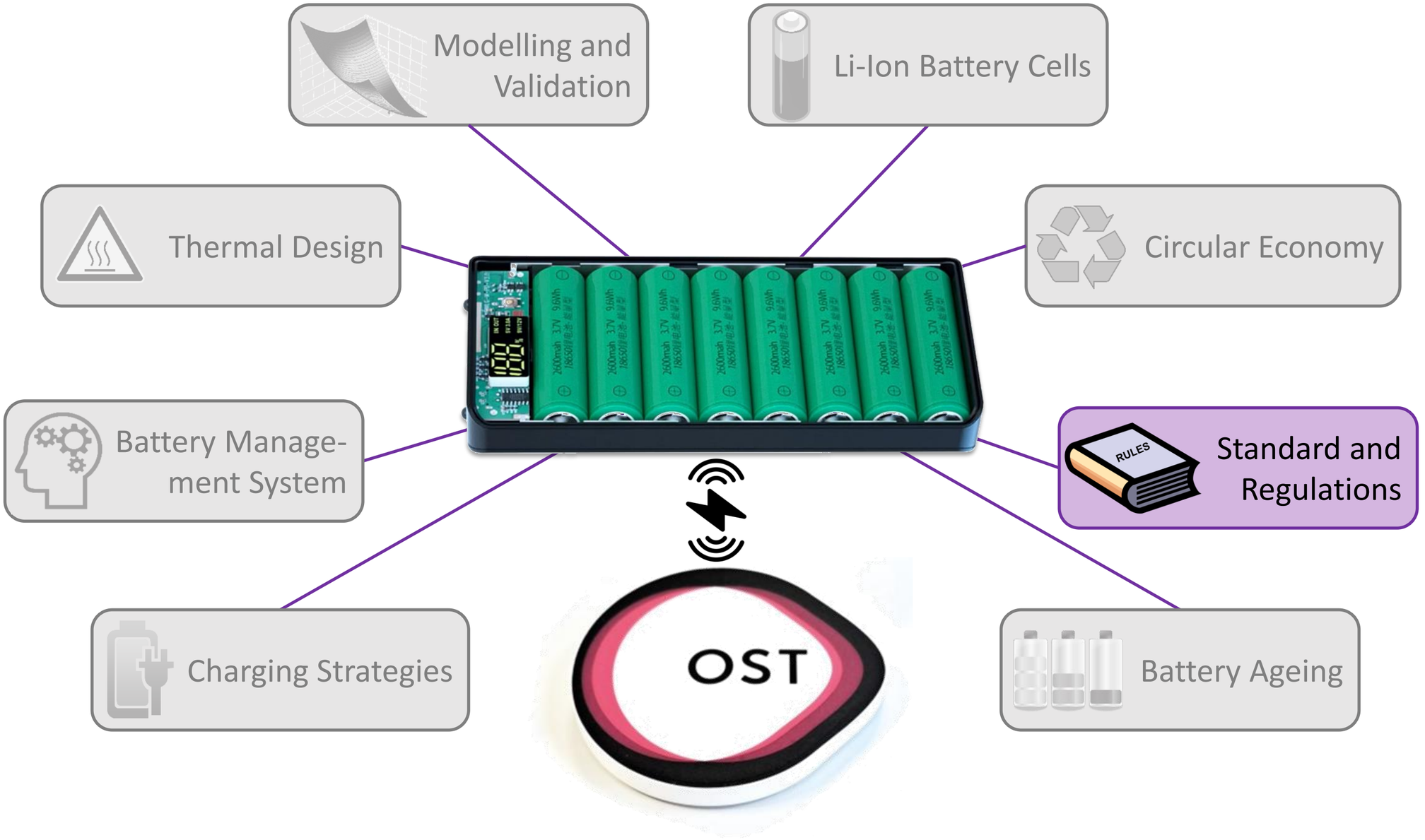
Phases of the consumption curve of the storage capacity Q

3. Cutoff-Point



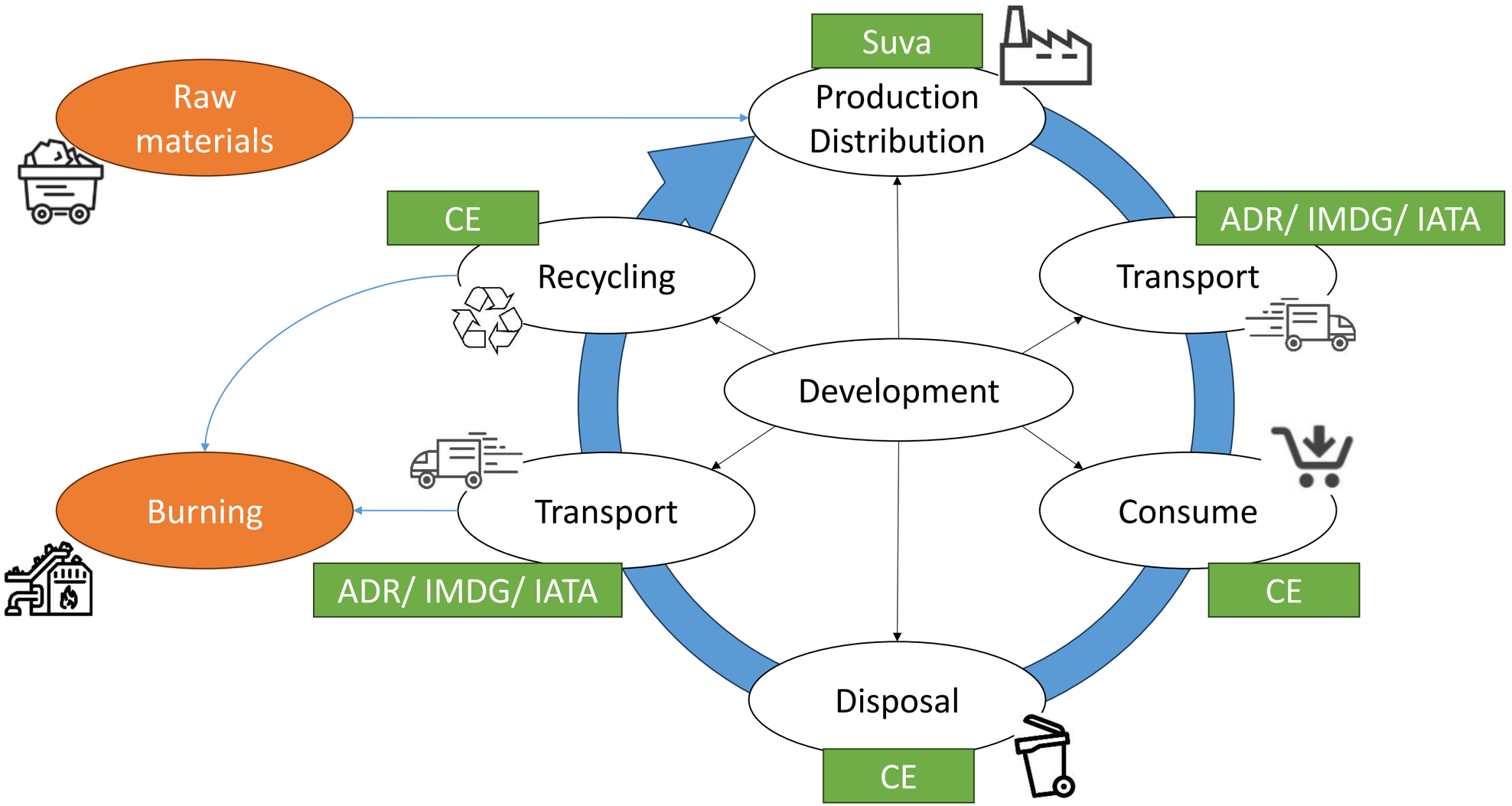
The third phase begins at around 50 ... 85% of the original storage capacity when the “Cutoff-Point” occurs. This marks a rapid drop in capacity over several cycles and signals the end of the battery's service life.

Li-Ion Battery Course

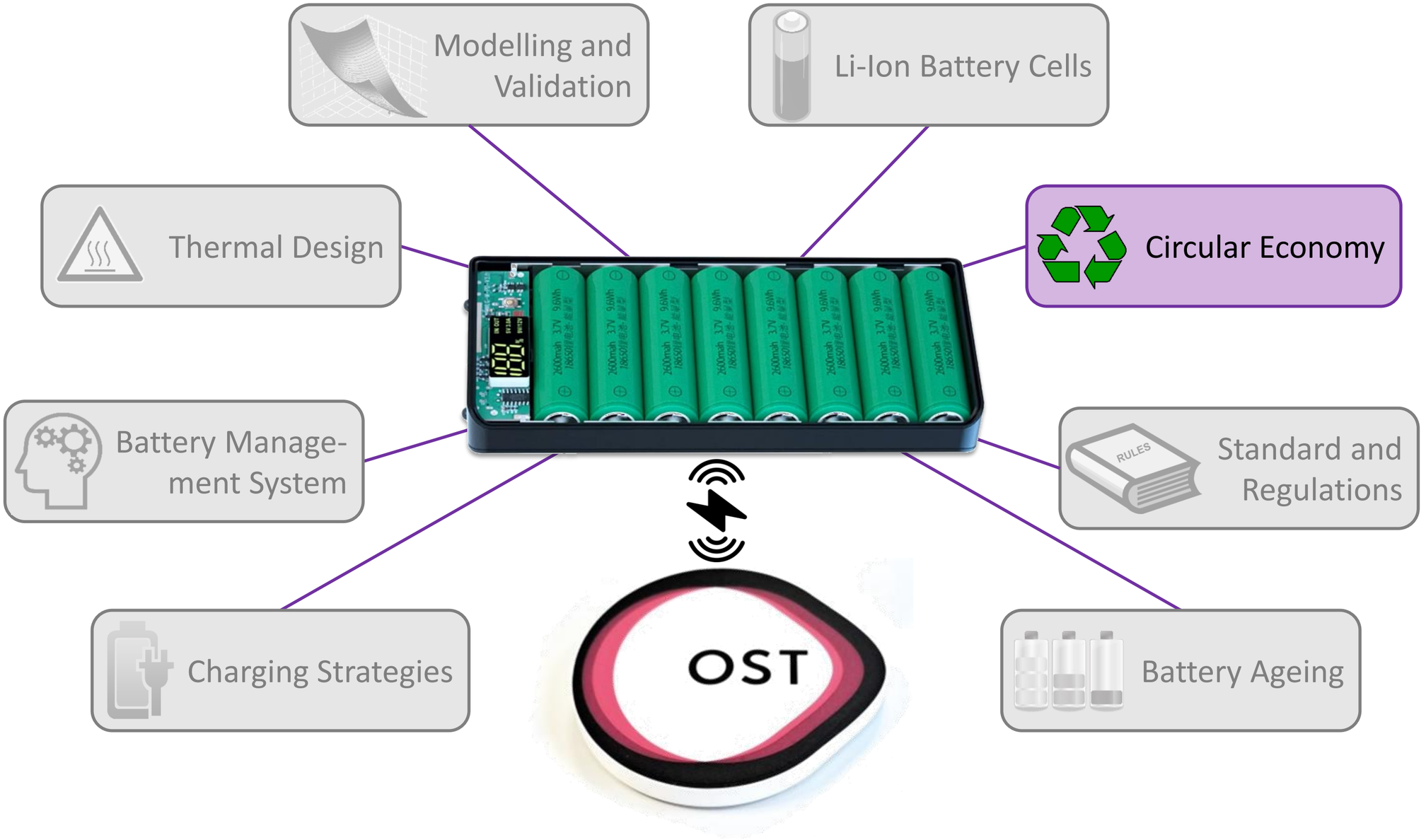


EU targets for environmental protection

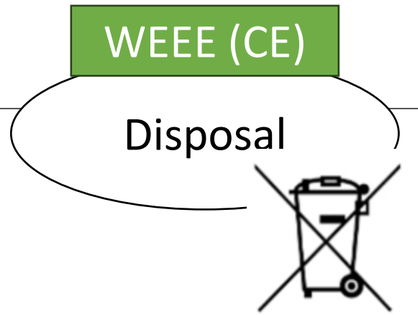
- CE directives and Responsible offices for safety



Li-Ion Battery Course



CE directives (Öko-Design)



- ErP / Eco-Design- directives (Öko-Design)

- **Gerätebatterien müssen leicht entfernbar sein:** Ab dem 18. Februar 2027 müssen Gerätebatterien, bis auf wenige Ausnahmen, auch durch Endnutzer aus Elektro- und Elektronikgeräten grundsätzlich entnehmbar und austauschbar sein. Für Batterien in leichten Transportmitteln gilt, dass diese zumindest von Fachpersonal entnommen werden können.

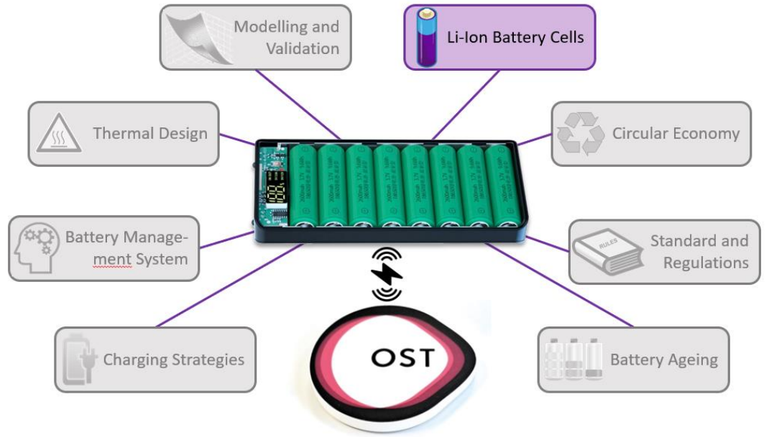
https://www.wko.at/oe/handel/maschinen-technologie/informationen-zur-neuen-eu-batterien-verordnung.
https://www.batteriegesetz.de/themen/die-neue-batterieverordnung-batt2-2023/

Agenda: Batteries enabling Innovations

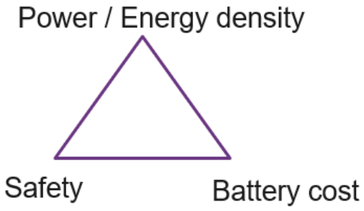
- Intro

- Batteries as enabler of Innovations - History

- How to design a Battery-Pack – the most important Steps:



- Future Trends in Batterie Technology



Future trends

1. **Solid-State Batteries**: Solid-state batteries use a solid electrolyte instead of a liquid one, which can significantly improve safety by reducing the risk of leaks and fires. They also offer higher energy density and longer life cycles. Companies and researchers are actively working on making solid-state batteries commercially viable.

2. **Lithium-Sulfur Batteries**: These batteries have the potential to offer much higher energy densities compared to traditional lithium-ion batteries. Lithium-sulfur batteries could be lighter and more cost-effective, making them suitable for applications like electric vehicles and portable electronics.

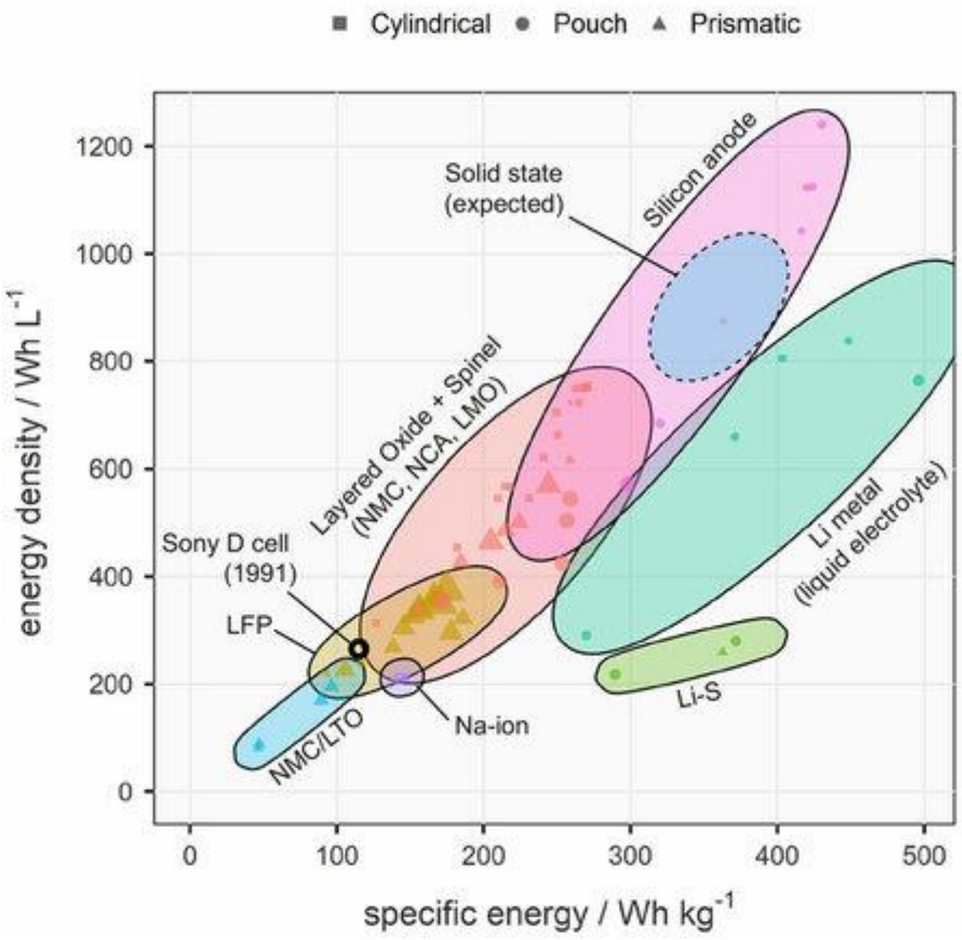
3. **Sodium-Ion Batteries**: Sodium-ion batteries are emerging as a promising alternative to lithium-ion batteries, especially given the abundance and low cost of sodium compared to lithium. They are particularly attractive for large-scale energy storage systems.

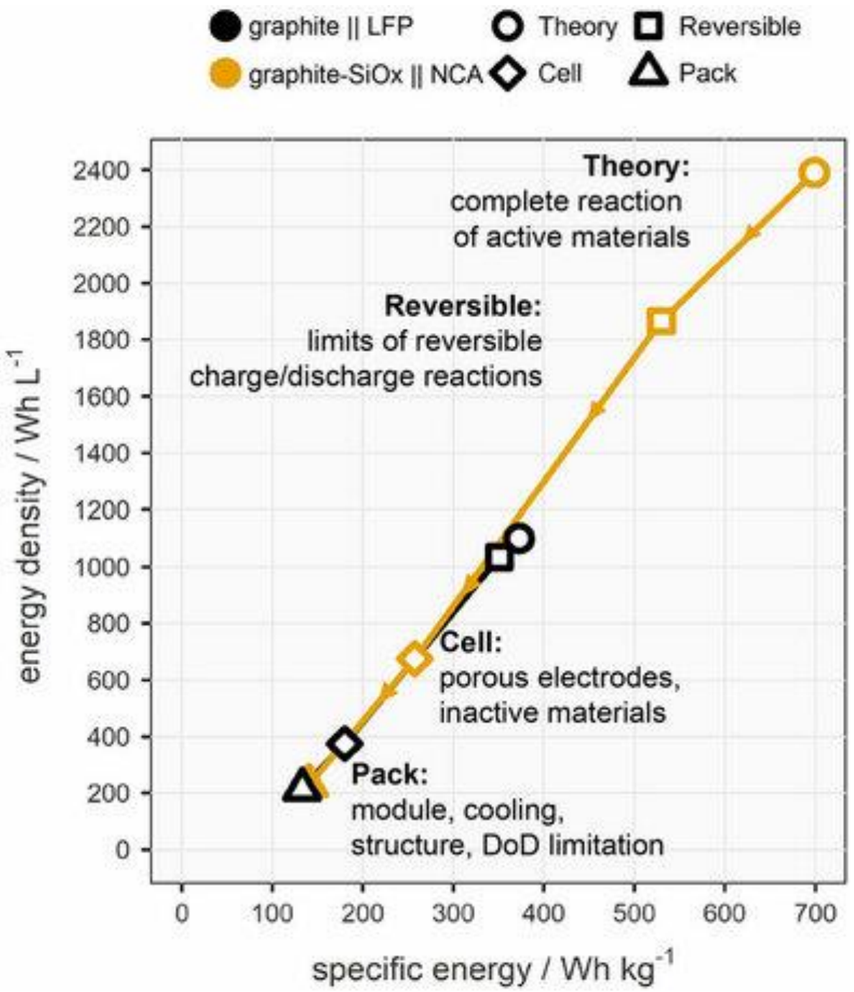
4. **Silicon Anodes**: Replacing graphite anodes with silicon in lithium-ion batteries can significantly increase their energy capacity. Silicon anodes can store more lithium ions, leading to higher energy densities. However, challenges related to silicon's expansion during charging need to be addressed.

Source: https://www.researchgate.net/publication/367435320_A_non-academic_perspective_on_the_future_of_lithium-based_batteries

Future Energy densities

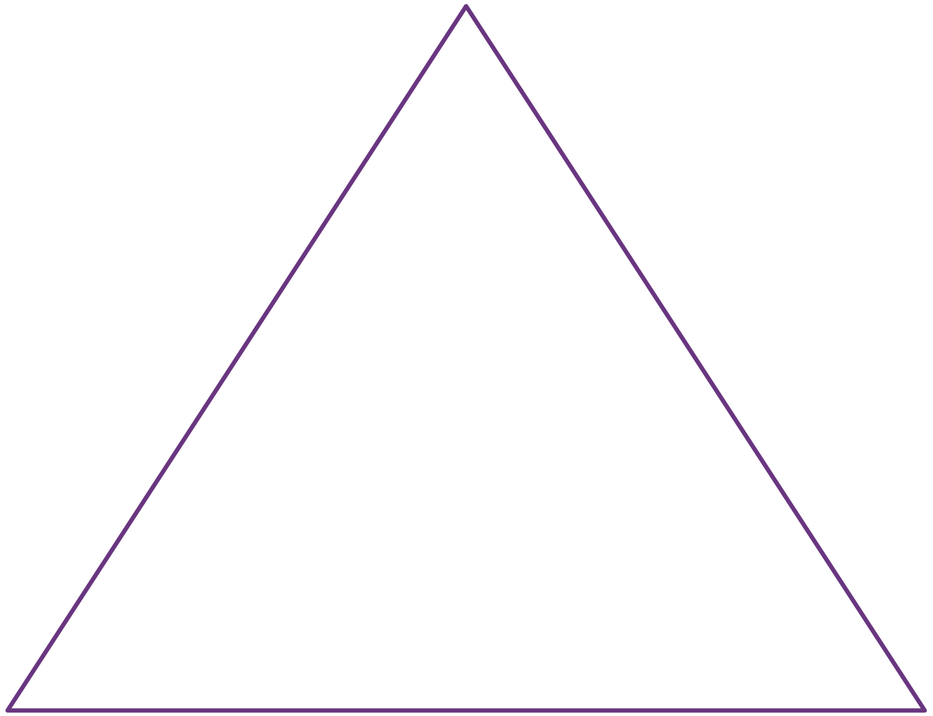
- Benzin: 9’500Wh/L





Summary

- Power / Energy density



- Safety
- Battery cost

Innovation potential in your company?

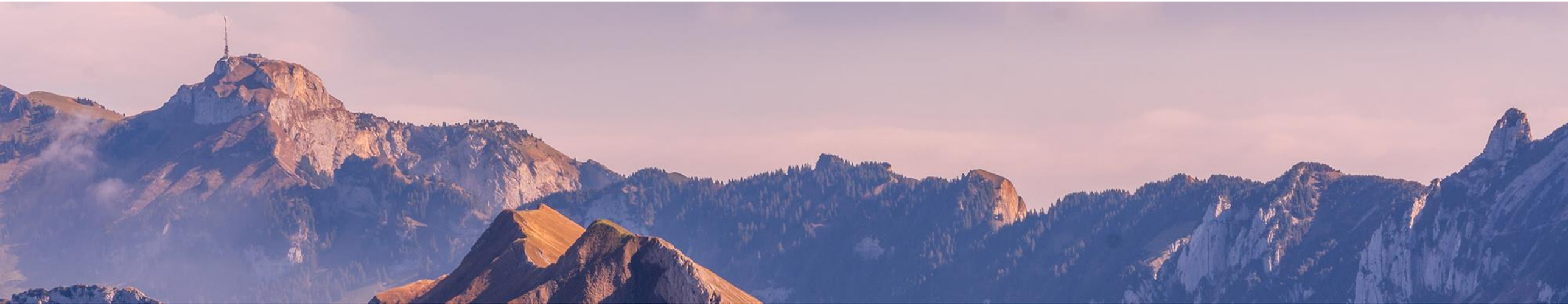
Thank you, please contact us for any questions.

Martin Stöck
Prof. Dr. sc. ETH
Head of Battery Research Group OST
https://www.ost.ch/battery

Tel: +41 58 257 3429
E-Mail: martin.stoeck@ost.ch

Institute for the Development of Mechatronic Systems EMS

OST – Ostschweizer Fachhochschule
Departement Technik
Werdenbergstrasse 4
CH-9471 Buchs / Switzerland



Programm

▪ Einführung:	Marco Jaggi / ITS
▪ Grundlagenreferat:	Martin Stöck / OST FH
▪ Praxisbeispiel:	Adrian Kummer / Wunderli Electronics
▪ Praxisbeispiel:	Simon Barjasic / SAVVY Telematic Systems
▪ Diskussion mit Q&A	
▪ Apéro & Networking	

AlarmNow

IoT Alarmierung und Steuerung
=> einfach und zuverlässig <=

Adrian Kummer CEO
a.kummer@wue.ch

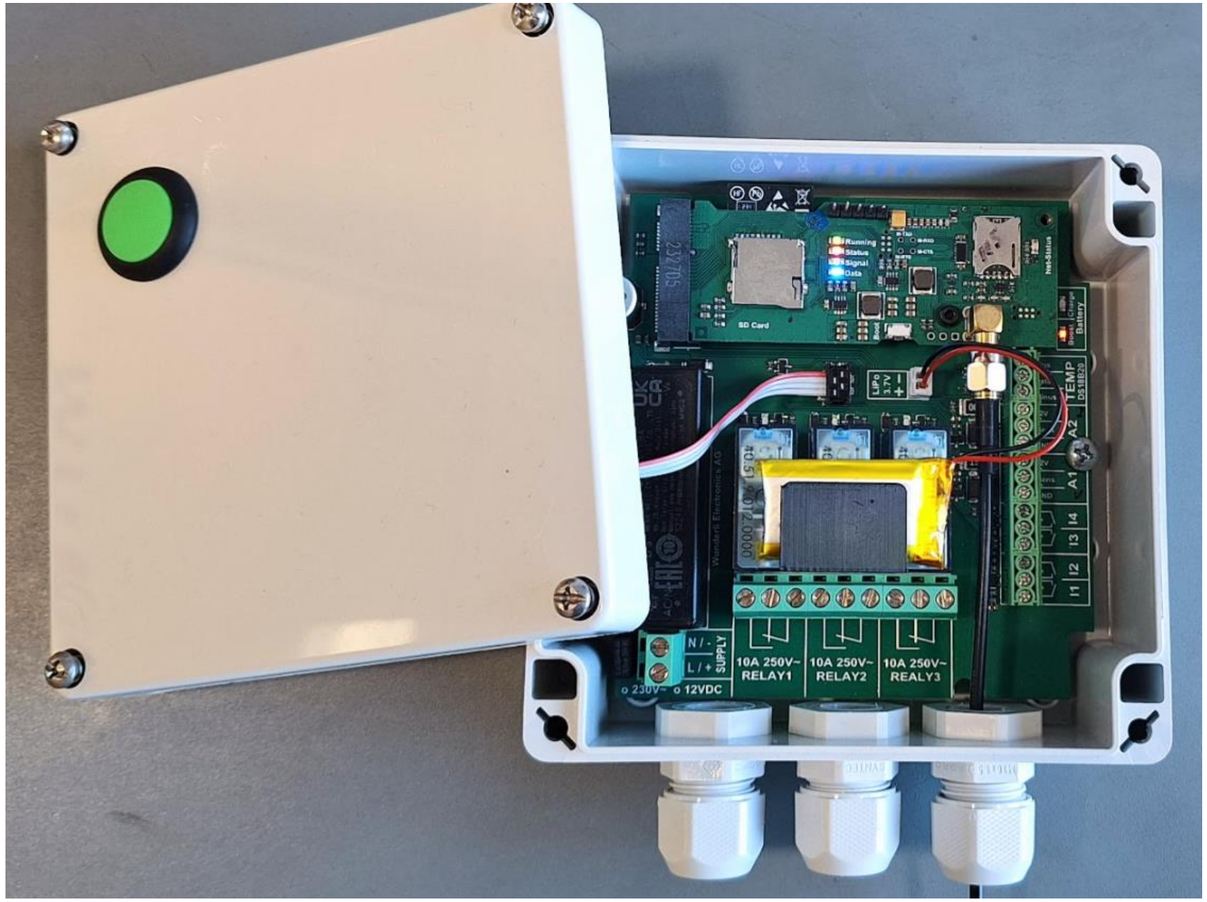
März 2025

WUNDERLI
Electronics AG

Unternehmensentwicklung

1975	Gründung durch Carl Wunderli in Oberegg AR
1989	Übernahme durch Christof Kummer, Umzug nach Weinfelden
2010	Eintritt von und Übergabe an Adrian Kummer
2015	Wachstum, Umzug an neuen Standort in Weinfelden
2018	Patenterteilung für Messverfahren Wassermelder
2019	4G Fernalarm-/Fernschaltgerät, 2G-Abschaltung Schweiz 2020
2022	Optischer Wassermelder für nicht konduktive Medien
2023	KNX-Wassermelder
2024	Entwicklung IoT Alarm Cloud Lösung

Anwendungsbeispiel: Mobile Heizung



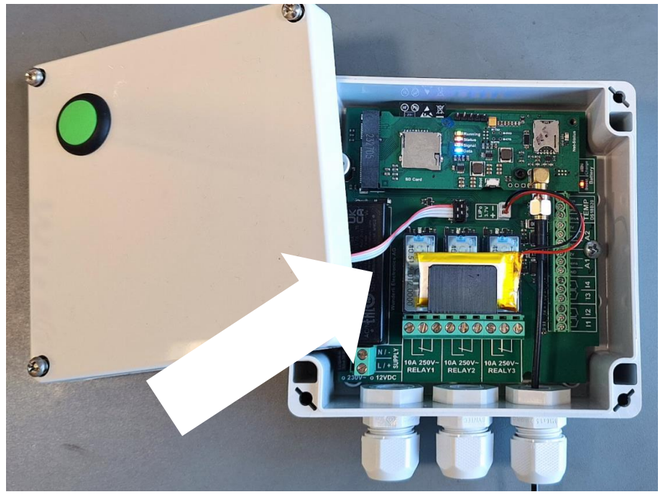
Heizsysteme für:

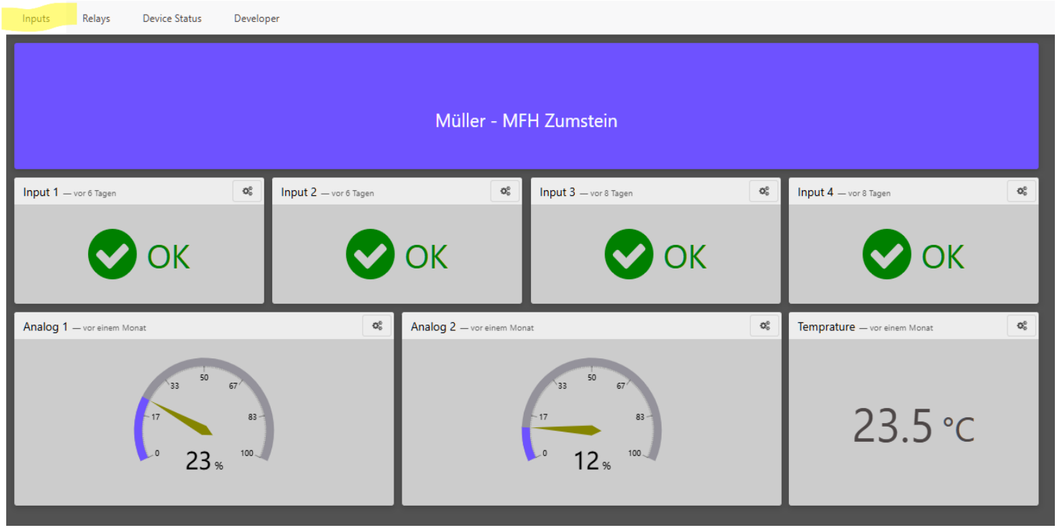
- Winterbaustelle
- Heizungssanierung
- Heizungsausfall
- Eventbeheizung

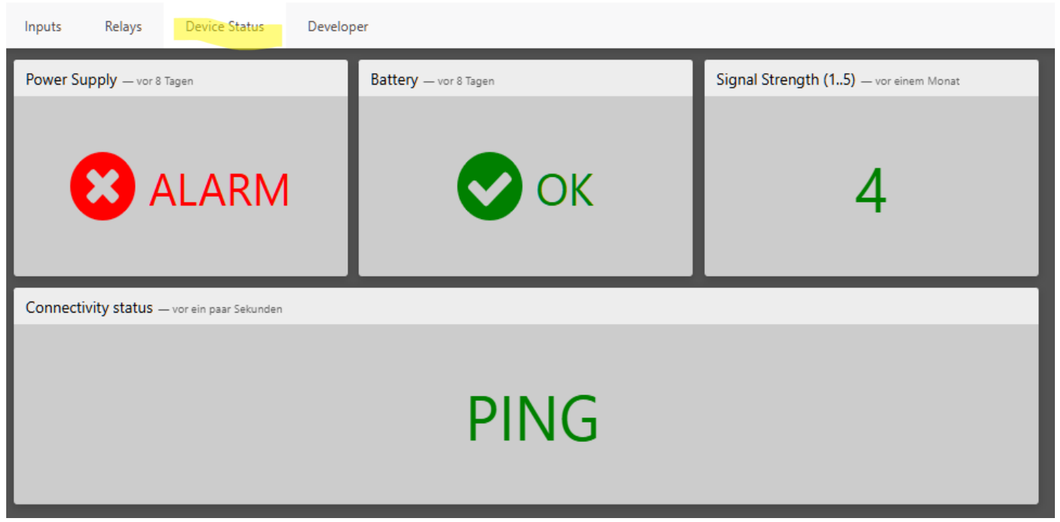
Anforderung - Mobile Heizung

- Geräte, über 4G Mobile Netz mit der Cloud verbunden.
- Temperaturregelung, Spannungsüberwachung,
  Ein- und Ausgänge und Pegelmessung des Öltanks.
- Via Browser (PC / Smart-Phone) kann der Kunde sein Gerät steuern (Zieltemperatur, Brennerstart) und Alarme definieren, um Mails oder auch SMS zu versenden.
- Die SIM-Karte muss Teil der Lösung sein.
- Spannungsausfall muss übermittelt werden.
  3h autarker Basis-Betrieb des Geräts.

Hardware und User Interface

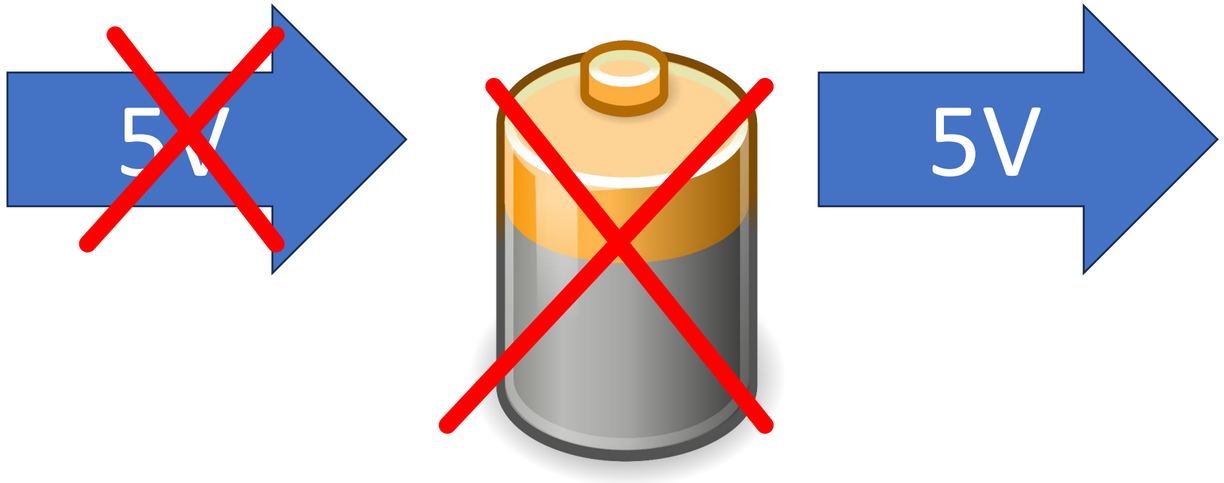






Stromversorgung

- Die Hardware benötigt eine “beefy” Versorgung mit 15W (3A) Peak für den zuverlässigen Betrieb.



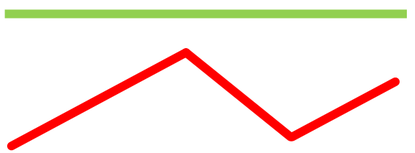
- Kandidaten:
  SuperCap / Li-Ion SuperCap / Li-Polymer / Li-Ion
  Einfachheit, Verfügbarkeit, Energiedichte, Bauform, ...

Herausforderungen Li-Po / Li-Ion

- Überladung

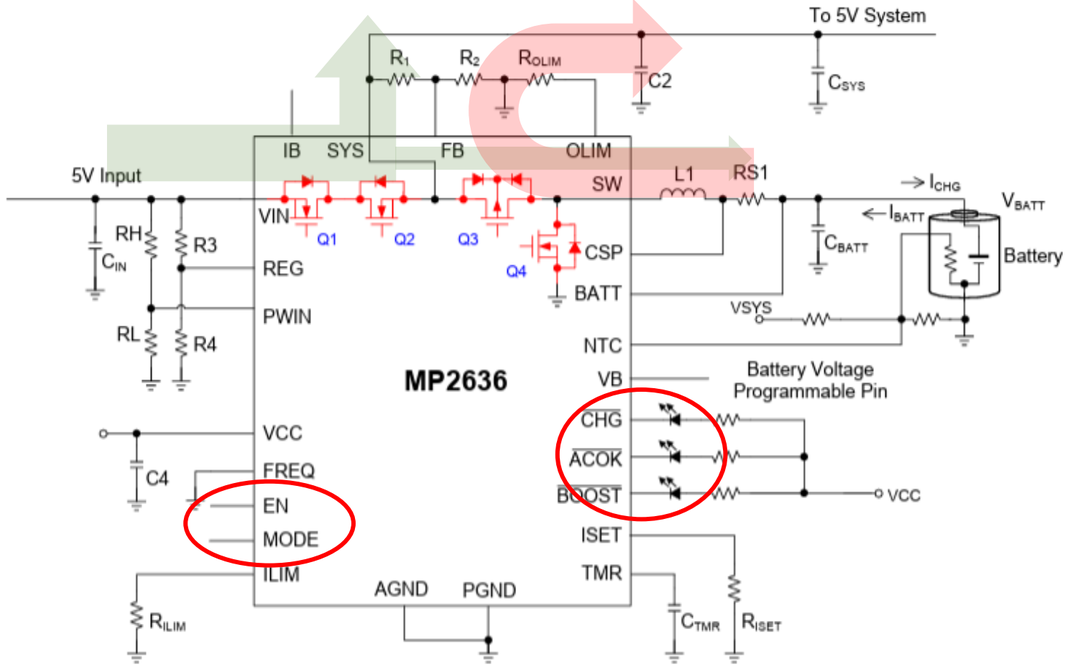
- Tiefentladung

- Spannungspegel 5V
  Li-Po Akku 3V-4.2V



MP2636 - 3A Lader

- Ladestrom- und Ladespannungsbegrenzung
- In 5V, Out 5V mit Booster
- Betriebsmodus Wahl
  - Charging
  - only Pass Through
  - Sleep (OFF)
- Akku Temperatur Überwachung
- Stromüberwachung Boost-Betrieb
- Unterspannungsabschaltung fehlt, jedoch
  - mittels Betriebsmodus extern
  - oder durch Battery Protection Circuit

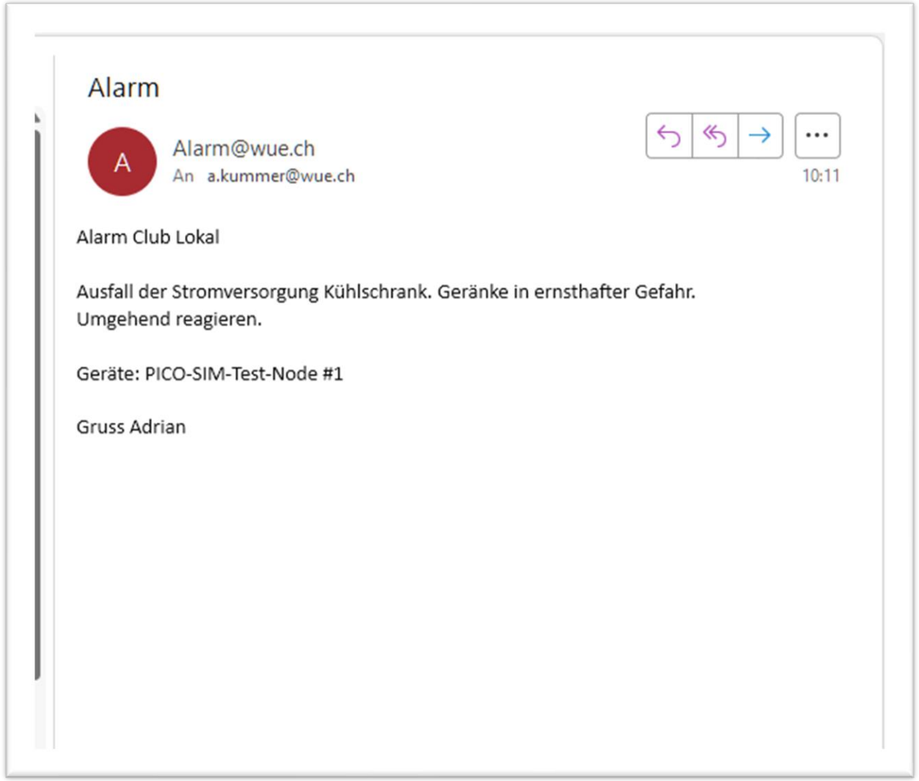


Source: Monolithic Power Systems

Herausforderung => Ausblick

- Abdeckung mobiler Netze
  LoRaWAN, 4G LTE CatM1, NBIoT, 5G, …
- SIM / eSIM Preis pro MB oder Monat relativ hoch
- Akku ist ein Fremdkörper im Produkt
- Akku Lebensdauer ist endlich (Zyklen)

Demo: Spannungsüberwachung



WUNDERLI

Electronics AG

Programm

▪ Einführung:	Marco Jaggi / ITS
▪ Grundlagenreferat:	Martin Stöck / OST FH
▪ Praxisbeispiel:	Adrian Kummer / Wunderli Electronics
▪ Praxisbeispiel:	Simon Barjasic / SAVVY Telematic Systems
▪ Diskussion mit Q&A	
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SAVVY
Telematic Systems AG

Praxisvortrag:
Batterietechnologie im Einsatz bei SAVVY®

www.savvy-telematics.com

[INDUS] HOLDING AG

As of May 2014, SAVVY® is a second-tier subsidiary of the SDAX-listed INDUS Holding Group (www.indus.de). The resulting financial stability is unique on the market and ensures SAVVY® customers' investments are protected and absolute data management neutrality maintained.

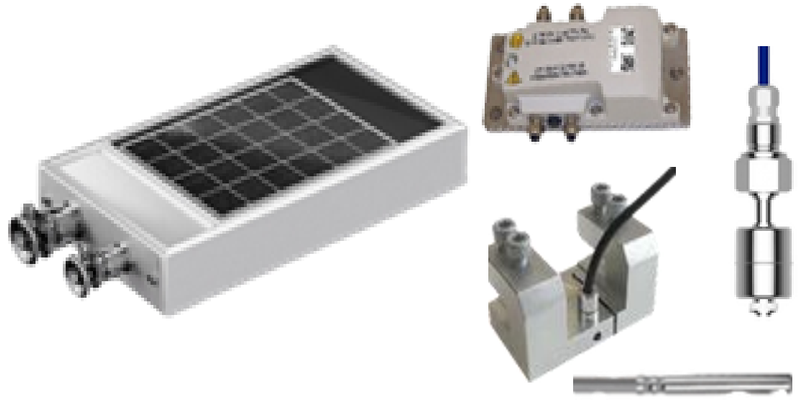
SAVVY® HQ in Schaffhausen/Switzerland.
INDUS Holding AG majority shareholder.
INDUS is listed on German SDAX.

Holds 46 mid-sized production oriented companies in construction infrastructure, mechanical and plant engineering, automotive-, medical- and metal technology.

Revenue 1,72 bn. €
EBIT 126.7 mio. € in 2024

SAVVY® PRODUKTPORTFOLIO

SAVVY ® IST SYSTEMLIEFERANT. ALLES AUS EINER HAND



1 Die SAVVY® Telematik sendet die ermittelten Daten (z.B. GPS- und Sensordaten)via Mobilfunk an unser SAVVY® Backend.

2 Die Daten werden im Backend entschlüsselt, für den Kunden aufbereitet und in unserem SAVVY® SNERGIE ENTERPRISE PORTAL visualisiert.

SAVVY Telematic Systems AG

13.500 equipped wagons

Since 2016

"Because we are a company that works across borders, with the daily challenge of distributing vacant wagons also used for forwarding goods, it is always important for TWA to know where its approximately 13,500 freight wagons are located. We already have a specially developed market-leading planning system in place. With SAVVY Telematic Systems we can now easily also show our customers exactly where their goods and wagons are located with an accuracy of two metres. Digitalisation makes it possible to provide new generation information access to our technicians, transport planners, and current and future customers. Regardless of country and on which railroad the goods are shipped." - - Managing Director Anders Nilsson, TRANSWAGGON AB, Helsingborg.

More

TRANSWAGGON TWA

Swiss Federal Railways

Since 2017

“SBB AG needs reliable data on SBB railroad wagon operations and positions to optimise their operations and maintenance. The invitation to tender stipulated that hardware and software with a minimum life cycle of seven years was required for its “GPS rail vehicles – HW and portal solution” project. SAVVY offered a telematics system solution based on innovative hardware and software technologies tailored to SBB’s needs and was awarded the contract in mid-August 2017.

All SAVVY® Synergy Portal users should be in the 3 to 4 digit range and access distributed among approximately 50 different user groups..

More

SBB CFF FFS

Batterietechnologie bei SAVVY®

Innovation – inspiriert durch unsere Kunden

Batterietechnologie - Smartphone

Die Batterielebensdauer hängt von der Nutzung des Users ab

Verwendung

- Displayzeit bzw. -nutzung
- Hintergrundanwendungen
- Rechenintensive Anwendungen

Energieeffizienz des Geräts

- Prozessor/CPU
- Displaytechnologie

Umweltbedingungen

- Betriebstemperatur
- Netzwerkabdeckung

Batterielebenszyklus – SAVVY® Produkte

Der Batterielebenszyklus hängt primär vom Use-Case des Kunden ab

SAVVY® Hardware

Systemkonfiguration

- Übertragungsfrequenz
- Datenvolumen
- Drittanbietersoftware (z.B. Vibrationssensor)

Angeschlossene Sensorik

- Anzahl der Sensoren
- Energieversorgung Sensoren oder Drittgeräte

Externe Faktoren

- Betriebstemperatur
- Netzwerkabdeckung

Intelligente Systeme

Innovation – inspiriert durch unsere Kunden und Erfahrungswerte

SMART TANK

The intelligent tank container

SAVVY® CargoTrac-S

ATEX/ IECEx certified with highest temperature class T6

Worldwide Mobile Network, GPS, Shock Detection

Wireless & Wired Industrial Sensor Interface

Tankmiles TankFeel

Digital display of temperature, level, pressure

ATEX Certification pending

Temperature — PT1000 – 3rd Party Supplier

Pressure — 3rd Party Supplier

Full / Empty — 3rd Party Supplier

Level/Pressure — Tankmiles Smart Flange TRP series

TRP300-100: radar liquid level sensor

TRP300-110: liquid sensor + pressure

Level — Float based – 3rd Party Supplier

SAVVY Telematic Systems AG

Tankmiles www.tankmiles.com

HEATER/REEFER REMOTE CONTROL

Worldwide and at any time

TEMPERATURE

SETPOINT

eltherm innovations in heat tracing

DIRAC INDUSTRIES

KLINGE

LÖBBE GMBH SCHALTANLAGEN UND INDUSTRIEELEKTRONIK

CIMC TANK CIMC ENRIC

DEN HARTOGH

RESPOL RESINAS, S.A.

WANHUA

NewPort

HOYER WHEN IT MATTERS

SUTTONS

TRS

Quality Assurance

Remote Intervention

Process Automation

SAVVY®
CargoTrac-Solar

SAVVY® CargoTrac-Solar

Nachfrage nach spezifischeren Konfigurationen und angeschlossener Sensorik steigt stark an

SAVVY® CargoTrac-Solar

Sensorik

- Direktanschluss am SAVVY® CargoTrac-Solar
- Möglichkeit zur Speisung von 2x 18 VOUT

Batterie

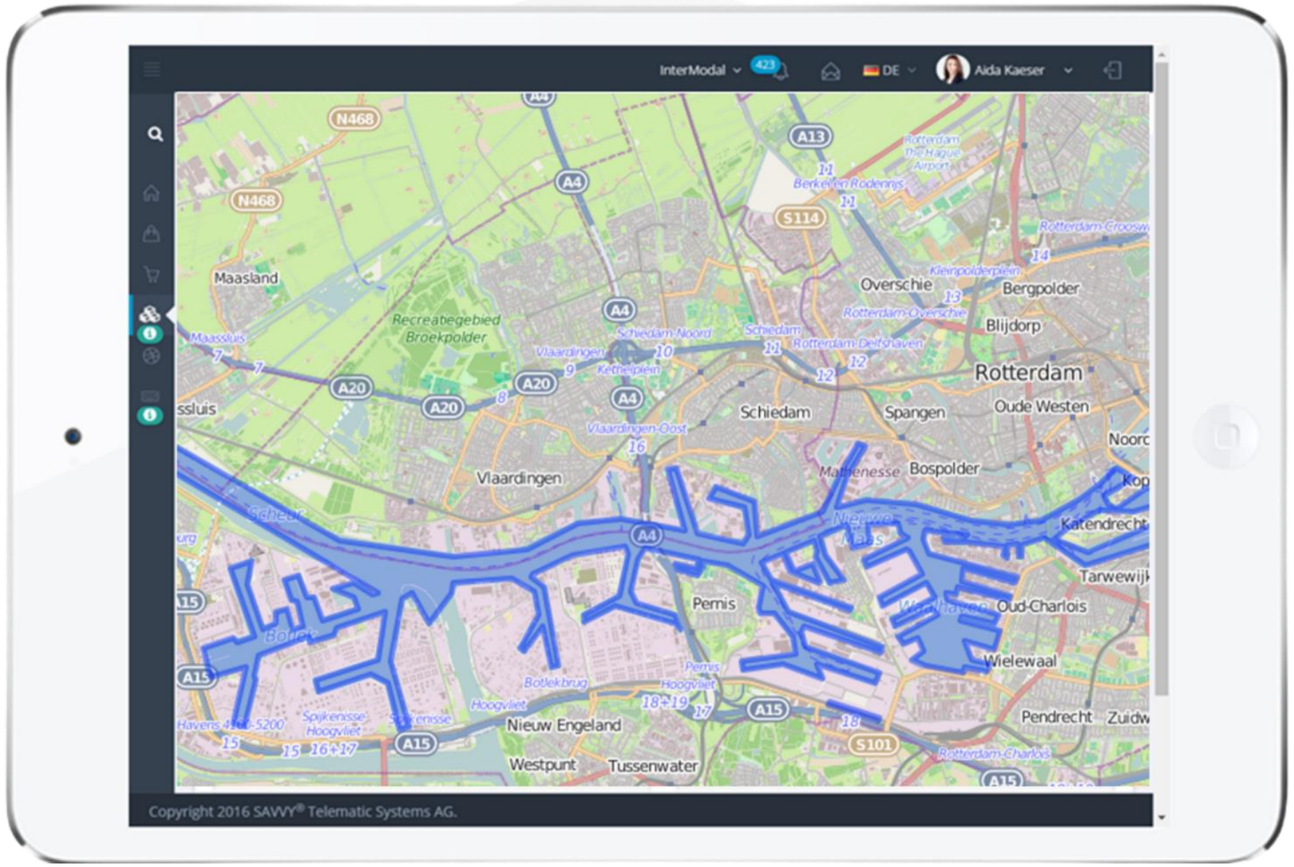
- Lithium-Ionen-Batterie (LiNiCoAlO2)
- Direkte Aufladung bei Sonneneinstrahlung
- Ladezeit von 0-100% in 20 Stunden

Neue Möglichkeiten

- Reduzierter Gerätebedarf
- Einsatz im High-Voltage-Bereich
- Autarkes System

Effizienzsteigerung durch Softwareinnovation

S A V V Y ® SYNERGIE ENTERPRISE – Das Gehirn der Hardware



Batteriesparlogik

- Geofencing zur Energieeinsparung
- Reduzierung der Messintervalle
- Reduzierung von Datenvolumen

→ Batterieentlastung bzw. –optimierung

→ Lebensdauerverlängerung der Batterie

Fazit & Ausblick

Zukünftige Innovationen in der Batterietechnologie ermöglichen neue Use-Cases

- **Batterietechnologie**
  - Abmessungen der Batterie verringern
  - Speicherkapazität/Energiedichte erhöhen
  - Ladezeiten verkürzen
  - Entladungsrate verringern
- **Energierückgewinnung**
  - Vibrationsenergie
- **Mobile Datenübertragung**
  - Kosten
  - Netzabdeckung/Verfügbarkeit
  - Satellitenkommunikation

SMART UP YOUR ASSETS - SAVVY UP YOUR BUSINESS!

SAVVY
Telematic Systems AG

LET'S STAY IN TOUCH !

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Simon Barjasic

Gemeinsam die digitale Transformation gestalten!

Programm

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Podium

Martin Stöck
IDEE / OST FH

Adrian Kummer
Wunderli Electronics

Simon Barjasic
SAVVY Telematic Systems

its

25 JAHRE its

Innovationswerkstatt 13. Mai 2025

Prozesse digitalisieren mit der Power Platform

– Potenziale entdecken und konkret umsetzen

its

WIR FÖRDERN
TECHNOLOGIE
UND INNOVATION.

Danke für Ihre Aufmerksamkeit. Geniessen Sie den Apéro…