



The Worldwide Rechargeable Battery Market 2021-2030

29th Edition – 2022

Introduction

- Key issues
- Worldwide battery market overview
- Applications covered in the survey
- Avicenne profile
- Our Business story
- Our Methodology
- Methodology: Extensive field research to retrieve & cross check information
- Customized & Multiclient survey for all the value chain
- Avicenne Energy: More than 350 references
- Speaker, chairman or workshop moderator
- Avicenne Energy: Renowned to have realistic forecasts comparison with other consultants

PART 1: The Rechargeable Battery Market in 2021

1995 - 2021 rechargeable battery market

- The battery market is really dynamic
- The worldwide battery market 1990-2021
- The worldwide battery (lead acid, NiCd, NiMH & Li-ion) market 1995-2021 (M\$)
- Worldwide Battery sales by chemistry, units, 1995-2021
- Worldwide Battery sales by chemistry, MWh, 1995-2021
- Worldwide Battery sales by chemistry, M\$, 1995-2021
- Worldwide Rechargeable Battery Market (NiCd, NiMH, Li-ion) by chemistry, M\$, 1995-2021

Lead acid, NiCd, NiMH, Li-ion main characteristics

- NiCd, NiMH, Li-ion main characteristics
- Overview of main battery technologies
- Technology adoption per market segment
- Battery market by technology
- NiCd, NiMH & Li-ion product performances: Wh/kg & Wh/l
- Each battery Technology has its specific absolute advantages
- Battery technology Energy & power
- 2021-2030 battery technology available

Battery suppliers' market shares in 2021

- Lead acid battery suppliers 2021
- VRLA battery suppliers 2021
- NiCd Battery: Market share in 2021 in volume & value worldwide

- NiMH Battery: Market share in 2021 in volume & value worldwide
- Japanese, Chinese & Korean market share, in value, 2021
- Major cell producers in 2021
- Li-ion Battery: Market share in 2021 worldwide
- Lithium ion battery production in 2021
- Lithium ion battery production for xEV (GWh)
- Battery for EV worldwide
- Li-ion cylindrical: Market share in 2021 in volume worldwide
- Li-ion cylindrical in volume by manufacturer (2003-2021)
- Prismatic Li-ion Battery (Small cells)
- Li-ion pouch Battery (Small cells)
- Battery production capacity 2021
- Typical li-ion battery plant
- LIB Manufacturing investments 2009-2022
- Production capacity forecast
- LIB Demand & supply 2020-2030 (GWh)
- Production capacity for major players
- Europe production capacity: from several GWh in 2020 to 100-150 GWh in 2023 & several hundred of GWh in 2028

Main applications in 2021

- Lead acid battery segmentation
- The worldwide battery market 1990-2021 in volume (MWh)
- The worldwide battery market 1990-2021 in value (B\$)
- The lead acid battery market by application and technology in 2021
- NiCd in 2021 main application: Power tools
- NiMH in 2021 main application: Hybrid vehicles
- Li-ion in 2021 main applications: Electronic devices, Auto & E-bus, Industrial ESS, ...

PART 2: Technical, economical & regulation trends

- The Main Trends
- Technical, financial and regulation trends
- NiMH battery
- NiMH major developments for consumer batteries
- NiMH major developments
- Example of NiMH developments for HEV
- LIB – Main components
- State of the art li-ion cells in 2021
- LIB - Performances in 2020/2021
- 2021-2030 battery technology available
- Li-ion battery roadmap
- CATL roadmap
- LG roadmap
- Panasonic roadmap – Cathode
- Panasonic roadmap – Anode
- Major cell Mfg roadmap: Samsung, LG, SK, CATL, Panasonic, Envision...
- Solid-State Batteries
- Ragone plot for lib, solid state, li-air
- Solid State Battery challenges
- SSB: The good news
- SSB: The bad news
- Solid State Battery Developers

- Solid-state technology approaches
- Major players – Not All Inclusive
- Solid-state electrolyte: polymers, sulfides & oxides
- Technical Approach Major players
- Solid State Intellectual Property
- Market segmentation
- The Solid State Battery market
- The Solid State Battery market forecasts
- The Solid State Battery market by applications
- Solid State Batteries - Automotive
- Automotive Launch?
- Solid State Production
- Solid State Battery and Electrolyte Technologies Insights
- Time to market for new materials in lib industry
- Battery technology roadmap
- Time to market for new materials in li-ion industry

Raw Materials trends

- LIB: the biggest part of the cost is raw materials
- CO & NI PRICE: Up & Down! Example between 2003 and 2021
- Li-ion value chain – Market demand
- Raw materials development & Raw material market
- LIB cathode insights
- Minerals and Raw Materials for cathode
- LIB cathode material
- LIB Cathode active material needs
- LCO demand: CAGR 2015-2030
- NMC demand: CAGR 2015-2030
- NCA demand: CAGR 2015-2030
- LFP demand: CAGR 2015-2030
- Cathode roadmap: Moving from NMC 111 to higher Ni content and lower Co content
- Cathode active material forecasts 2000-2030
- The cathode value chain
- Metals Supply and Pricing Insights
- Metal needs for rechargeable battery will increase rapidly
- Update on Major LIB Metals Pricing
- Lithium consumption for batteries forecasts
- Lithium Demand and Effective Capacity
- Lithium demand – Different scenario & sources
- How to forecast li price?
- Lithium carbonate & hydroxide pricing forecasts
- Cobalt needs for batteries in 2021: Li-ion, NiMH & NiCd
- Cobalt Supply Chain
- Cobalt Supply By Country – 2021
- Cobalt needs for batteries is growing
- Cobalt demand by end users
- Cobalt consumption for batteries forecasts 2000-2030
- Cobalt capacity depend on Ni and Copper production
- Cobalt price forecasts
- Cobalt price forecast could (will) be wrong...
- Nickel needs for batteries
- Nickel needs for battery forecasts
- Copper pricing
- Aluminum pricing

- Mn pricing
- Silicon price
- Li-ion anode Insights
- Minerals and Raw Materials for anode
- Li-ion cell constitution
- Anode active materials in Tons in 2021
- Anode for LIB in 2021
- Natural graphite: CAGR 2020-2030
- Artificial graphite: CAGR 2020-2030
- ANODE active material forecasts
- Graphite is the main anode in 2021
- LTO (Li₄Ti₅O₁₂) demand: CAGR 2020-2030
- Anode Road map diagram: 2019 – 2020 – 2025 - 2030
- Anode Road map diagram - Anode material: Graphite is a commodity; Add Si to increase capacity
- Major trends in anode materials
- The anode active material market 2010-2030
- Li-ion separator insights
- Minerals and Raw Materials for separator
- Lib Separator market 2000-2030
- Separator average price
- Separator market by supplier in 2021
- Separator: pros & con
- Separator market by separator type & application in 2021
- Separator market by separator type & application in 2025
- Separator market by separator type & application in 2030
- Separator market by application in 2021 Rationales
- Separator market forecast 2000 – 2030 (volume, Mm²)
- Separator market forecast 2000 – 2030 (value, MUS\$)
- Li-ion electrolyte insights
- Minerals and Raw Materials for electrolyte
- Electrolyte suppliers/Customers in 2021: TINCI, Zhangjiagang Guotai-Huarong, Capchem, Jinniu, Mitsubishi, Smoothway, PANAX-ETEC, Golden Light, Shanshan, Ube...
- Electrolyte developments
- Electrolyte: automotive Solid State Batteries significant issues remain unsolved
- Electrolyte: automotive Solid State Batteries early technology leaders and developers
- Electrolyte components
- Electrolyte formulation
- Electrolyte market 2000-2021 (M\$): CAGR 2010-2021
- Electrolyte market forecast: 2000 – 2030 (volume, tons)
- Electrolyte: minimum and average price 2020
- Electrolyte: minimum and average price 2021
- Electrolyte: price evolution in 2020-2021
- Electrolyte suppliers in Eu and US
- Electrolyte market
- Electrolyte supply matrix
- Electrolyte component market: Lithium Salt
 - LiPF₆ market forecast: 2010 – 2030 (volume, tons)
 - LiPF₆ major suppliers
 - LiPF₆ customer/supplier relation
 - LiPF₆ price: cost structure
 - LiPF₆ price in china & outside china
 - LiPF₆ production capacity vs. demand
 - LiPF₆ market trend & forecasts
- Electrolyte component market: Solvent

- Solvents
- Solvents market 2000 – 2030 (value)
- Electrolyte component market: Additives
 - Why additives?
 - High-grade LIB contains over than 10 additives
 - Electrolyte additives
 - Electrolyte additives market in 2021

Battery format trends

- Lithium ion small cell market
- Some OEM's have chosen cell geometries depending on availability and are currently changing this choice
- We expect growth of prismatic cells market share at the global level but pouch and cylindrical cells market size will increase due to global market growth
- Prismatic provides over 80% of China's demand through 2021-2030. In 2026, prismatic overtakes pouch in Europe, while pouch will exceed cylindrical in USA
- Li-ion: Cylindrical, prismatic & pouch cells in China, in Europe & in USA

Economical trends

- Battery Prices
- Average price per Cell by chemistry 2000-2025 (small cells)
- Portable PC battery low cost details
- Li-ion battery cost 2010-2025 forecasts
- Li-ion battery cost 2005-2030 forecasts

Safety issues

- Safety issues: Li-ion and LMP are not thermally stable what raises serious safety concerns
- Safety is a sine-qua-non selection criteria for battery technologies

PART 3: 2021 & 2030 Forecasts

- Parameters analysis (Details are in the Application's module)
- Battery market forecasts 2021-2030
- Growth projections: the COVID-19 health crisis will have a severe impact on economic activity in 2020
- World Economic Outlook: growth projections: The COVID-19 pandemic will severely impact growth across all regions
- Portable electronic devices forecasts 2010-2025
- Portable electronic devices forecasts 2010-2025: Laminate & Cylindrical
- 2030 LIB forecasts for portable electronic devices
- X-EV market worldwide in 2021
- HEV, P-HEV, EV 2030 forecasts
- EV forecast: EV sold, in million units, worldwide, 2010 – 2030
- Total battery DEMAND for X-EV - 2030 forecasts
- The worldwide battery market in 2021
- Total potential market (M\$, Pack level); E-bikes, Forklifts, Power Tools, Telecom, UPS, ESS...
- E-bikes: LIB & LAB
- E-bikes: LIB & LAB overview
- Power Tools: LIB overview
- Motive industrial: E-Forklifts (Including all kind of materials handling equipment as Automated Guided Vehicles, Scrubber Dryer Machines...) LIB & LAB
- Motive industrial: E-Forklifts and others... LIB & LAB overview
- Stationary: telecom market LIB & LAB
- Stationary: telecom market LIB & LAB overview
- Stationary: UPS market LIB & LAB
- Stationary: UPS market LIB & LAB overview
- ESS Segmentation
- Five technologies are competing for most of the applications

- ESS market & forecasts 2015-2025
- ESS global market
- Li-ion battery market forecasts: Electronic devices / Auto, E-bus Excl. China / Auto, E-bus China / Industrial ESS / Others 2021-2030
- Battery market 2010-2030
- Lithium ion battery recycling 2021-2030
- Takeaways
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MODULE 1: Automotive (HEV, P-HEV, EV)

Battery market for Hybrid, Plug-in & electric Vehicles

- Introduction
- In 2016/2017 several announcements accelerate the X-EV growth
- OEM investment in vehicle electrification
- Carmakers to invest more than \$300 Billion in EV in January 2019
- 2021: Carmakers to invest more than \$500 Billion in EV
- OEM & government announcement 2025-2050
- Worldwide Battery Sales by Chemistry, MWh 1995-2021
- Worldwide Battery Sales by Chemistry, MUS\$, 1995-2021
- The rechargeable battery market in 2021 - MWh
- The rechargeable battery market 2000-2021 - Value in MUS\$
- X-EV market
- Why X-EV?
- CO₂ Emission worldwide
- CO₂ Emission in Europe
- Estimation of the financial impact of CO₂ emission on OEM in 2021
- European OEM volumes & CO₂ penalty level if nothing is done
- HEV, P-HEV & EV Definition & Segmentation
- Energy storage solution for X-EV
- Energy storage solution for micro hybrid
- HEV worldwide in 2021 in M units
- HEV advantages & disadvantage
- HEV market 2000-2021 by country: USA, Japan, Europe, China, Others
- HEV market 2000-2021 in the USA
- HEV market 2000-2021 by car makers
- HEV advantages and disadvantages
- HEV cells on the market
- NIMH in 2021 main application: Hybrid vehicles
- P-HEV worldwide in 2021: Number of P-HEV - Positive impact of the COVID
- P-HEV cells on the market
- P-HEV sold worldwide
- EV sold worldwide in 2021
- NEV* development in China (*NEV=PHEV+EV (New Energy Vehicles)
- EV cells on the market
- OEM – cell suppliers
- VW supply chain
- STELLANTIS supply chain
- Mercedes-Benz supply chain
- RNB supply chain
- BMW supply chain
- Tesla supply chain
- Ford supply chain
- GM supply chain

- RIVIAN supply chain
- LUCID supply chain
- HONDA supply chain
- HYUNDAI supply chain
- BYD supply chain
- GEELY supply chain
- Great wall supply chain
- Dongfeng supply chain
- Major cell producers in 2021
- Lithium ion battery market share in 2021
- Lithium ion battery production in 2021
- Lithium ion battery production for X-EV in 2019-2021
- Lithium ion production & production capacity (MWh)

X-EV forecasts

- Historical forecasts: AVICENNE has realistic forecast compared to other analyst
- The Lithium ion battery market forecasts: 3 major limiters on batteries, for the development of electric vehicle
- Safety issues: Li-ion and LMP are not thermally stable what raises serious safety concerns
- Safety is a sine-qua-non selection criteria for battery technologies
- Time to market for new materials in LIB industry
- Time to market
- LIB battery cost
- Li-ion battery cost 2015-2025
- Price increase in 2022
- LIB cost forecasts
- HEV, P-HEV, EV 2030 forecasts
- EV forecast 2015-2030
- Total battery DEMAND for x-EV 2030 forecasts
- Li-ion battery market forecasts 2000-2030
- Production capacity forecast: China, Asia (Exclu. China), Europe, US 2020-2025-2030
- LIB Demand & supply 2020-2030 (GWh) in China & in Europe
- LIB Demand & supply 2020-2030 (GWh) in US & in Asia (Excl. China)
- Europe production capacity: from several GWh in 2020 to few hundred GWh in 2025 & several GWh in 2030
- US production capacity: from ~45 GWh in 2020 to up to 100 GWh in 2025
- Installed, under construction & planned capacity in China in GWh 2021- 2025 – 2030 – 2030
- Takeaways
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MODULE 2: Portable electronic devices 2021-2030

● Cellular Phones & Smartphones

Smartphones in 2021

- Mobile Phones evolution: 1980–2021 REMEMBER...
- What is the power need of a Cellular Phone in 2021?
- Smartphone Trends: Power Consumption and Thickness
- Cellular market worldwide & its growth in volume, 1993-2021
- Worldwide quarterly cellular phones sales, units, Q1 2000 – Q4 2021
- Smartphone market by manufacturer (units) 2016 & 2019 & 2021
- Worldwide number of cellular phones active subscribers 1995-2021
- Cellular Phones demand by geographic area (New subscribers & renewal)
- Worldwide cellular phone demand by geographic area 1998-2021
- Worldwide handsets sold in 2016 & 2019 & 2021 by geographic area: Japan, USA, Western Europe, Asia Pacific, China, India, Eastern Europe, Latin America, Africa
- 2020/21 Cellular handsets Growth by geographic area: Japan, USA, Western Europe, Asia Pacific, China, India, Eastern Europe, Latin America, Africa
- Smartphone penetration is increasing 2008-2021
- Smartphone penetration 2009-2021 in volume & penetration in %
- Smartphone sales 2010-2021 by TOP suppliers
- Ratio of handset powered by NiCd, NiMH, Li-ion & Li-Pol batteries worldwide, 1995-2021
- Battery market for cellular phones worldwide
- Cellular phones/LIB suppliers relationships: Samsung, LG, ATL, Lishen, Panasonic, Murata, BYD, Maxell...
- Cellular phones lib battery price (cell level)
- LIB market for cellular phones 2000-2021 (cell level)

Battery for cellular phones forecasts

- 6 key factors are needed to forecast LIB market for cellular phones
- The world is changing more and more rapidly
- Forecasting Battery market for Cellular Phones up to 2030
- Forecast: Batteries for cellular Worldwide 2000-2030
- Cellular phones lib battery price (cell level)
- Battery market for cellular phones 2000-2030

● PORTABLE PCs

The Battery for Portable PCs in 2021

- Worldwide Portable PCs sales in 2021
- Desktop pc & portable pcs market 1997-2021
- Portable PCs market shares 2016, 2019 & 2021
- Portable PCs company market shares evolution 2005-2021
- Portable pcs production in China
- What is the power need of a portable PC?
- Ratio of Portable PCs equipped with NiCd, NiMH and Li-ion batteries
- Ratio of NiMH & Li-ion Batteries for Portable PCs, 1995-2021
- Portable PCs LIB market 2000-2021 - Increase of pouch cells
- Portable pcs market by size
- After market battery for Portable PCs
- Li-ion Safety issue
- Notebook screens get bigger & bigger
- 18650 LIB cells sold per year by capacity, 2004-2021
- 18650 lib capacity
- Li-ion 18650 cells: price decreases
- Batteries for Portable PCs in 2021
- Shift pouch cell from cylindrical
- Pouch cells & cylindrical cells energy density (cell level)
- Portable PCs market forecasts 1995-2030
- Battery chemistry & LIB form factor in Portable PCs 1995-2030
- 2000-2030 Battery market for PCs
- LIB market for portable PCs 2000-2030

● TABLETS

THE TABLETS MARKET WORLDWIDE

- Tablets market 2009 – 2021 (Apple / Non Apple)
- Tablets market worldwide in Volume, M Units, by Size
- Tablets market 2009 – 2021 (Commercial / Consumers)
- Tablets market share 2021
- Tablets market share 2010-2021 sales by manufacturers
- Tablets market share 2010-2021
- Worldwide quarterly Tablets market sales, in Million units: Q1 2014 – Q4 2021
- Tablets market 2009 – 2021 (Mature market / Emergent market)

BATTERY FOR TABLETS IN 2021

- Tablets battery needs
- Tablets LIB demand (M cells) 2010-2021 & comparison with other devices demand
- LIB market for tablets (MWh) 2010-2021
- LIB market for tablets (M\$) 2010-2021
- LIB for tablets trends Thickness & Width
- Set Trend: Battery Adoption in Tablet
- Tablets lib suppliers
- Consumer Insights: Tablet Battery
- Shift pouch cell from prismatic or cylindrical

- Pouch cells & cylindrical cells energy density (cell level)

MARKET FORECASTS

- Tablets market forecasts 2010-2030
- 2010-2030 Battery market for tablets in volume (M cells)
- 2010-2030 Battery market for tablets in volume (M Wh)
- LIB market for TABLETS 2000-2030: market in volume, market in MWh, average sales price, market in value (cell level)

● CAMCORDERS

The Battery for DSC in 2021

- Camcorders market worldwide 2000-2021
- Camcorders market 2000-2021
- Camcorders market worldwide: analog & digital
- Camcorders market share worldwide in 2021
- Battery for camcorders: consumptions, voltage, size...
- Market forecast & Market construction & methodology
- Battery for camcorders
- Retail market is important but decreasing (except for small camera like GoPro)
- NiCd for Camcorders: OEM & Retail
- NiMH for Camcorders: OEM & Retail
- Li-ion for Camcorders: OEM & Retail
- The NiCd battery market for camcorders
- The NiMH battery market for camcorders
- The LIB market for camcorders
- The battery market for camcorders, M cells, 2000-2030
- The battery market for camcorders, MWh, 2000-2030
- The battery market for camcorders, MUS\$, 2000-2030

● CORDLESS PHONES

Cordless Phone market worldwide

- Cordless Phones market worldwide in volume 2000-2030
- Cordless Phones market 2000-2030: Analog Vs. Digital 2000-2030
- Digital Cordless Phones market share worldwide
- Market construction & Methodology
- Battery for Cordless Phones 2000-2030
- The NiCd battery market for Cordless Phones 2000-2030 in volume & in MWh
- The NiMH battery market for Cordless Phones 2000-2030 in value, MUS\$
- Batteries for Cordless Phones: Conclusion

● DIGITAL CAMERA

DSC market worldwide

- Digital CAMERA market 2019, 2020 & 2021: shipments
- Digital CAMERA market 2019, 2020 & 2021: interchangeable lens

- Digital CAMERA market 2019, 2020 & 2021: built-in lens
- Digital camera market worldwide 2000-2030
- Digital camera market share worldwide in 2021
- DSC power needs
- Market construction & Methodology
- Ratio of DSC sold powered by each technology by OEM
- Size evolution: average number of AA cells per camera
- DSC sold with Primary batteries in the World
- DSC sold with Primary batteries in the World
- NiMH for DSC: OEM & Retail
- NiMH battery prices for digital cameras
- NiMH for DSC in value 2000-2030
- Li-ion battery for digital cameras 2000-2030 in volume, M cells
- Li-ion battery for digital cameras 2000-2030 in MWh
- Li-ion battery for digital cameras price in US\$/Wh
- Li-ion battery for digital cameras 2000-2030 in MUS\$
- 2000-2030 battery market for digital camera in volume, M cells
- 2000-2030 battery market for digital camera in Value, MUS\$

● PORTABLE HDD & FLASH MUSIC PLAYERS

- Worldwide HDD & Flash Music Players sales 2000-2030
- HDD & flash music players energy & Power needs
- HDD & flash music players: Battery needs
- The Li-ion battery market 2000-2030, in volume (M cells, US\$/Wh, MWh & MUS\$)

● R/C CARS & TOYS

- Worldwide R/C Cars sales 2000-2021
- 3 Segments: Toys / Hobby / Competition
- 3 types of batteries: The engine, the remote control, the receptor
- Worldwide R/C Cars sales 2000-2021, for Toys, Hobby & Competitions
- R/C Cars For TOYS makers market share in 2021
- R/C Cars For Hobby & Competitions makers market share in 2021
- Ratio of R/C cars equipped with NiCd & NiMH
- Number of minimum cycles needed for each segment in 2021
- Number of battery pack per R/C cars owners ion 2021
- Important criteria for Toys / Hobby / Competition
- Battery chemistry penetration for each segment
- TOYS:
 - Toys: Number of R/C cars sold per year
 - Toys: R/C cars suppliers in 2021
 - Toys: Which battery?
- HOBBY:
 - Hobby: Number of R/C cars sold per year
 - Hobby: R/C cars suppliers in 2021
 - Hobby: Battery used by makers in 2021

- Hobby: Which battery?
- COMPETITION:
 - Competition: Number of R/C cars sold per year
 - Competition: R/C cars suppliers in 2021
 - Competition: Which battery?
- Battery needs for R/C Cars in volume, M Cells, 2000-2030
- Battery needs for R/C Cars in MWh, 2000-2030
- Battery prices 2000-2030
- Battery market for R/C Cars 2010-2030

● VIDEO GAMES

- Worldwide Video Games sales 2000-2030
- Main Video Game makers: Video Games unit shipment worldwide by makers, in volume, 2000-2021
- Video Games makers market share in volume 2017-2019-2021
- Power Needs Video Games in 2021
- Video Games: Battery needs: Ratio of Video Games equipped with Li-ion & Li-P batteries, in %, 2000-2030
- Li-ion & Li-Polymer Penetration rate for Video Games 2000-2030
- The Li-ion battery market 2000-2030, (M cells, US\$/Wh, MWh & MUS\$)

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MODULE 3: Power Tools

The Battery for Power Tools in 2021

- Cordless Tools
- Tool brands
- Cordless Power Tools Market 2000-2030 in volume
- Cordless Power Tools company market shares, in %, in 2021
- Market Trend in voltage & format
- Worldwide Power Tools sales 2000-2021 by Voltage
- Power Needs for Power Tools (Professionals Vs. Consumers)
- Power tools battery by chemistry 2000-2021
- LIB penetration by OEM, in %, in 2021
- LIB needs by OEMs in 2021 in volume (M cells)
- NiCd, NiMH & Li-ion penetration in cordless power tools 2000-2030
- The NiCd battery market for cordless power tools, (M cells, US\$/Wh, MWh & MUS\$), 2000-2030
- The NiMH battery market for cordless power tools, (M cells, US\$/Wh, MWh & MUS\$), 2000-2030
- The li-ion battery market for cordless power tools, (M cells, US\$/Wh, MWh & MUS\$), 2000-2030
- 2000-2030 Battery market for cordless power tools in MWh & MUS\$)
- Cordless Tools: OEM expectations

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MODULE 4: E-Bikes

- Market definition: There is 3 kinds of what we call E-bikes
- Bikes market worldwide: More dynamic than car market!
- The Bike in use worldwide by Geographic area in 2021
- E-bike market worldwide & in Europe 2000-2021
- E-bike drive system market share in 2021
- European e-bike market 2020-2027
- E-bikes market in Europe (units)
- E-bikes market in France, Italy & UK E-bikes market (units)
- The E-bike, Pedelec & E-scooter Worldwide market
- The E-bike, Pedelec & E-scooter market: China, Europe, USA and Row
- The E-bike, Pedelec & E-scooter market: Japan, USA, Europe and Row
- Drivers for e-bikes in China
- Banning of gasoline powered motorcycles in China boost E-bikes
- E-bike cost in China

- battery choices available: Lead acid & Li-ion
- Lead acid, NiCd, NiMH or Li-ion
- Lead acid battery: China could move to ban Lead Acid batteries for E-bikes
- Which technology today and for tomorrow in China
- Which technology today and for tomorrow in Europe, Japan & USA
- E-bikes: energy needs
- Present & Future needs for e-bikes
- Li-ion E-bike pack
- Li-ion E-bike pack: cylindrical cells
- Li-ion E-bike pack: cylindrical cells & Pouch cells
- E-bike battery market by battery technology penetration rate in %: Lead Acid, NiCd, NiMH & LIB worldwide
- E-bike battery market by battery technology penetration rate in %: Lead Acid, NiCd, NiMH & LIB in China
- E-bike battery market by battery technology penetration rate in %: Lead Acid, NiCd, NiMH & LIB in Japan
- E-bike battery market by battery technology penetration rate in %: Lead Acid, NiCd, NiMH & LIB in USA
- E-bike battery market by battery technology penetration rate in %: Lead Acid, NiCd, NiMH & LIB in Europe
- E-bikes sold worldwide by battery chemistry in volume (Million units) 2000-2030
- The NiCd Battery market for E-bikes, 2000-2030
- The NiCd battery market 2000-2030, in volume (M cells & MWh)
- The NiCd battery price 2000-2030 in US\$/kWh
- The NiCd battery market 2000-2030, in value (MUS\$)
- The NiMH Battery market for E-bikes, 2000-2030, in volume (M cells & MWh)
- The NiMH battery market 2000-2030, in volume (M cells & MWh)
- The NiMH battery price 2000-2030 in US\$/kWh
- The NiMH battery market 2000-2030, in value (MUS\$)
- The Li-ion Battery market for E-bikes, 2000-2030
- The Li-ion battery market 2000-2030, in volume (M cells & MWh)
- The Li-ion battery price 2000-2030 in US\$/kWh
- The Li-ion battery market 2000-2021, in value (MUS\$)
- E-bike LIB battery market by form factor in %
- Lib battery for E-bikes in volume (M packs) – OEM / Retail sales
- Battery market for E-bikes, in volume, MWh, 2000-2030
- LIB Battery market for e-bikes, in value, MUS\$, 2000-2030 (cell level)
- Conclusions

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MODULE 5: HOUSEHOLD Devices

- HOUSEHOLD DEVICES SEGMENTATION
- CORDLESS SHAVERS MARKET
 - Market in Volume, 2000-2021
 - Segmentation
 - Market share in 2021

- Cordless shavers battery needs 2000-2030
- Battery technology choice by makers
- Battery for cordless shavers market by technology (NiCd, NiMH, Li-ion)
- TOOTHBRUSH MARKET
 - Market in Volume, 2000-2021
 - Segmentation
 - Market share in 2021
 - Battery needs 2000-2030
 - Battery technology choice by makers
 - Battery market by technology (NiCd, NiMH, Li-ion)
- PORTABLE CLEANERS MARKET
 - Market in Volume, 2000-2021
 - Segmentation
 - Market share in 2021
 - Battery needs 2000-2030
 - Battery technology choice by makers
- Worldwide Battery market for household devices (2000-2030) by technology NiCd, NiMH & Li-ion in M cells
- Worldwide Battery market for household devices (2000-2030) by technology NiCd, NiMH & Li-ion in MWh
- Battery suppliers
- The NiMH Battery market for Household devices, 2000-2030 (M cells, US\$/Wh, MWh & MUS\$)
- The LIB Battery market for Household devices, 2000-2030 (M cells, US\$/Wh, MWh & MUS\$)
- Worldwide Battery market for household devices (2000-2030) by technology, in value (MUS\$), 2000 - 2030

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MODULE 6: Security Lighting

- Worldwide battery market for Emergency Lighting
- Characteristics of Emergency Lighting Systems
- Batteries for Emergency Lighting
- NiCd Vs. NiMH for Security Lighting?
- Security lighting systems market 2000-2021
- Battery market in MWh 2000-2021
- The NiCd battery market 2000-2021, in volume (M cells)
- The NiCd battery market 2000-2021, in value (MUS\$)

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MODULE 7: Stationary applications-ESS

- The worldwide battery market 1990-2021
- The worldwide battery market in 2021 in B\$
- Total potential market (M\$, Pack level)
- Market segment synthesis template
- 1- STATIONARY: TELECOM MARKET LIB: in B\$ in 2021 & in 2030 – CAGR₂₁₋₃₀
- 2- STATIONARY: UPS MARKET LIB: in B\$ in 2021 & in 2030 – CAGR₂₁₋₃₀
- ESS power generation system under major transformation
 - The power system is under major transformation requiring more flexibility and interconnection to optimize energy resources
 - US, Europe, Japan and Islands are leading the development of Energy Storage
 - However, need for storage will be only required when renewable energy reach very high share of the power generation mix
 - New stationary energy storage usages will still be limited in 2030, especially when compared with other markets
- Stationary applications-ESS market segmentation
 - Services provided by Energy Storage System (ESS)
 - Regulation services aims at reconciling momentary differences caused by fluctuations in generation and/or loads
 - Arbitrage services aims at storing energy off peaks and releasing it during the peak hours
 - Back-up and reserves services provide emergency power when utility power is not available
 - Black-start storage provides an active reserve of power and energy to autonomously start alternative power generator
 - ESS can enable to defer infrastructure investments by levelling loads peaks with limited recurrence
 - Grid independent power services use hybrid systems that usually couple generation means with energy storage
 - Applied along the value chain, ESS services generate 20 market segments
- Stationary applications-ESS market dynamics
 - ESS have grown by 2% p.a. over 2010-2021, dominated by Hydro storage capacities
 - ESS market will remain dominated by Hydro (90%); Non Hydro ESS will enjoy CAGR between 3% & 12%
 - New storage capacities are expected to reach ~60GWh/year with \$12bn sales in 2025
- Stationary applications-ESS market requirements
 - Segments require specific performance that can be mapped along 8 main parameters
 - On structuring parameters: discharge time and average power, segments highlight different patterns
 - Many players are competing in the market, most being specialized by technology
 - ESS are demanding a broader range of performance compared with automotive or consumer goods
 - Automotive and ESS market has different development needs, main unmet needs for ESS being long term functionality & cost
 - ESS providers will have to adapt their products to end market specific needs
- ESS technical solutions

- To match the performance range of ESS, various technologies exist: mechanical, chemical, electro-chemicals and others
- Mapped on discharge time and power, technologies will appear suitable for certain segments only
- Technologies have specific performance along the main parameters that will make them suitable for specific segments (1/2)
- Technologies have specific performance along the main parameters that will make them suitable for specific segments (2/2)
- Automotive players are pushing for 2nd use, but several drawbacks question feasibility and economical viability
- Some technologies are unlikely to be mature before 2030 as Li-S, Metal-Air or fuel cells
- ESS market & forecasts
- ESS global market
- Li-ion battery market forecasts 2000-2030

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- Main Hoverboards makers
- Hoverboards & Safety: UL certification compliance
- Hoverboards market players in 2021
- The LIB market for Hoverboards 2015-2030 (M cells, Price US\$/cell, MUS\$ & MWh)

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- Drone market and forecasts 2015-2030
- Major Drone suppliers
- Worldwide Drones market in value 2018-2024
- Drones market: revenues market share by application, Worldwide in 2021
- Drone market share in volume: DJI is dominating the market by far
- Drones market – Value chain and players involved
- Batteries for Drones: Depending on the segment, Battery specification are really different
- Batteries for Drones: Depending on the segment number of battery / device is very different
- Battery market for Drones: Number of pack needed / Battery needs (MWh)
- Battery used for drone

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- Low Speed Electric Vehicles: 6-8 hours for an electric three-wheeler to get charged to run for around 40 miles of range
- Worldwide LSEV unit shipment 2015-2030
- Low Speed Electric Vehicles Sold in China and outside China 2015-2030
- Low Speed Electric Vehicles in China by technology
- Low Speed Electric Vehicles outside China by technology
- Low Speed Electric Vehicles market players in 2021: Terra Motors, Zero Motorcycles, Changzhou Yufeng Vehicle, Jiangsu Kingbon Vehicle, Hero Electric Vehicles, Jiangsu East Vehicle Manufacturing, Shandong Zhidou Electric Vehicle, ...
- Low Speed Electric Vehicles energy needs per device
- In China, Low Speed Electric Vehicles energy needs are huge in GWh 2015-2030
- Battery used for Low Speed Electric Vehicles: Lead Acid, LFP, Li-ion
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