

March, 28 March 2022

## **ETA-Leveling enables second-life battery applications with “pick-n-mix” cells connected in series**

**Operating battery cells connected in series – from different manufacturers, of different ages, and at different nominal capacity: ETA-Leveling makes it possible. It is the only charging process available enabling the simple reuse and repurposing of, for example, cells from power storage modules declared defective.**

It goes without saying that completely randomly combined cells do not represent a useful second-life application. However, it has been demonstrated that such cells can be connected and operated in series and leveled using the straightforward ETA-Leveling process. This has been labelled disruptive – justifiably so – and can be completed in as little as a few hours. The resulting “patchwork battery” can be operated long-term without any issues. During charging, each cell is treated as if it was part of a single-cell battery application – thanks to efficiency leveling. This disproves the long-held assumption that the cells within a battery block need to be as identical as possible, and that even minor differences complicate or impede operation.

### **No more recycling unless a battery is actually defective**

In light of large numbers of discarded battery modules piling up in manufacturer’s storage facilities and many more returning items that will join them in the years to come, this can be considered a revolutionary technology. Depending on a module’s designated application, it can retain as much as 80 % of its original capacity. Its current capacity results from individual, prematurely aged cells that unbalance the block and by doing so cause the actual defect. This means that the weakest cell within a module determines the entire block’s capacity. In turn, this translates to most of the cells within discarded battery blocks still being in excellent condition – or at least too good to recycle them. ETA-Leveling makes it possible to connect and operate very different cells in series: the first-of-its-kind, easy solution to continue to use these cells. “Up until recently, we ourselves would’ve never thought that combining cells randomly would work. It has not been possible with any of the traditional BMS,” says Frederik Fuchs, Managing Director of Benning CMS Technology. “Manufacturer, age, nominal capacity, cell chemistry – it really doesn’t matter. Our leveling process also recognises which cells are a reasonably sensible match based on their capacities. We then combine these cells to a long-lasting battery block that works perfectly.” This unlocks unprecedented opportunities for reusing discarded battery modules. Whether the aim is repurposing or processing to varying degrees (refurbishment, reconditioning, remanufacturing) – all possible scenarios become significantly more simple.

Licences for ETA-Leveling, which is suitable for battery blocks of all kinds and requires no hardware changes, recently became available for purchase.

You can find more information at <https://cms-technology.de/en/>.

*((Vorspann & Fließtext: 3.169 Zeichen, inklusive Leerzeichen))*

**ETA-Leveling and what it can do**

The cells which cause a battery block to become defective have usually aged prematurely. This means that their state of charge (SoC) differs from that of neighbouring cells and that they have lost considerably more of their efficiency. This causes the block to become unbalanced. If these cells regularly exceed set cut-off limits in the upper or lower voltage range, they at some point prevent the entire block from being charged or discharged sufficiently. By this point at the latest, the entire block is discarded. ETA-Leveling targets various aspects of this process: When used as BMS in the first place, it prevents the premature ageing of cells and prolongs the lifespan of a battery block considerably. When used in defective blocks, this charging process can at best re-level the cells so that the block can continue to be used. ETA-Leveling is also suitable for second-life applications: "patchwork batteries", consisting of cells combined as desired, can be connected in series using this technology.

*((Infobox: 1.193 Zeichen, inklusive Leerzeichen))*

**About Benning CMS Technology GmbH:**

BENNING CMS Technology considers itself a battery system thinktank. Founded in 2017 as a start-up called Sybac Systems GmbH, the company has specialised in new developments of power electronics and charging processes for battery systems. All employees could already look back on a number of years developing and operating electricity storage systems when they founded the company. Industrie automation Energiesysteme GmbH has held 50% of company shares since spring 2019. It was within the framework of this cooperation that Q-Leveling became ready for series production. Its successor, ETA-Leveling, has been a marketable product since 2021, with the development team labelling it as disruptive technology due to it being the very first charging process tackling efficiency levels (hence the name ETA-Leveling – derived from the Greek letter "η", used in physics to denote efficiency). You can find more information at <https://cms-technology.de/en/>.

**Images:**

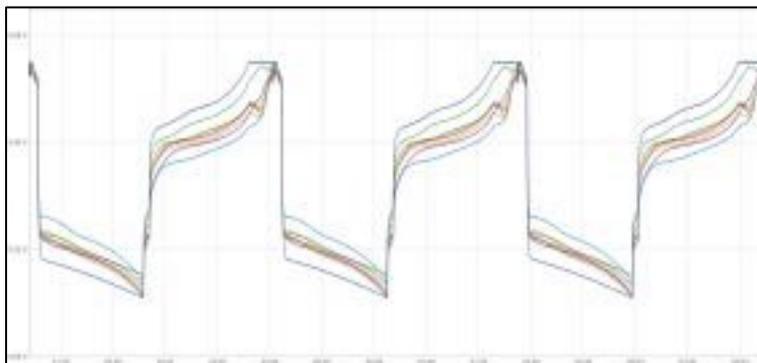
(Please note, this is screen resolution only. To request print resolution quality, please contact [batterie-leveling@pr-hoch-drei.de](mailto:batterie-leveling@pr-hoch-drei.de).)



**Image 1:** A “patchwork battery” operated using ETA-Leveling: All cells are used and some have been stored for several years; the largest cell has a capacity of 68.6 Ah, the smallest of 45.9 Ah.

cell #	manu- facturer	nominal capacity	actual capacity
1	Lishen	50 Ah	46,229 Ah
2	Winston	60 Ah	68,630 Ah
3	Lishen	50 Ah	45,938 Ah
4	Lishen	50 Ah	46,601 Ah
5	Lishen	50 Ah	46,601 Ah
6	HighPower	60 Ah	48,525 Ah
7	Lishen	50 Ah	46,216 Ah
8	Winston	60 Ah	66,914 Ah

**Image 2:** A “patchwork battery” operated using ETA-Leveling: 33 % capacity difference between the largest (68.6 Ah) und the smallest (45.9 Ah) cell.



**Image 3:** The “patchwork battery” is operated at 80% DoD (depth of discharge) of 45.9 Ah (smallest cell). This results in 36.72 Ah of usable energy (standard operation).

Image credits: BENNING CMS Technology GmbH

Please do not hesitate to contact us if you have any questions. If you had the opportunity to cover this information, we would much appreciate you sending us a link and/or a hard copy. If you are interested in an exclusive specialist article on the topic or a specific aspect of it, please reach out to us.

**Media contact:**

PR hoch drei GmbH  
Ramona Riesterer  
Turnhallenweg 4  
79183 Waldkirch

Phone: +49 (0) 7681 - 49 225 - 11  
[batterie-leveling@pr-hoch-drei.de](mailto:batterie-leveling@pr-hoch-drei.de)  
<https://www.pr-hoch-drei.de>

**Reader contact:**

BENNING CMS Technology GmbH  
Frederik Fuchs  
Am Untergrün 6  
79232 March

Phone: +49 (0) 7665 - 52 372 - 72  
[info@cms-technology.de](mailto:info@cms-technology.de)  
<https://cms-technology.de>