Enhancing the performance of pure lead batteries for cycle life in Renewable Energy Storage Applications

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Project: 101096033 — LoCEL-H2 — HORIZON-CL5-2022-D3-01

Agenda

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- Project Overview
- The Battery (technical specialities, layout)
- Tests, Results, highligthing PSOC service
- Summary

LoCEL-H2

https://locelh2.org/

RHYDE
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cea

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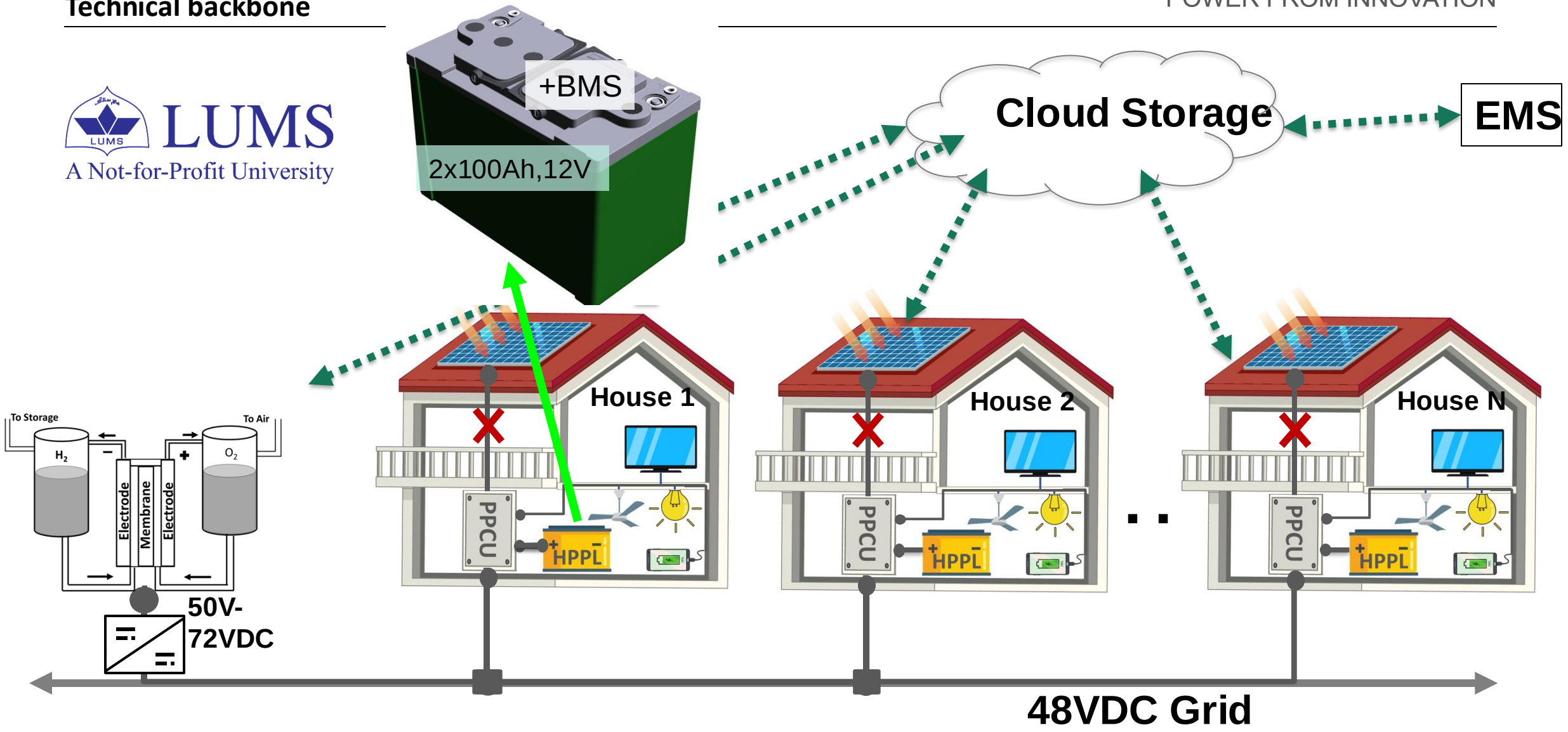
Hollingsworth & Vose® Creating a Cleaner World™

LoCel-H2, Work Package 4: LAB within the Microgrid

Technical backbone



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The HPPL Battery

Hoppecke premium product for Telecomunication and UPS market

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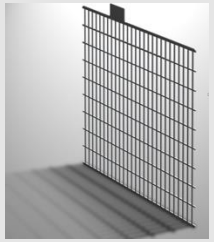
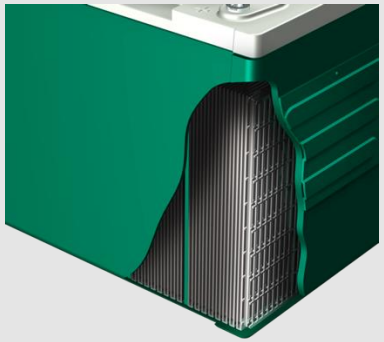
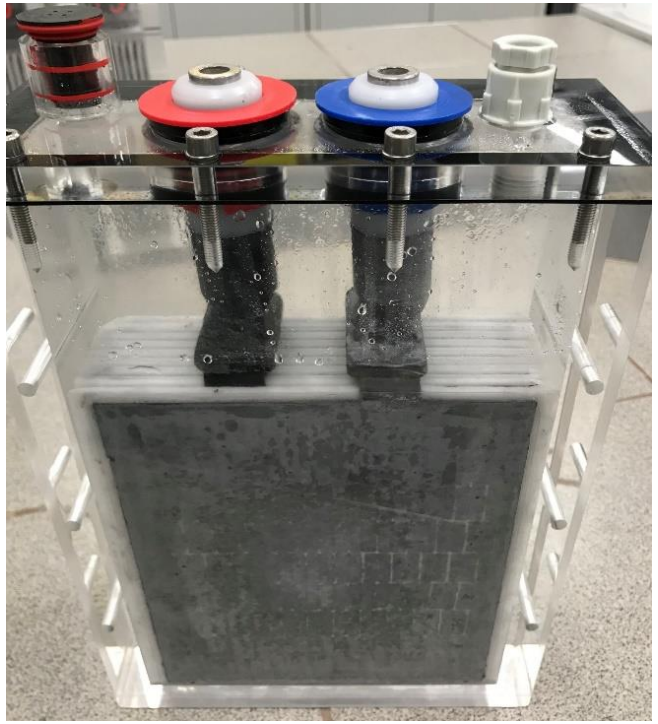
Sealed Lead Acid Battery in Thin Plate Pure Lead Technology

Large capacity range from
12V 50 - 170 Ah (TT) and
12V 100 - 200 Ah (FT)

Feature	Advantage	Benefit
Performance optimized continuously produced pure lead grid electrodes 	✓ Lowest corrosion rates ***LABAT 2021, Langer, Cattaneo, Riegel*** ✓ Minimized material consumption ✓ Low tolerance manufacturing	• Lower operating costs • Design Life 15 years @ 20°C, 10 years @ 30°C • Superior high current performance over service life
Thin plate technology 	✓ Higher number of electrodes in the given volume ✓ Low internal resistance despite high energy density: A very big advantage, especially at cold temperatures. ✓ Significantly more surface area, thus higher power density and faster chargeability	• Increased energy efficiency • Fast charging capability • Lower investment costs • High current capability and cycle stability

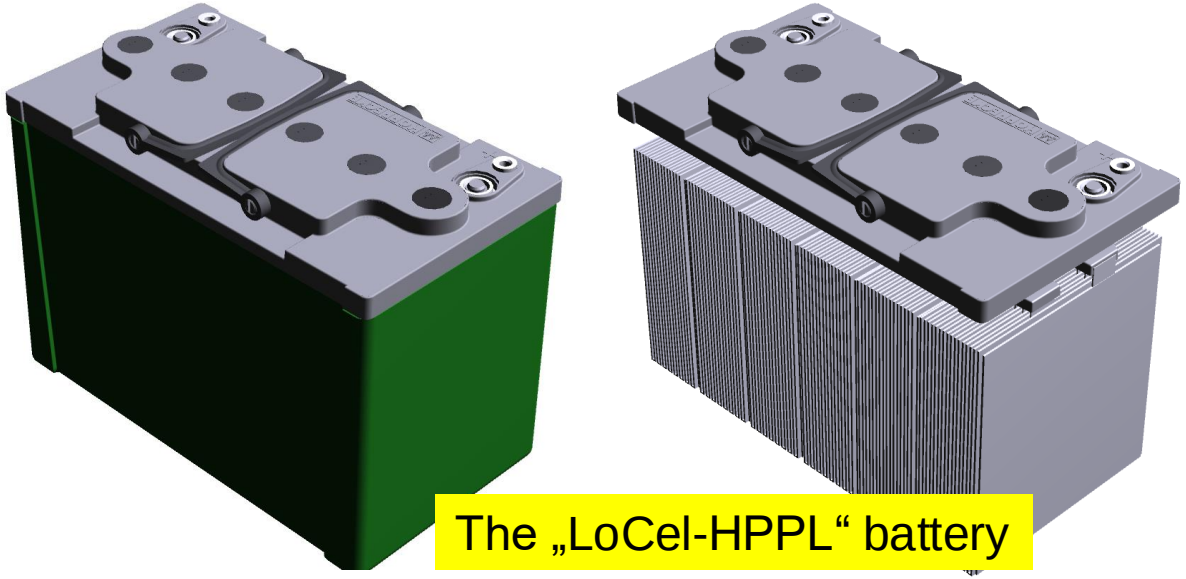
HPPL Battery for cyclic applications (e.g. photovoltaic)

Test Batteries and Single Cells appearance

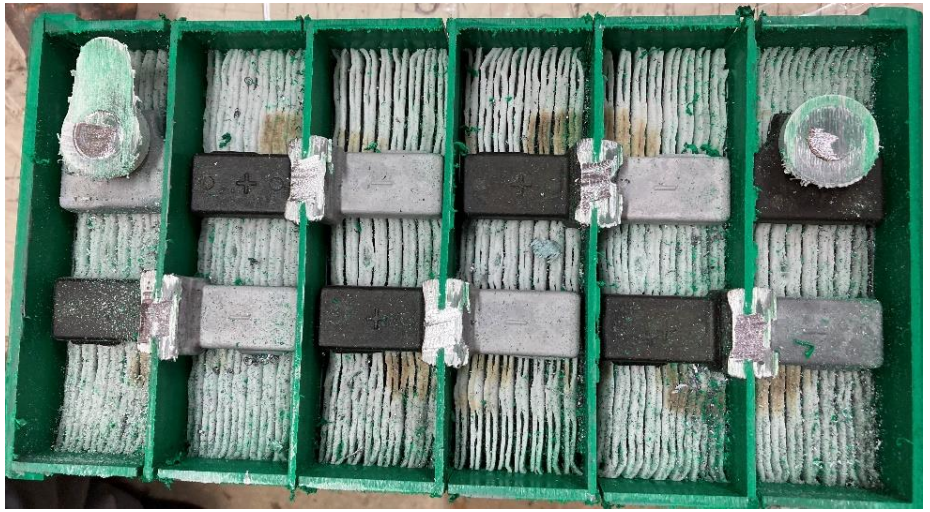


Same cell size as
in the bloc to the right

For: PAM recipe, NAM recipe
(Expander trials), Layout, AGM



The „LoCel-HPPL“ battery



HPPL Battery for cyclic applications (e.g. photovoltaic)

Layout modifications

		TT110 RP	**LoCel-battery**
	C_{10}	110 Ah	**100 Ah**
layout	pos / neg	08/09	**08/09**
grid dimension	height	168 mm	**168 mm**
ratio	PAM/NAM (fo dry)	1,28	**1,57**
electrolyte	density @20°C	1,335 g/ml	**1,320 g/ml**
spec. Capacity	pos	11,60 g/Ah	**15,53 g/Ah**
	neg	9,05 g/Ah	**9,89 g/Ah**
theoretical max PAM utilization	TMPU (acid consumed)	46,3%	**34,8%**
saturation, measured	100%	878 ml	835 ml

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LoCel-HPPL Battery

Test procedure and results for batteries

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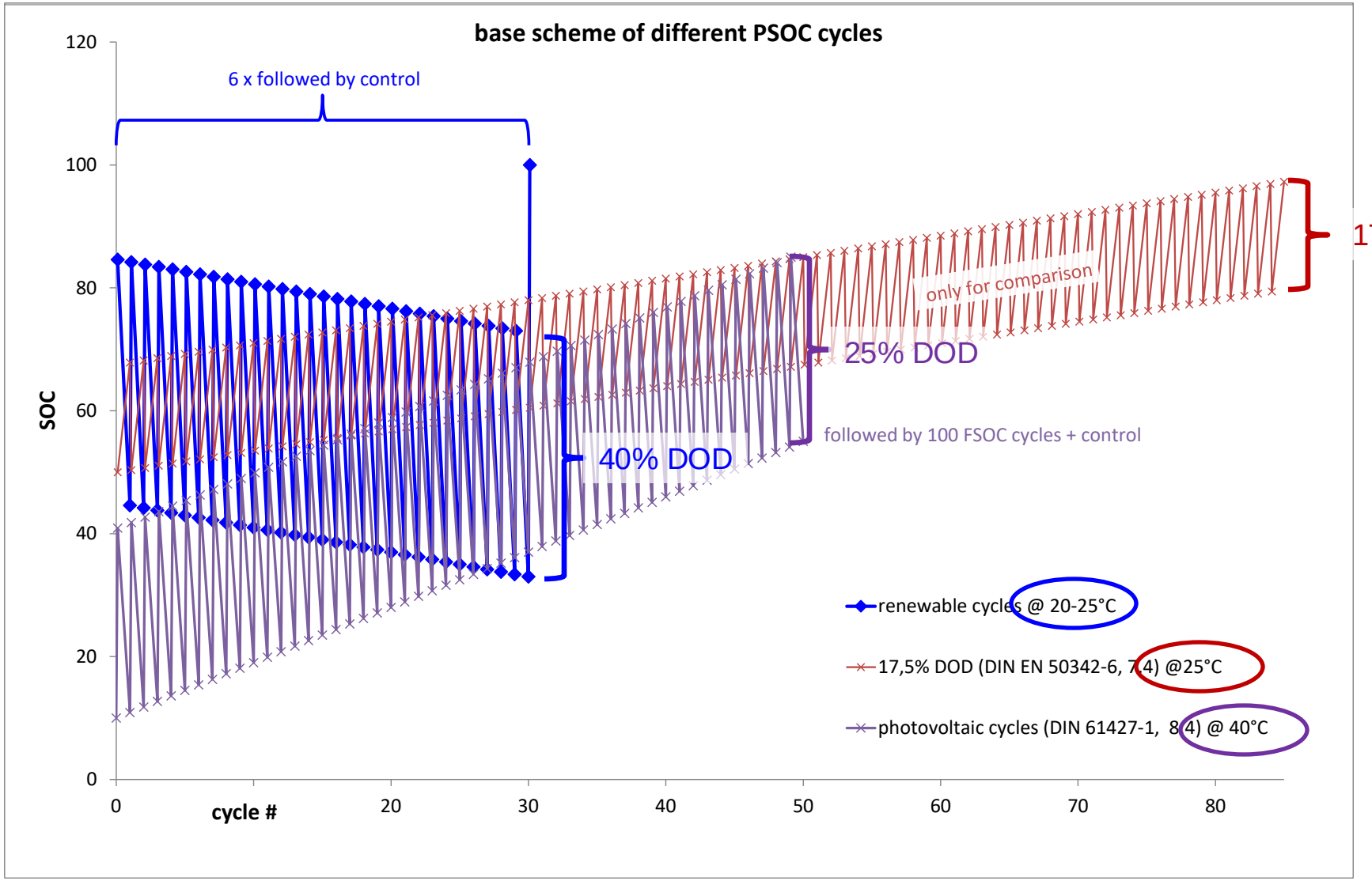
✓Test procedure defined (**in blue tests acc to internal standards**) and in evaluating with first prototyping batteries

To simulate	cyclability	PSOC	PSOC	High temperature, life time	Storage behaviour	Charge efficiency	Deep discharge
special test	70% DOD DIN 60254-1 cycling	Renewable Energy PSOC cycles	IEC 61427-1 (chapter 8.4) PV cycle endurance	corrosion acc. to IEC 60896-21 6.16 (55°C)	Self discharge, acc. to IEC 60896-21 (6.12)	acc. to IEC 62093 + adjustments	deep dch test (internal)
remark	@ 40°C	Prolongation of equalization cha	@ 40°C				10 x [3 x **(C_{10} ,1Vpc 12h rest)** + cha]
status	**100 cycles**	**5 simulated years**	**5. Unit C10~97%**	**6. Unit C3~104%**	**1% / month**	**> 97%**	**achieved**
progress	running	running	running	running	**done**	**done**	**done**

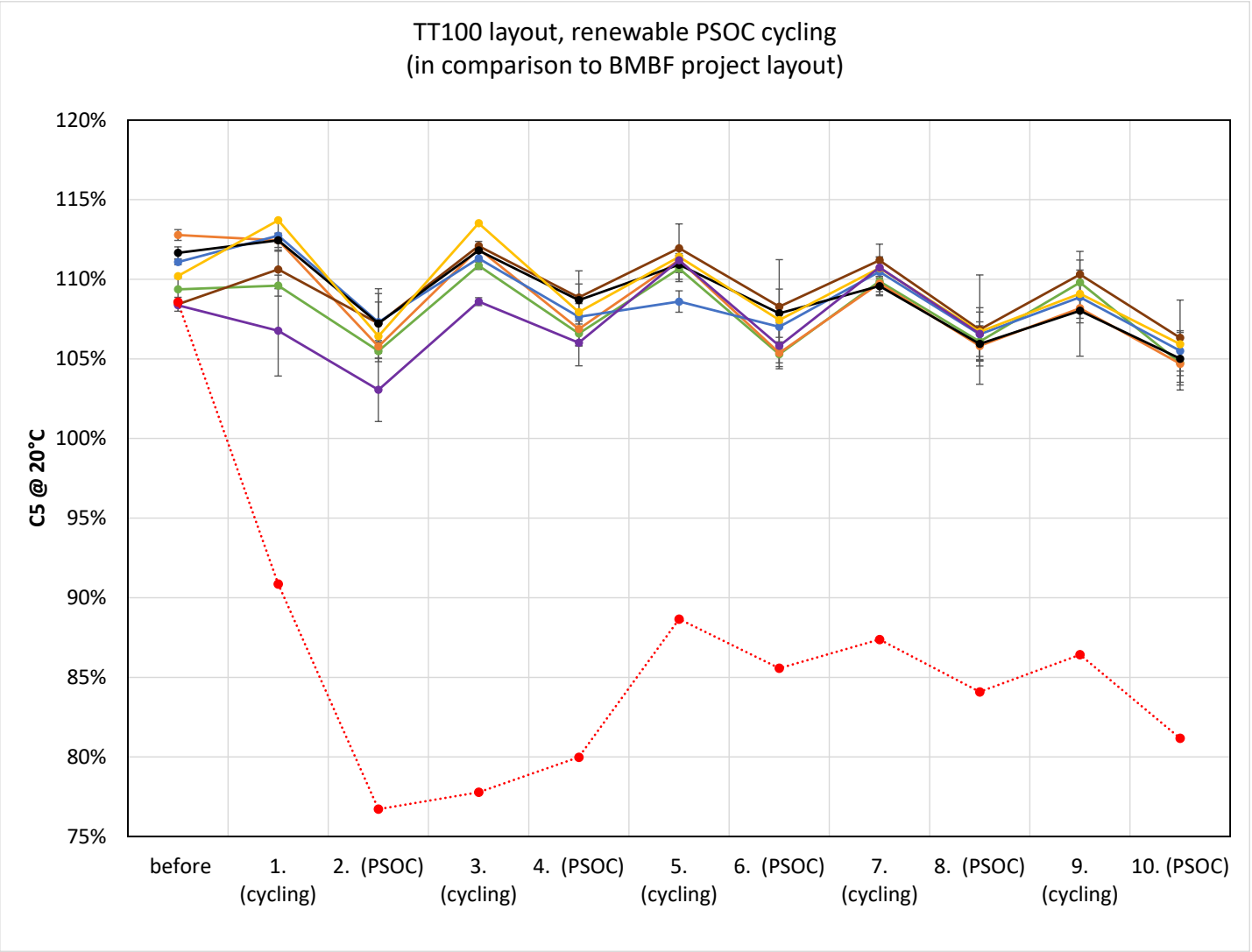
General

Different PSOC cycles



LoCel-HPPL Battery

PSOC cycling



Single cells different expander
1810 cycles, 720 FCE

LoCel-HPPL Battery

Influence layout

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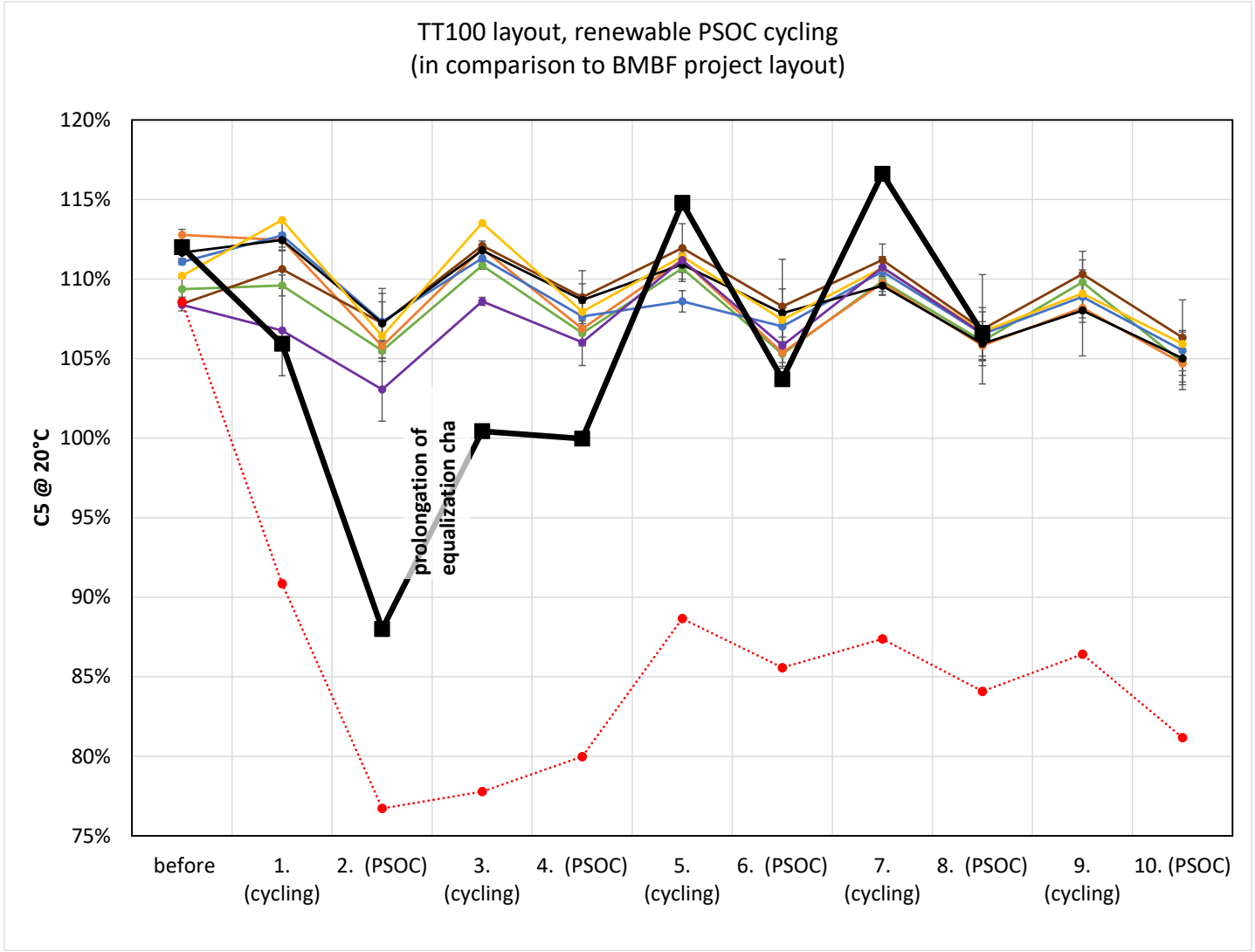
		BMBF project	**LoCel-battery**
	C_{10}	245 Ah	**100 Ah**
layout	pos / neg	12/12	**08/09**
grid dimension	height	238 mm	**168 mm**
ratio	PAM/NAM (fo dry)	1,77	**1,57**
electrolyte	density @20°C	1,335 g/ml	**1,320 g/ml**
spec. Capacity	pos	14,40 g/Ah	**15,53 g/Ah**
	neg	8,14 g/Ah	**9,89 g/Ah**
theoretical max PAM utilization	TMPU (acid consumed)	**43,0%**	**34,8%**
saturation, measured	100%	2225 ml	835 ml

LoCel-HPPL Battery

PSOC cycling



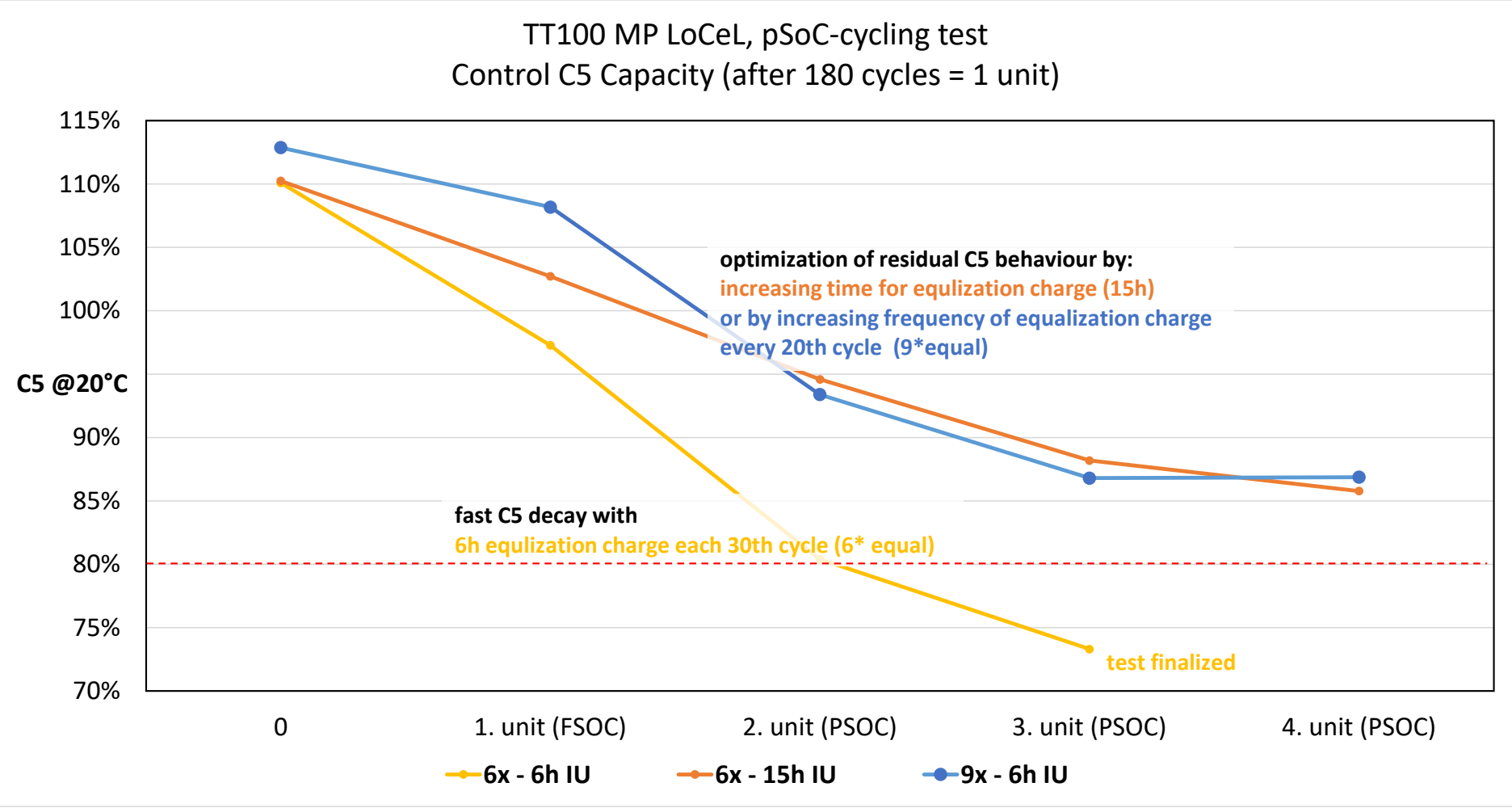
Single cells different expander
1810 cycles, 720 FCE

BMBF battery (former project)

LoCel-H2 battery, after 2.(PSOC): prolongation of equalization 6h→ 24h

LoCel-HPPL Battery

Influence equalization charge



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Summary

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- **Horizon Europe project LoCel-H2 with a prosumer plug-and-play Microgrid**
- **pure lead HPPL Battery as storage system with high circularity to be developed for renewable cycles**
- **Layout is significant for cyclability**
- **PSOC cycling regime was set closer to reality by a decrease of SOC during cycling and introducing regular equalization charges**
- **PSOC cycling result of LoCel-H2 battery can be optimized via more frequent and/or longer equalization charges**

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Thanks for your attention

We are pleased to answer your questions

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