

# RIMAC

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## ENERGY

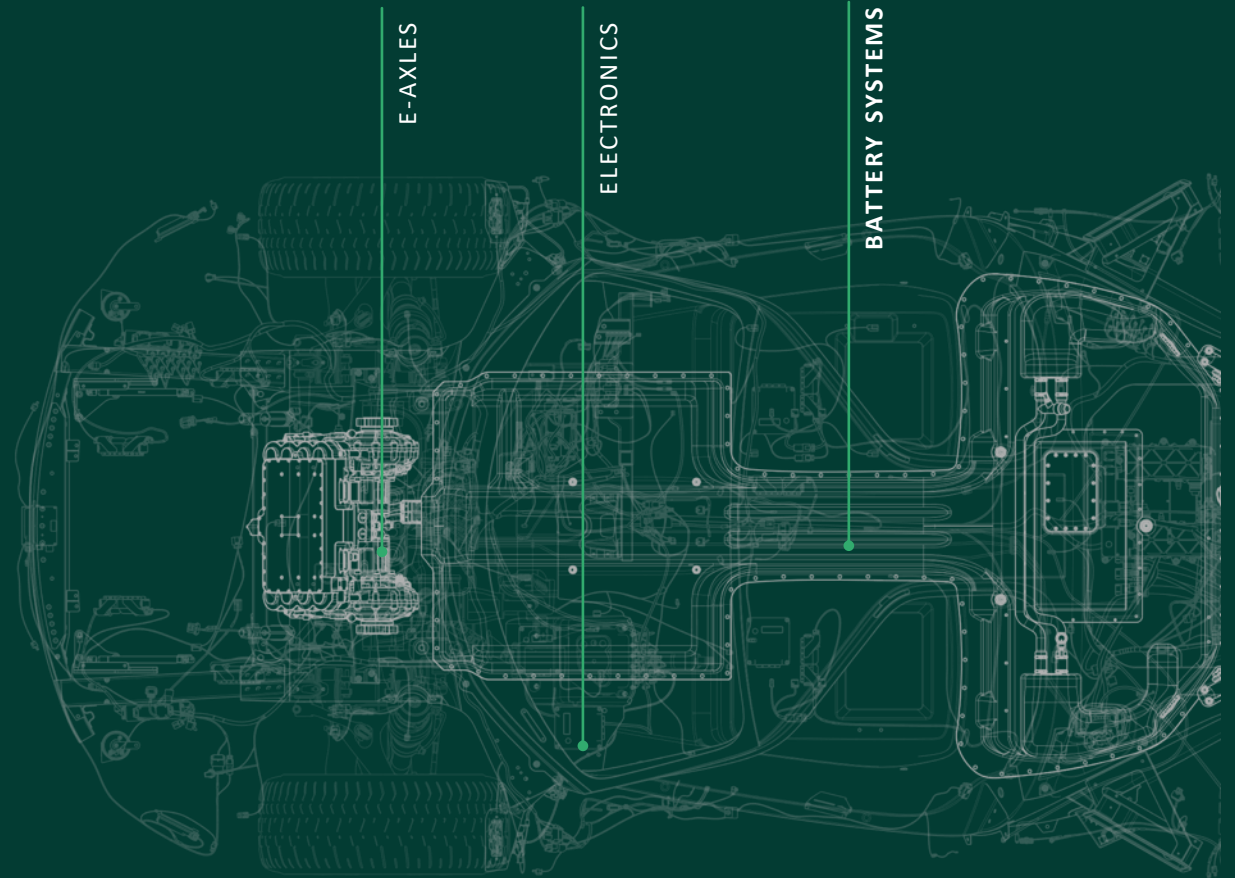
THE NEXT GENERATION OF  
ENERGY STORAGE SYSTEMS

01

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# RIMAC Group Introduction

# OUR ROOTS



HYPERCARS



Developing and building the world's most advanced hypercars.



EV TECHNOLOGY

Helping the car industry go electric by designing and producing key components for large OEMs.

# RIMAC GROUP: FACTS AND FIGURES

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15

YEARS IN THE  
MAKING

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13

LOCATIONS

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2200+

EMPLOYEES

---

1100+

ENGINEERS

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12

OEM CUSTOMERS

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30+

OEM PROJECTS

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29

WORLD RECORDS

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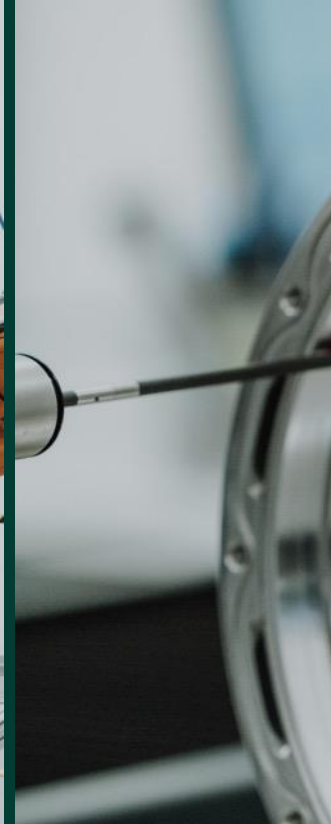
#1

INNOVATOR  
IN CROATIA

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# IN-HOUSE DESIGN AND MANUFACTURE



CONCEPT

DEVELOPMENT

RAPID  
PROTOTYPING

INDUSTRIALIZATION

VERIFICATION &  
VALIDATION

HOMOLOGATION &  
CERTIFICATION

SERIES  
PRODUCTION

# RIMAC LOCATIONS ACROSS EUROPE

**BERLIN  
(GERMANY)**



**ZAGREB & SVETA  
NEDELJA (CROATIA)**



**WARWICK  
(UNITED KINGDOM)**



**OXFORDSHIRE  
(UNITED KINGDOM)**



**MOLSHEIM (FRANCE)**

**BOLOGNA (ITALY)**



**SPLIT (CROATIA)**



**OSIJEK (CROATIA)**

# RIMAC CAMPUS

SIZE (m<sup>2</sup>)

100.000+

INVESTMENT (€M)

200+

PRODUCTION OPERATIONAL

Q2 2024



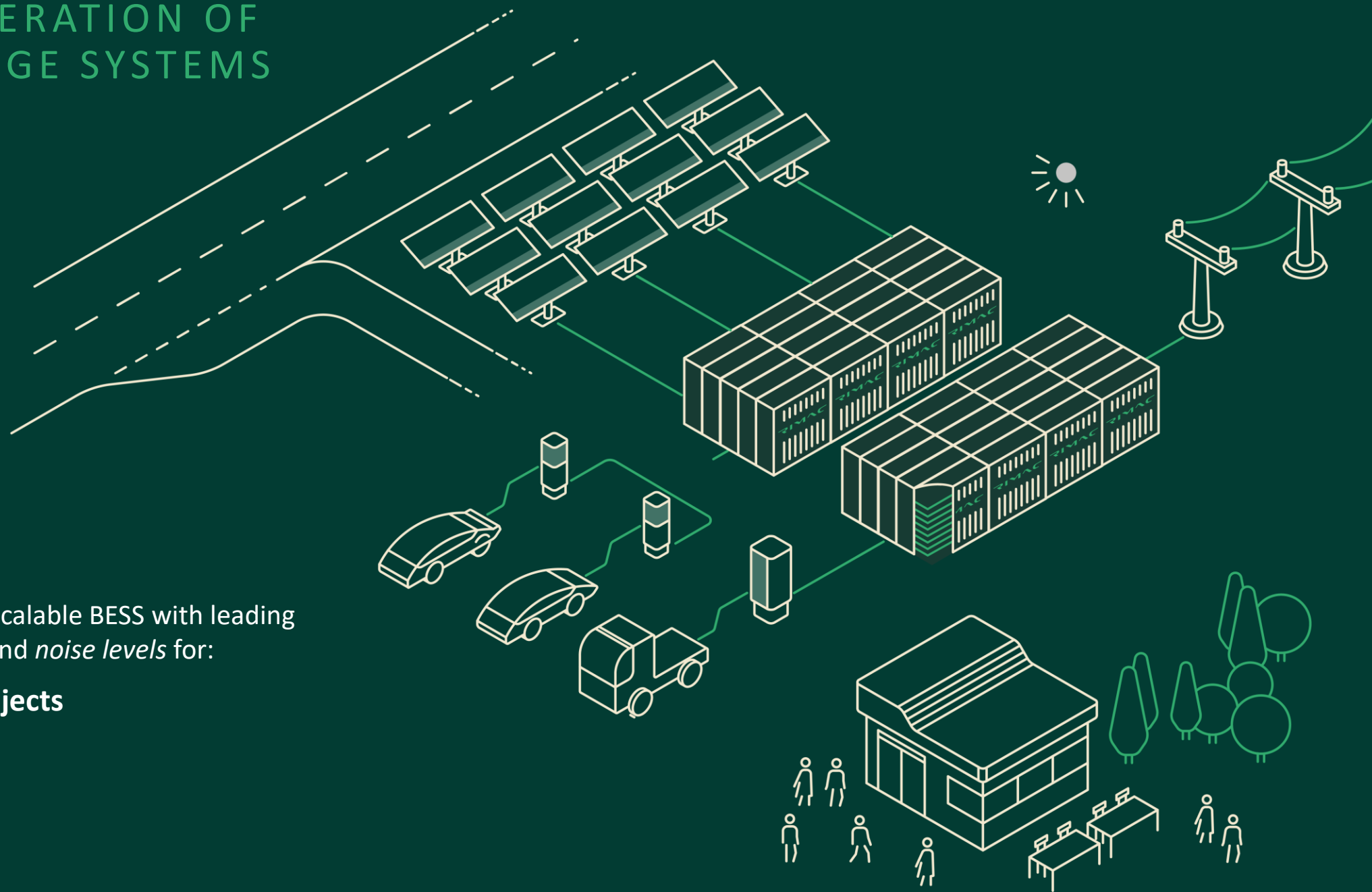
02

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# RIMAC ENERGY

## Introduction

# THE NEXT GENERATION OF ENERGY STORAGE SYSTEMS



Fully integrated and scalable BESS with leading *footprint, efficiency and noise levels* for:

- **Utility scale projects**
- **C&I projects**

# The most technologically advanced BESS in the world



**Fully integrated BESS**  
using modular multilevel converter



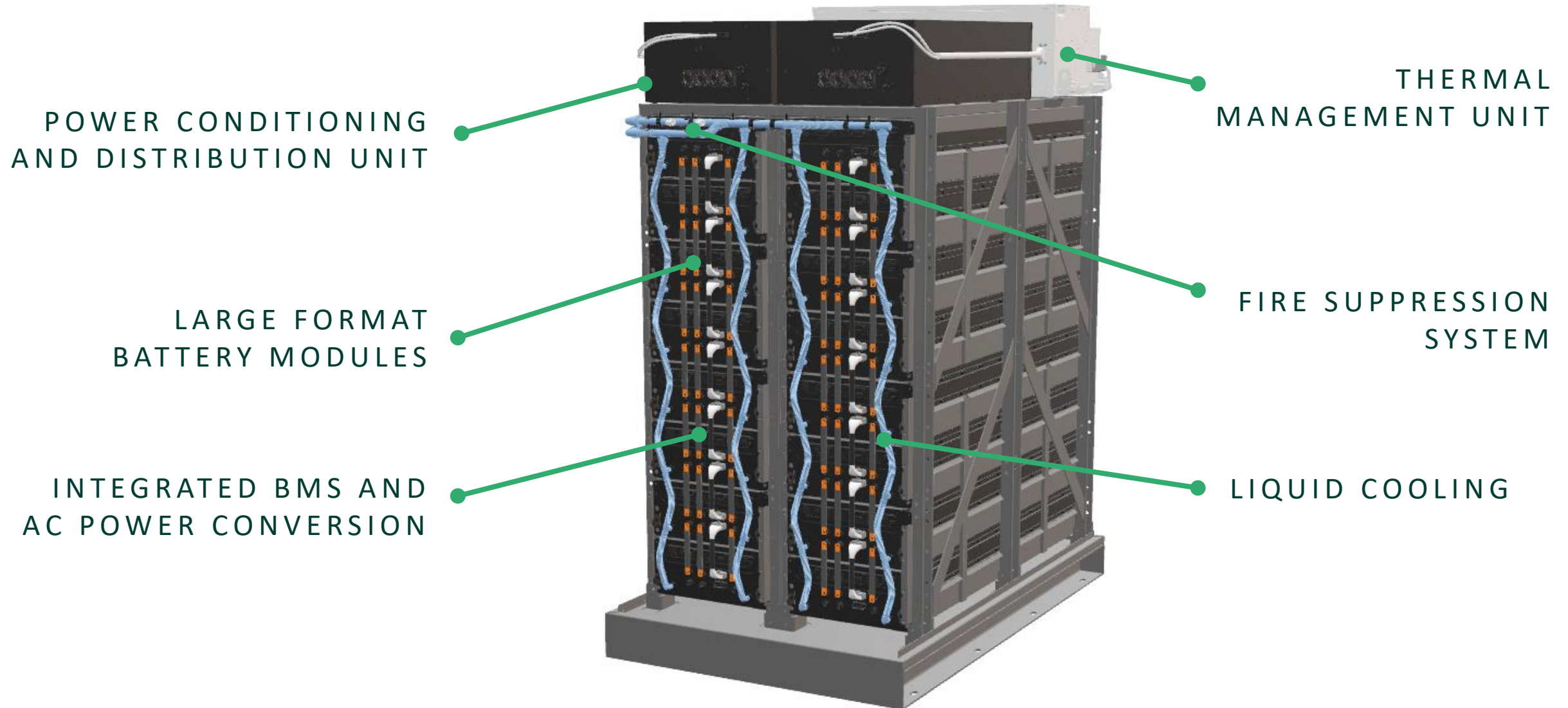
**Industry-leading**  
footprint and efficiency



**European**  
design, development and manufacturing



# FULLY INTEGRATED BESS PRODUCT



# INDUSTRY LEADING ARCHITECTURE

## RIMAC ENERGY:

830 kWh Stack  
3.0m<sup>2</sup> footprint



AC Stack Output  
Therefore no external inverter required



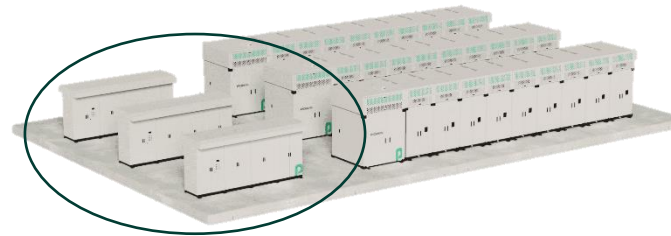
# VS

## COMPETITOR 1:

750 kWh Stack  
3.8m<sup>2</sup> footprint



DC Stack Output  
Additional central inverter(s) greatly increase overall site footprint



## COMPETITOR 2:

800 kWh Stack  
5.8m<sup>2</sup> footprint



**40%+**  
improvement in  
stack kWh/m<sup>2</sup>

**+ No  
Central  
Inverter**

## THE MOST TECHNOLOGICALLY ADVANCED BESS IN THE WORLD



### Most advanced BESS

- Fully integrated BESS using modular multilevel converter
- Class-leading footprint, efficiency and noise levels

### Experienced European partner

- European design, development and manufacturing
- Utilizing Rimac's automotive experience

# EUROPEAN

ENGINEERING

SUPPLY CHAIN

MANUFACTURING

JOB CREATION

CRITICAL ENERGY  
INFRASTRUCTURE



03

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RIMAC ENERGY  
SineStack

THE MOST TECHNOLOGICALLY ADVANCED BESS IN THE WORLD

# SineStack



**830 kWh - 400Vac OUTPUT - MODULAR & SCALABLE**

## Minimising Levelised Cost of Storage:

01

### Class-leading Footprint and Flexibility

- Fully integrated PCS and liquid cooling system
- Modular architecture enables simple scalability and augmentation

02

### Maximising Energy Efficiency + Energy Extraction

- Reduced switching losses through multi-level topology
- Maximum energy extraction through granular balancing

03

### Exceptional Lifetime

- Advanced SoH monitoring and prediction algorithms
- SoH balancing enabled through distributed inverter architecture
- Enabling 12000+ cycles lifetime

04

### Minimising System Downtime

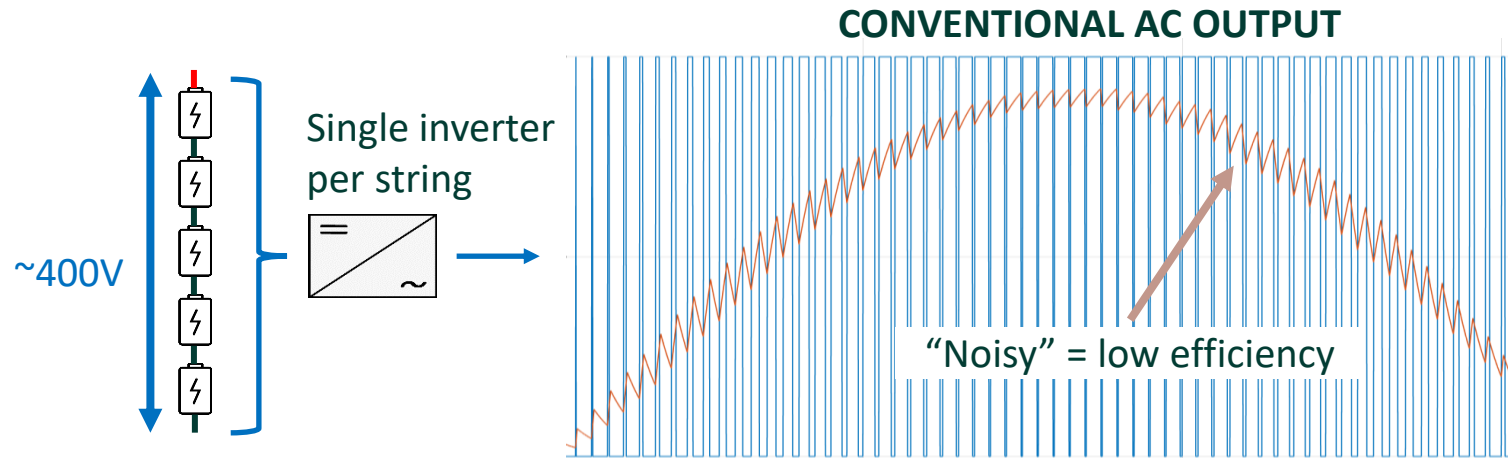
- Maximised system availability through highly redundant architecture
- Diagnostics without system downtime

05

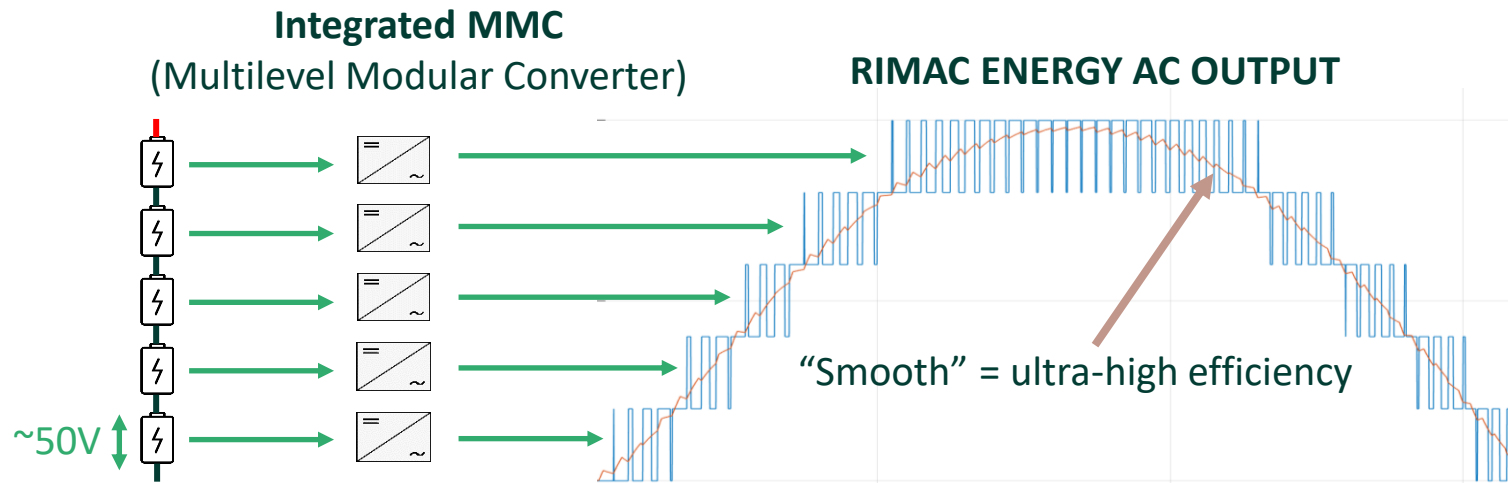
### Software Based Optimisation

- State-of-the-art Lifetime Optimiser – up to 30% more revenue over life
- Continuous optimisation with Over-the-air software updates

# ROUND-TRIP EFFICIENCY



Low redundancy - large cell-block lost if inverter fails



High redundancy – no interruption to output if small cell-block is bypassed

## How does RIMAC Energy MMC improve efficiency?

- Use of low voltage MOSFETs  
→ ultra-low switching losses
- 8-level MMC architecture  
→ improved power quality with inherently low harmonics
- Significantly reduced filter size  
→ lower losses, space and cost
- Lower heat rejection  
→ closer integration, lower Aux loads and part-count reduction

>92%

Round-Trip Efficiency

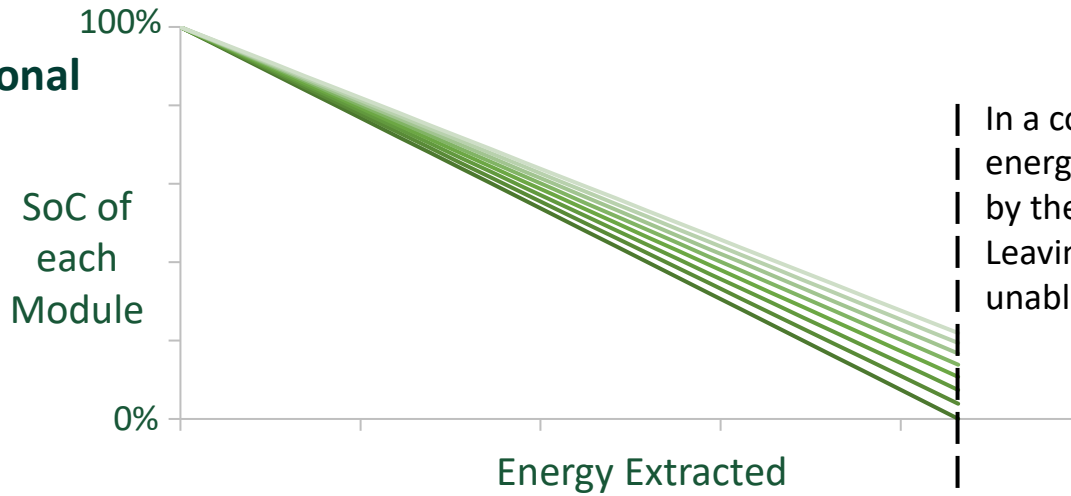
# MAXIMISING ENERGY EXTRACTION AND LIFETIME



## SoC Balancing

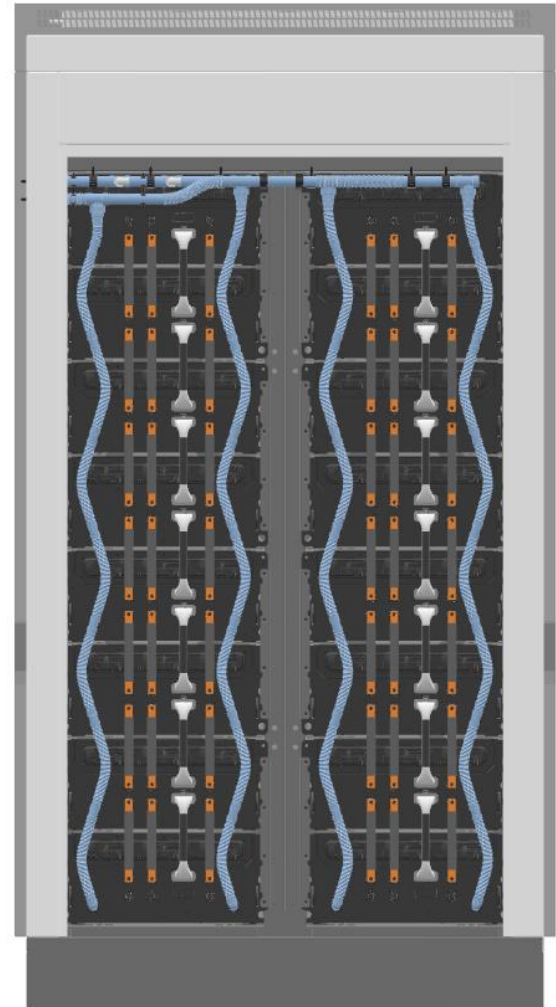
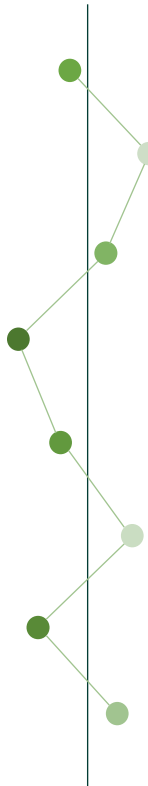
SoC across modules can be actively balanced to maximise energy extraction.

### Conventional System

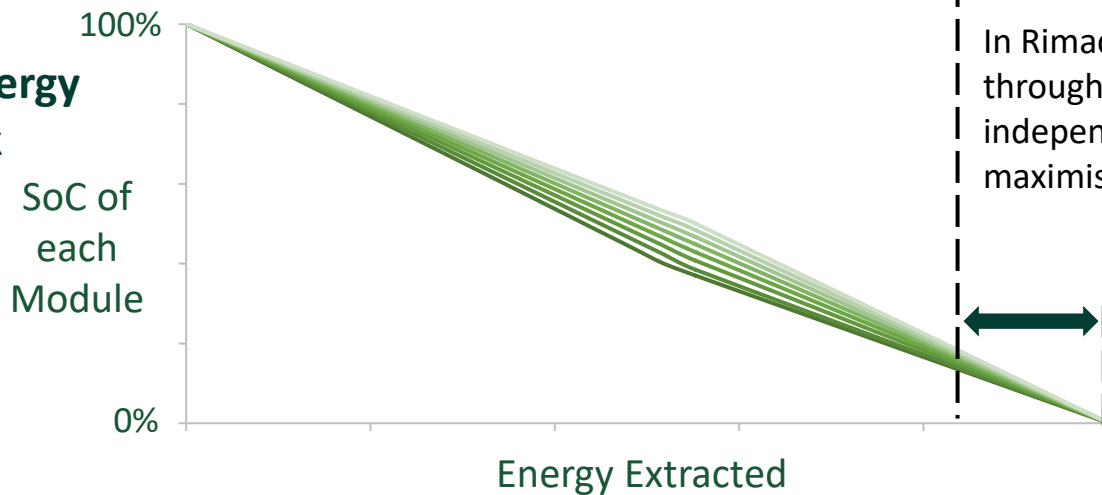


In a conventional system energy extraction is limited by the weakest module. Leaving some modules unable to discharge fully

### Current Output per module



### Rimac Energy SineStack



In Rimac's system the current through each module can be independently adjusted to maximise energy extraction

**+7% Usable Energy\***

\*based on competitor's data, not validated by Rimac

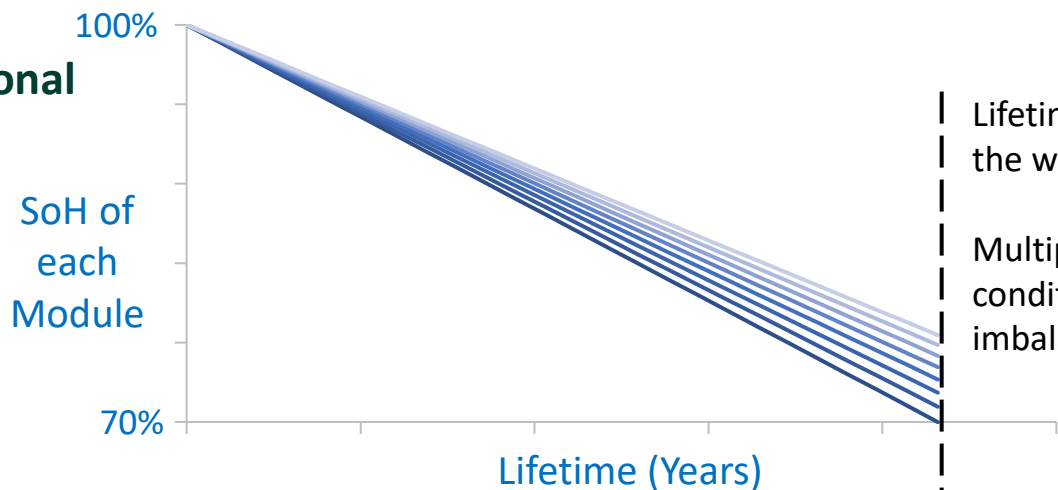
# MAXIMISING ENERGY EXTRACTION AND LIFETIME



## SoH Balancing

Modulation control also used to balance State of Health over lifetime so that all modules hit the end-of-life capacity limit at precisely the same time

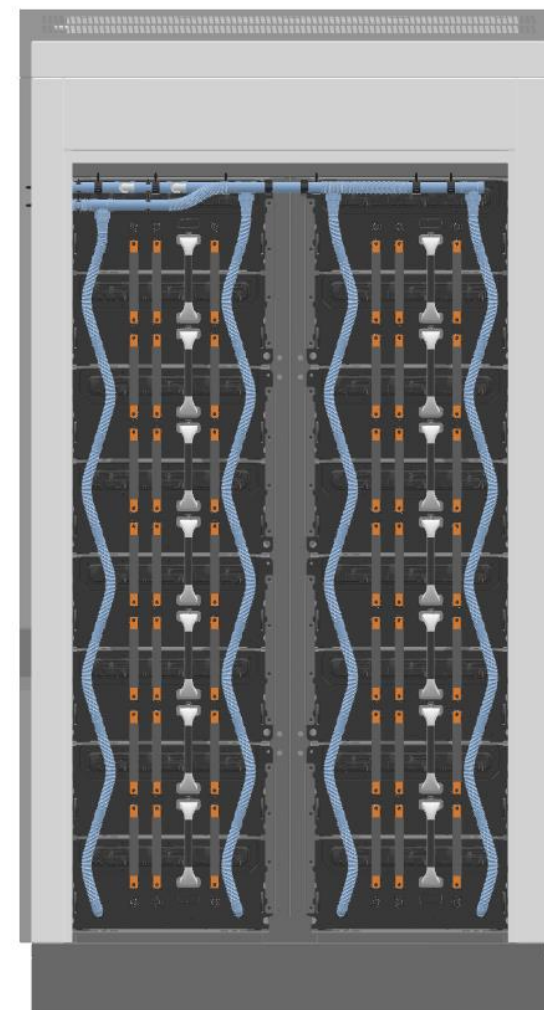
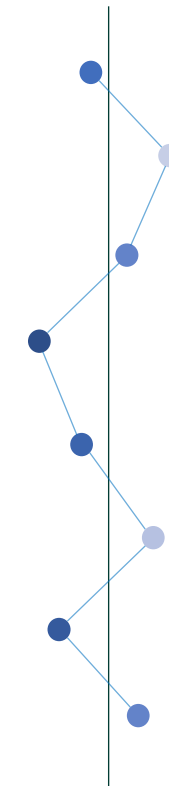
### Conventional System



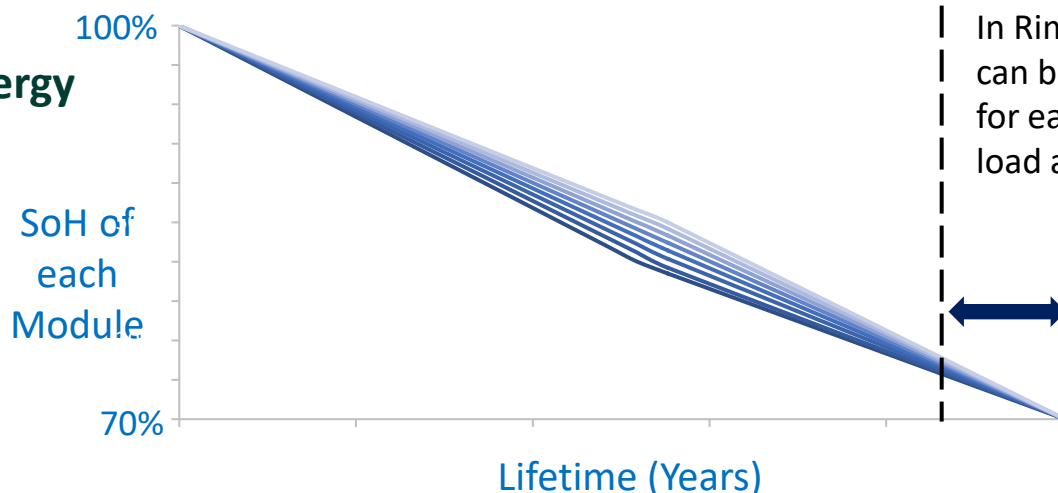
Lifetime is generally limited by the weakest module.

Multiple factors such as thermal conditions will result in aging imbalance between modules

### Duty Cycle per module



### Rimac Energy SineStack



In Rimac's system degradation can be managed independently for each module by adjusting load and duty cycle conditions

Along with other innovations this enables:

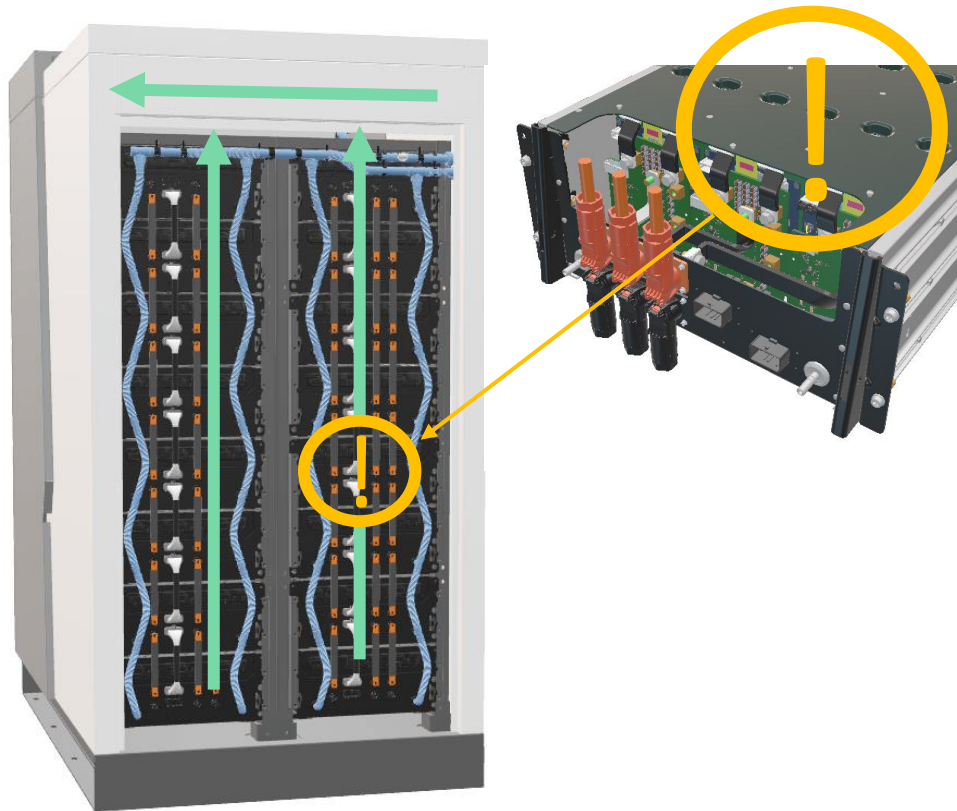
**>12,000 cycle lifetime**

## MINIMISING DOWNTIME



### Module Level Redundancy

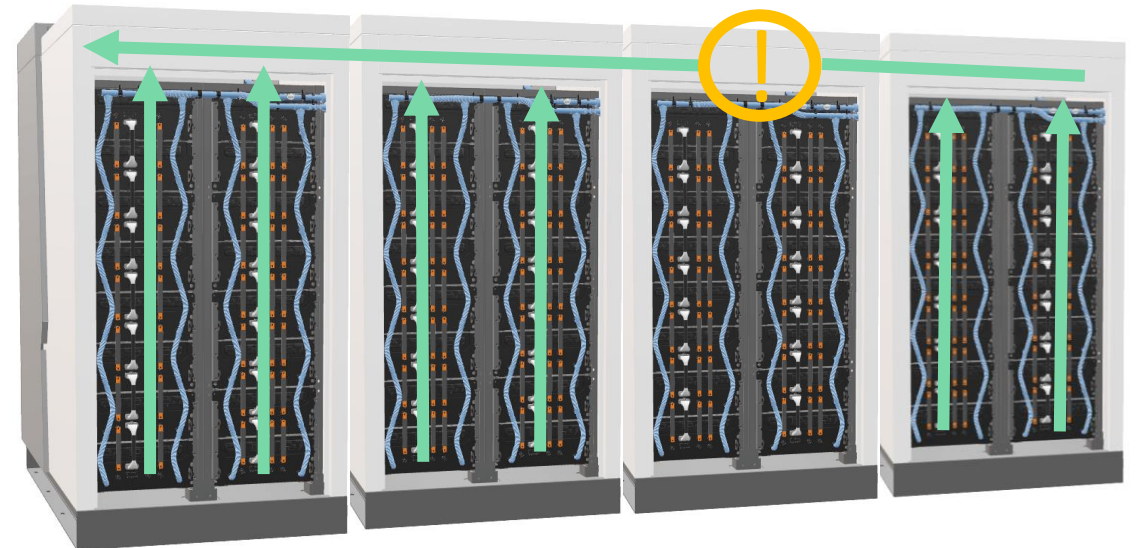
If one module encounters an error, it can be bypassed automatically by the control system, with no impact on system performance.



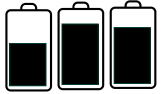
### Stack Level Redundancy

Similarly, if multiple modules or an entire rack encounter errors, the system can still bypass that rack and continue operation.

In the meantime, the bypassed stack can run diagnostics in the background



# ELEVATING BATTERY MANAGEMENT



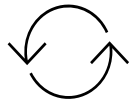
## Enhanced management in cell to cell variation

- Each cell will have its own unique model
- Each cell will have dedicated SOX algorithm



## Enhanced cell degradation control

- Frequently update cell parameters to adapt to aged cells
- Captures capacity loss & DCIR growth



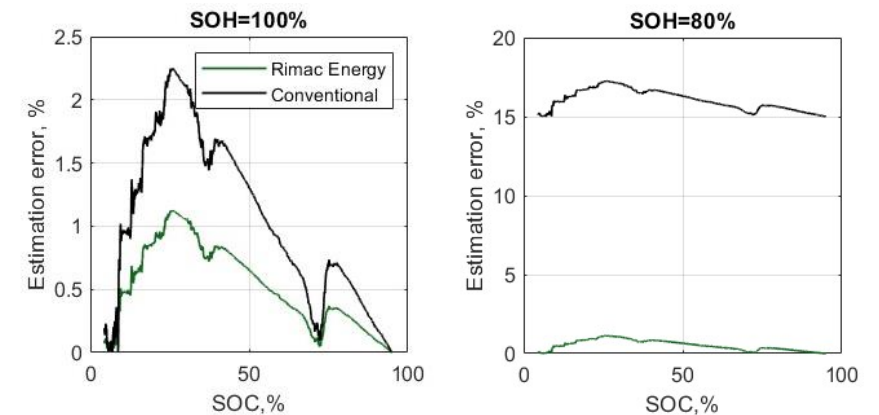
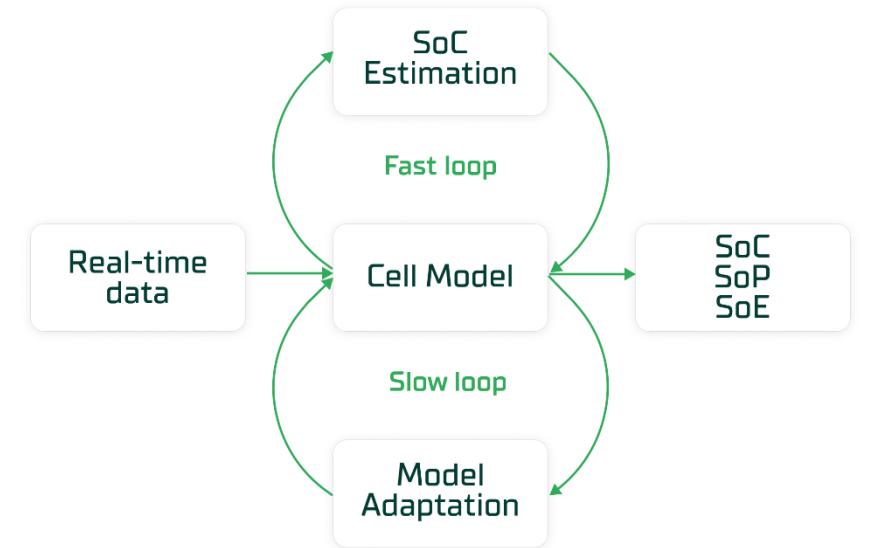
## Enhanced self-adaptability

- Enables precise control to maximise energy throughout & lifetime
  - Adaptive balancing strategy
  - Adaptive power derating strategy



## Continuously improved accuracy

- Maintains highest accuracy throughout lifetime, while the accuracy of conventional methods deteriorate over time



# RIMAC ENERGY OPERATING PLATFORM

## Control & Analytics



Live & Historic data  
 Site & multi-site analytics  
 Remote and Local user interface  
 Commands  
 Events

## Predictive Health, Anomaly Tracking & Optimization

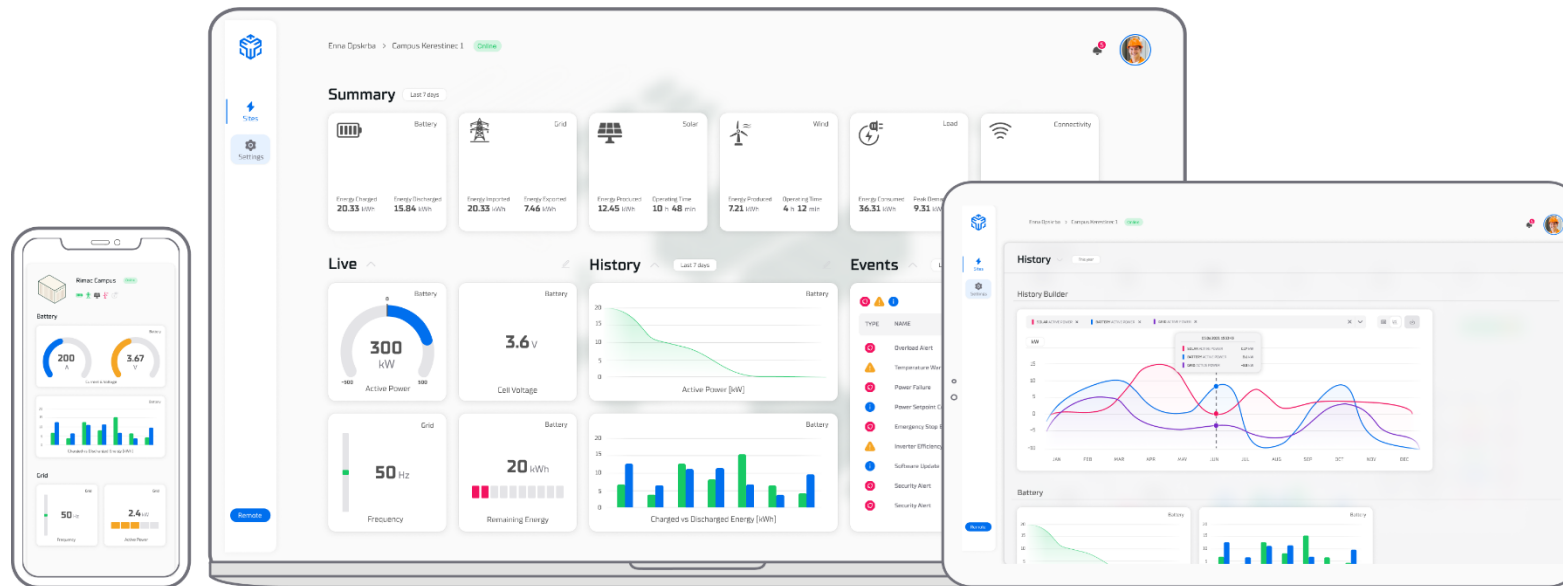


Anomaly models  
 Charge Cycle optimization  
 Battery State of Health prediction  
 Remaining Battery Useful Life calculation  
 Degradation cost estimation

## Optimized Dispatch & Investment Navigator



Energy market trend analysis  
 Energy price prediction  
 Demand forecasting  
 Real-time response to grid demand  
 Energy trade execution on energy exchange



# Operating Platform

## EMS Software Stack

## SUMMARY SPECS



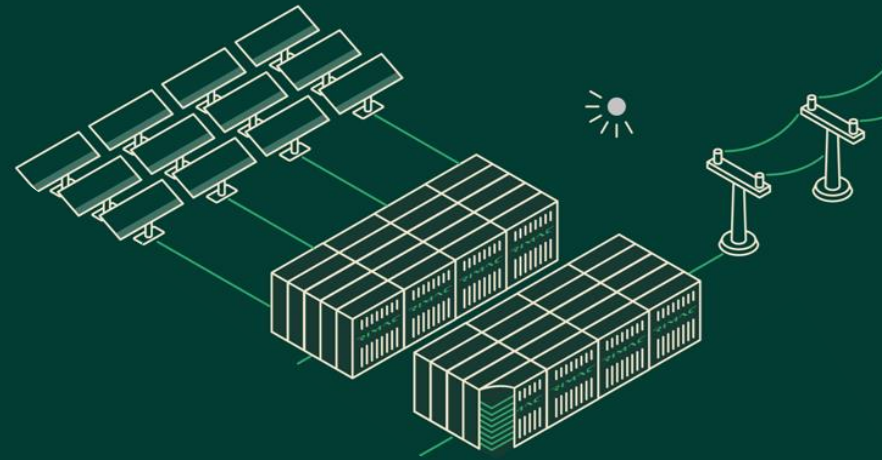
Rated Energy Capacity	830 kWh
Voltage Output	3 Phase AC – 400 Vac
3-Phase AC Voltage Range	320 Vac - 480 Vac
Nominal P-rate	0.5 [2 hour system]
Stack Rated Apparent Power	420 kVA [2 hr system]
Adjustable power factor	-1.0 to +1.0
AC Round trip efficiency at BOL [0.5C]	>92%
Max. THD of current	3% @ rated power
Dimensions per stack [H x L x W]	2650 x 2150 x 1420 mm
Operating temperature	-30 – 50 degC
Coolant type	Water/Glycol
Cycle Life [25 degC, 0.5P, 70% SoH]	Up to 12,000 Cycles at 95% DoD
Cell Chemistry	LFP

## RIMAC ENERGY OFFERING



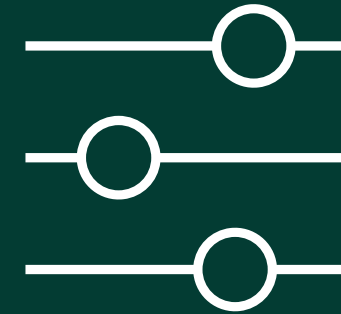
## TECH PROVIDER

- Rimac SineStack's
- Operating Platform
- Lifetime optimizer
- Advanced battery analytics



## TURNKEY SOLUTIONS

- Supply offering
- Site design
- EPC management

LONG-TERM SERVICE  
AGREEMENT

- Preventive and reactive Maintenance
- 24/7 System operation
- Extendable product warranties
- Performance guarantees

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# THANK YOU

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10431 Sveta Nedelja

**RIMAC**  
ENERGY