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**Sigenergy**

6 November 2024

8:30 am – 9:30 am | CET, Berlin  
3:30 pm – 4:30 pm | CST, Beijing  
3:30 pm – 4:30 pm | AWST, Perth

pv magazine  
**webinars**

# The impact of modularity on cost-efficiency of battery storage systems



**Tristan Rayner**  
Editor  
pv magazine



**Will Hall**  
Managing Director  
Sigenergy




**Thomas Hillig**  
Founder and Managing Director  
THERnergy



**Pontus Lindberg**  
CEO and Owner  
Inlandets Solenergi



# Welcome!

Do you have any questions?  

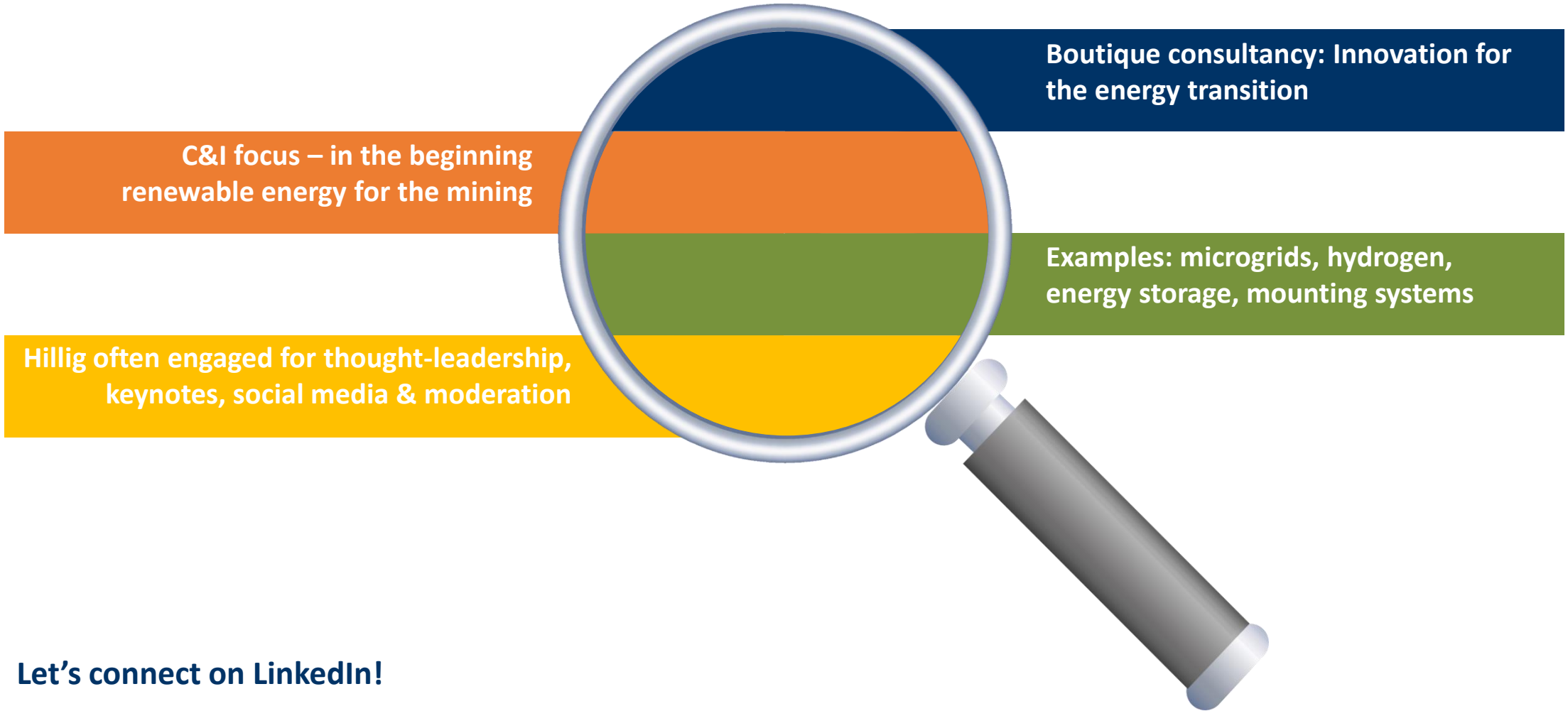
Send them in via the Q&A tab.  We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 

We'll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience.  

# About THEnergy



# Battery safety & costs: Pay now - or maybe later!

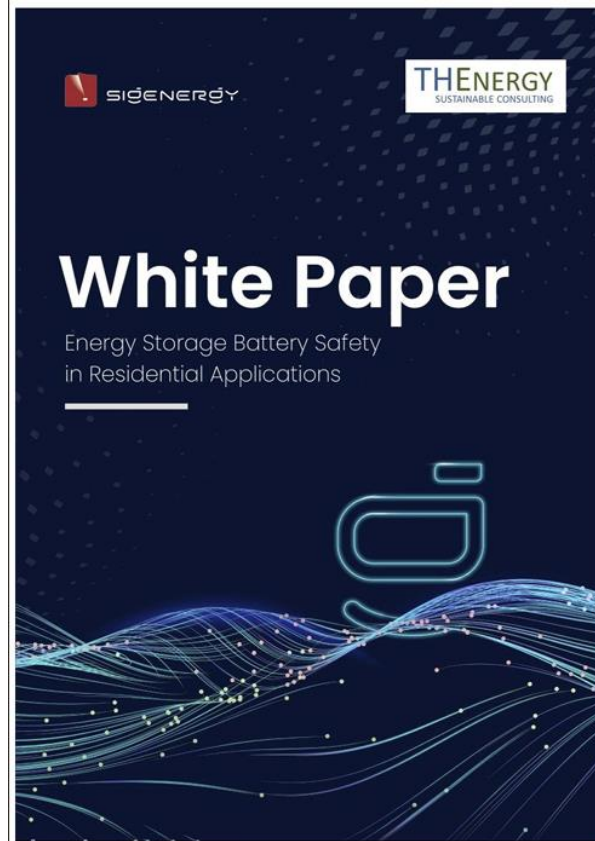


Location: France – Saint-Trivier-sur-Moignans  
Date: March 2023  
Application: Data center  
Owner: Maxnod  
Battery type: Li-ion  
System type: PV + energy storage  
Storage size: 2.3 MWh  
Cause: most likely thermal runaway



Location: South Korea, Gyeongsangbuk  
Date: January 2022  
Application: Military base  
Owner: South Korea National Guard  
Battery type: Li-ion  
System type: PV + energy storage  
Storage size: 1.5MWh  
Cause: most likely thermal runaway

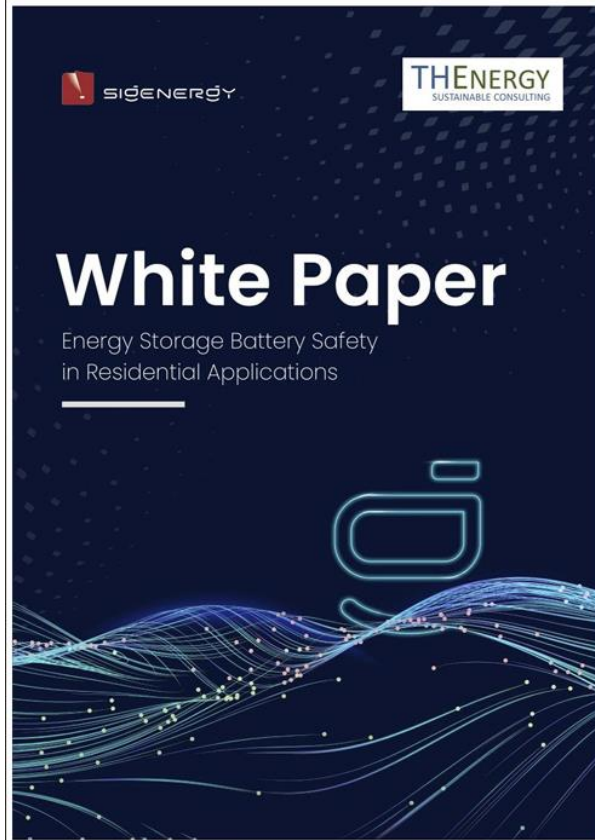
# Battery safety & costs: Pay now - or maybe later!



Pls scan QR-code with your phone to download the report



# Battery safety & costs: Pay now - or maybe later!



- Battery design
- Battery charging maps
- Overcharge protection
- Full charge cut-off strategy
- Thermal management
- Decompression valves
- Integrated fire extinguisher
- Protect devices on system level
- Manufacturing requirements
- Safety tests
- Certification
- App-based transparency



SIGENERGY



**pv magazine**

# Webinar

2024.11.6



# Innovative Modular Energy Systems for C&I and Utility





# The Hidden Challenges of Cabinet ESS Solution

1

Enormous impact  
of security incidents



Cabinet-level fire extinguisher,  
Thermal runaway will spread  
throughout the whole cabinet

2

AC-couple  
lower efficiency



AC coupling of PV and ESS,  
lower comprehensive round  
trip efficiency

3

Complicated  
installation



High environment requirements  
& crane needed,  
higher installation cost

4

Complex &  
Regular O&M



Multiple check items on  
cabinet ESS bring higher  
annual maintenance cost

# 1 Challenge in C&I ESS Solution

## Impact of security incidents is enormous



Two U.S. lithium-ion storage site caught fire for a week, causing smoke and plastic fumes, leading to school evacuations .

### Thermal runaway

Contributing Factors

**2 ESS site**

**7 days**

Fire extinguishing time

UK, Sept. 2020 <sup>1</sup>



The Liverpool BESS was of only 20MWh capacity housed in four shipping containers, one of which had exploded damaging its neighbors. Although an automatic fire alarm system was present. It did not prevent the fire or the explosion.

### Thermal runaway

Contributing Factors

**20 MWh**

Failure range

**11 hours**

Fire extinguishing time



Source: z

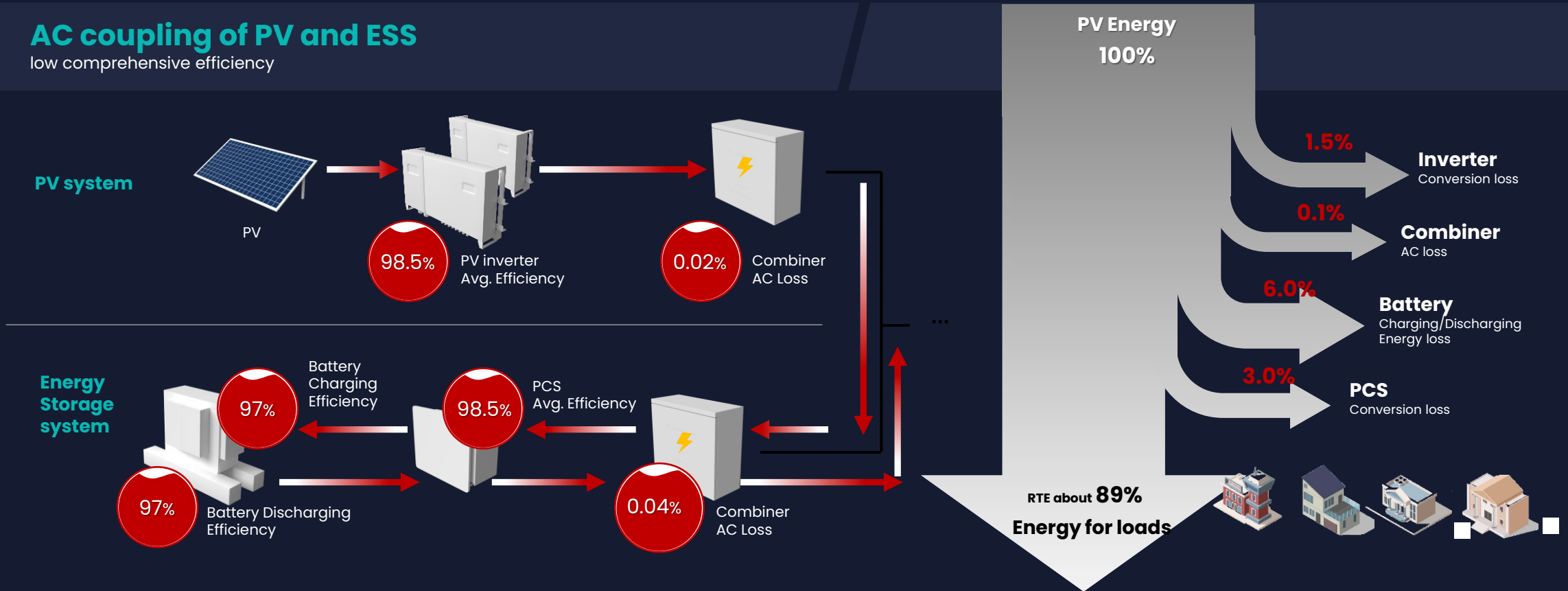
1. Fire at 20MW UK battery storage plant in Liverpool, <https://favershamsociety.org/battery-explosion-and-fire-in-liverpool/>
2. News 12: Lithium-ion batteries removed from Warwick storage site following 2 fires

# 2 Challenge in C&I ESS Solution

## AC Coupling, Lower integration with PV

### AC coupling of PV and ESS

low comprehensive efficiency



# 3 Challenge in C&I ESS Solution Complicated Installation

1

1 MWh EES installation cost **up to €21,000**

Need specialized lift equipment



Crane

€700 /day



Forklift

€480 /day

Complex wiring

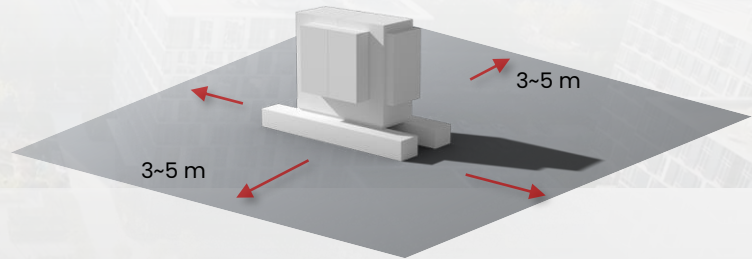


- ✗ Install copper bars for packs
- ✗ Many rack controller cables
- ✗ Many communications cables

2

High environment requirements

**3~5 m** front and rear space reservation



3

High skill requirements

Need **supervisor service**

- 1 Install ESS (cabinet & components)
- 2 Install fire extinguish system
- 3 Connect cables
- 4 System power-on
- 5 Deployment & commissioning

For a **1 MWh** PV+ESS project



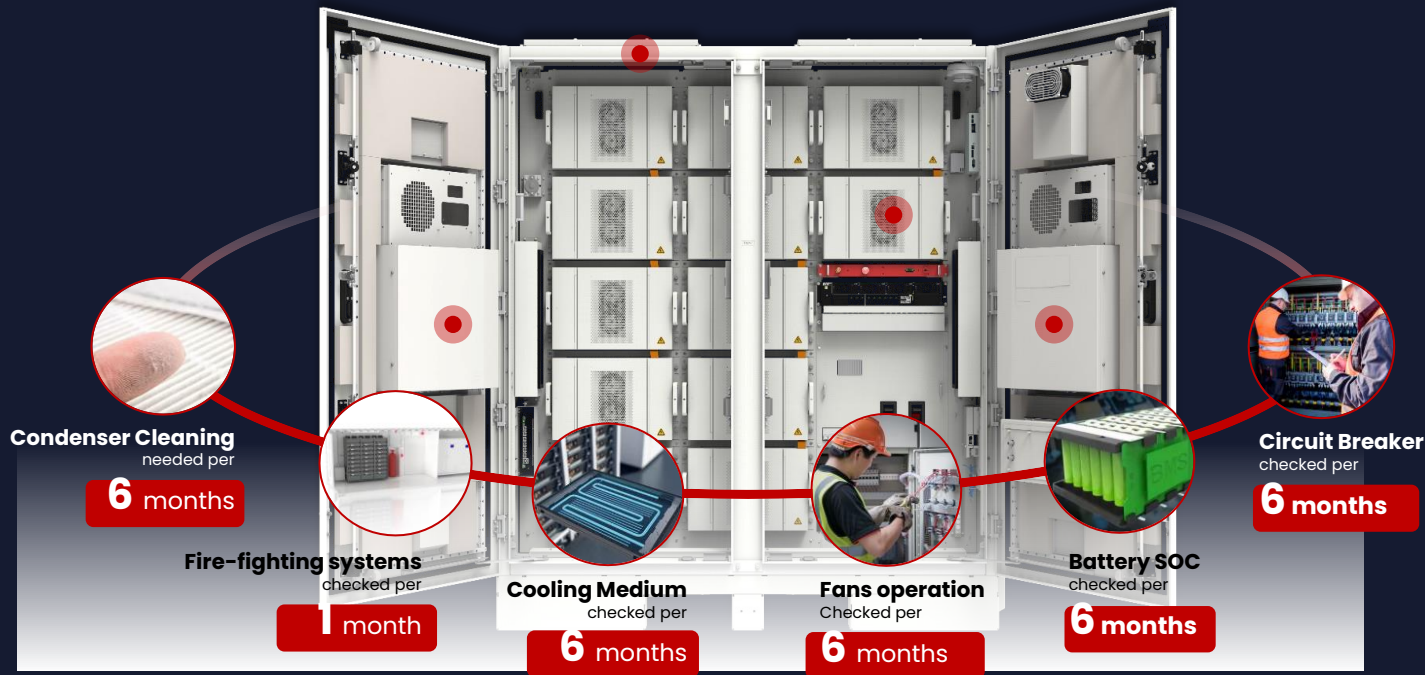
**32** work hours of  
Cold commissioning

**32** work hours of  
Hot commissioning

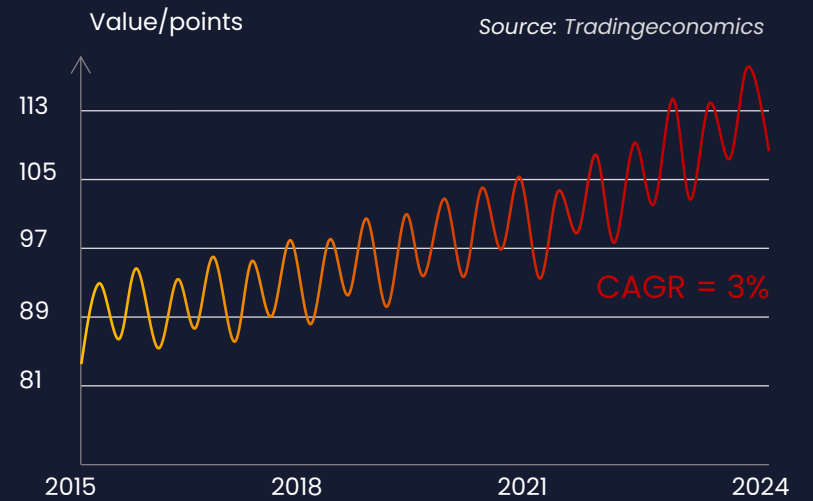
# 4 Challenge in C&I ESS Solution

## Complex and Expensive O&M Cost

Traditional Cabinet ESS solutions

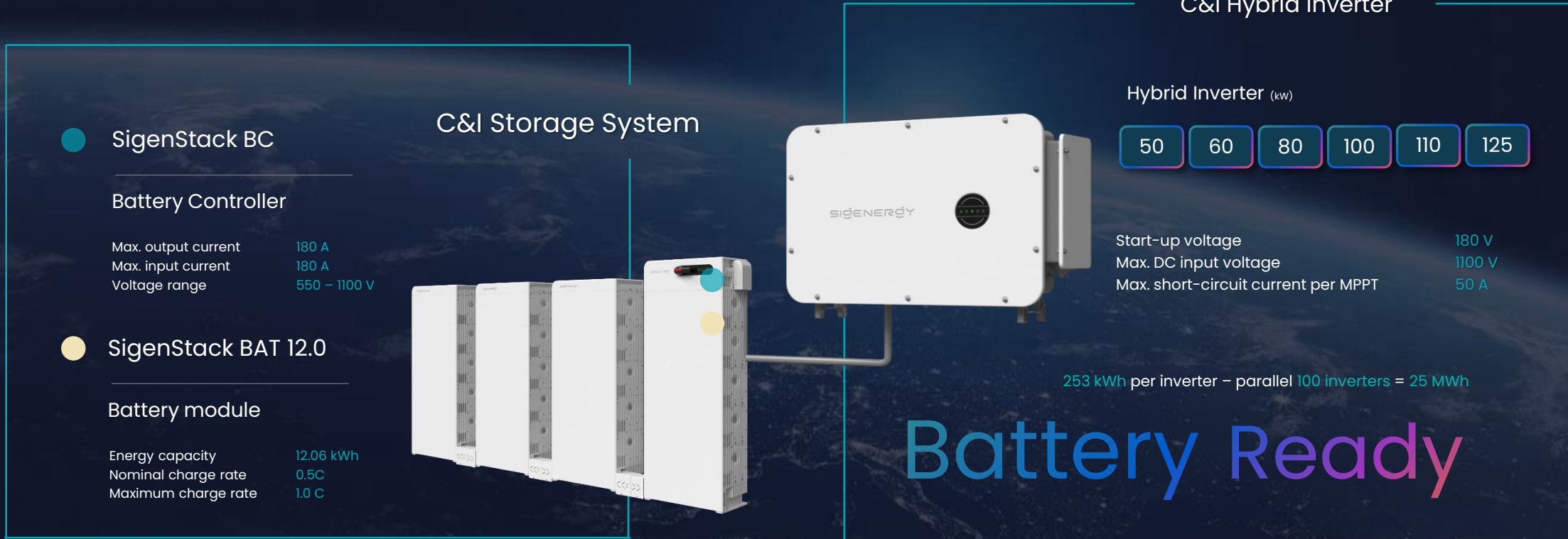


European Union Labor Cost

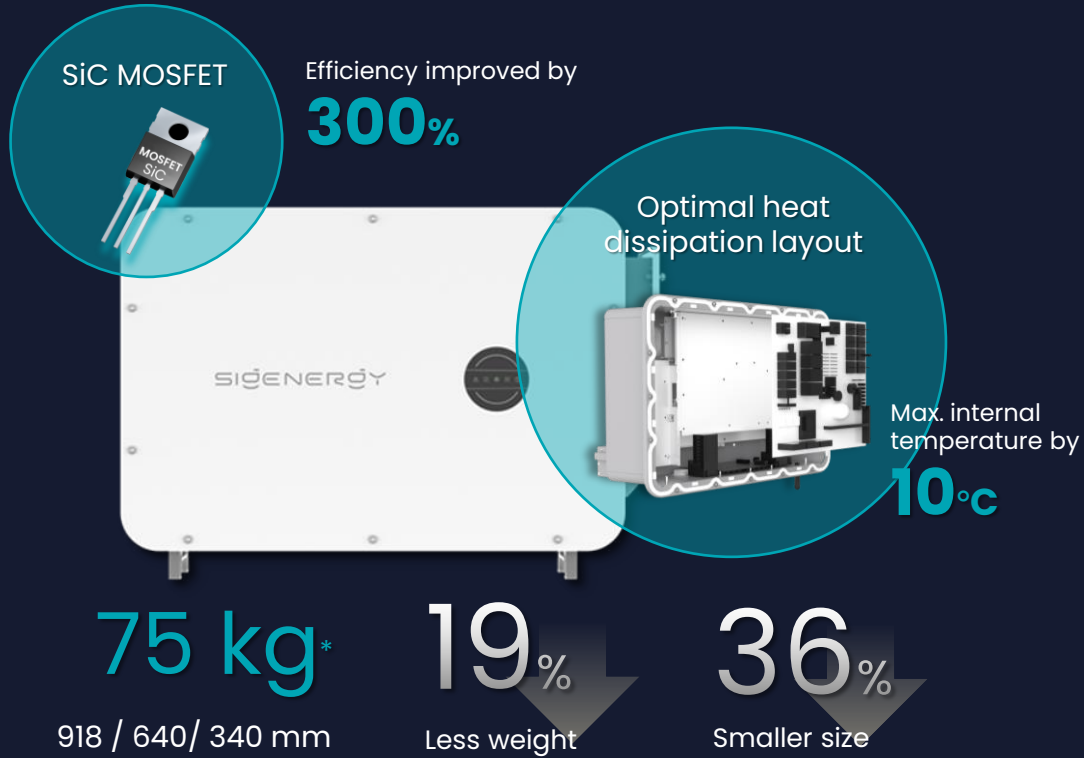


~**33%** growth from 2015,Q1 to 2024,Q1  
 Expect to **increase continuously**

# Battery Ready with SigenStack – More Flexible & More Powerful



# Exquisite Design, Compact & Lightweight The Industry's Lightest & Smallest 125 kW Inverter



SiC MOSFET Efficiency improved by **300%**

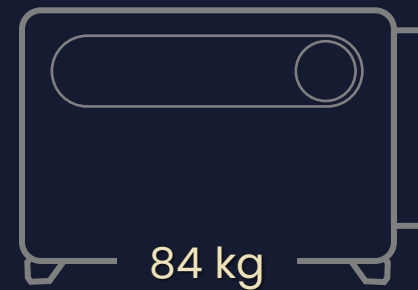
Optimal heat dissipation layout

Max. internal temperature by **10°C**

**75 kg\***  
918 / 640 / 340 mm

**19%**  
Less weight

**36%**  
Smaller size



\*For 50/99.9/110 kW inverters

# Industry-First Phase Adjustment Algorithm Simplified Wiring

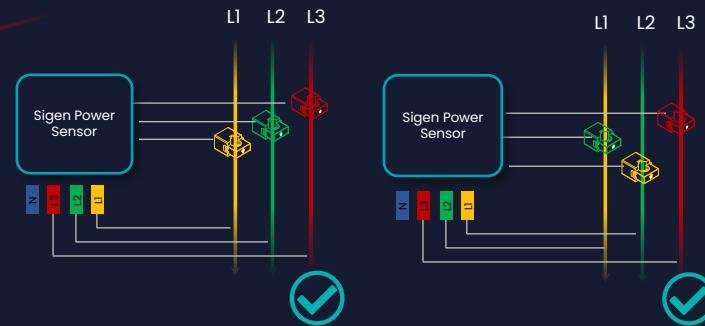
Self-adaptive phase sequence  
by Sigenergy



## Arbitrary Wire, more flexible



## Automatic Adjust, no manual operation



## Traditional solution

Positioning



Inspection



Correction



# 0.5 days

Each Rectification



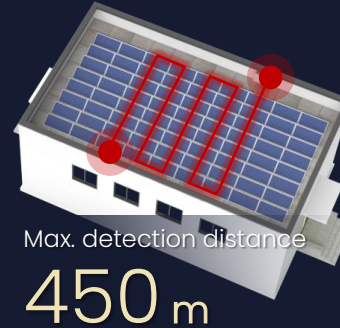
# AI-Powered Longest AFCI Detection Distance Ever Lower OPEX

## Sigenergy

Improved safety through continuous algorithm calculations



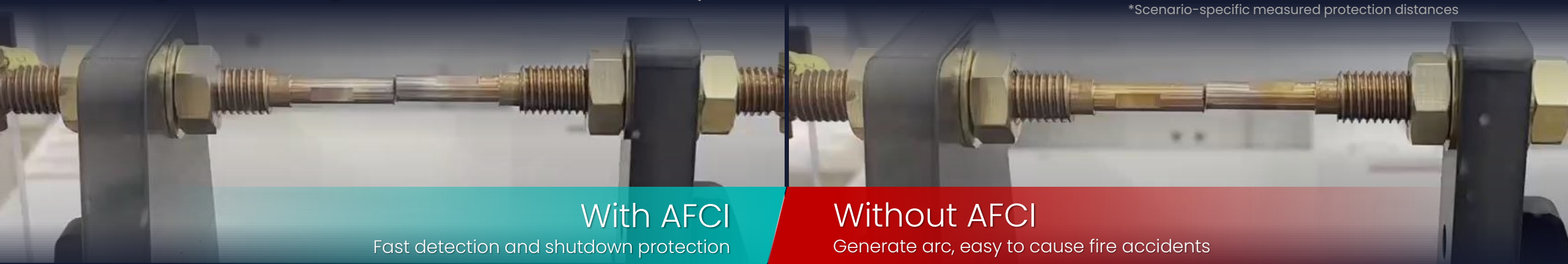
Former industry record



Average industry level



\*Scenario-specific measured protection distances



**With AFCI**

Fast detection and shutdown protection

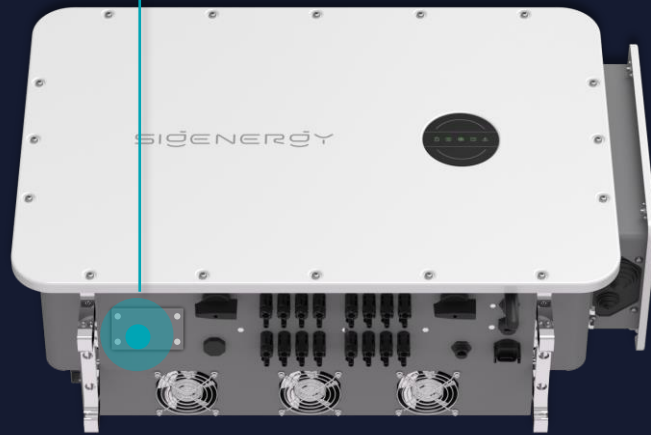
**Without AFCI**

Generate arc, easy to cause fire accidents

# Battery Ready, Both DC & AC-coupling Supported

## We make the Most Powerful Hybrid Inverter in the Industry

Battery Ready



Max. nominal power

**125 kW**

110/100/80/60/50 kW

Max. current per MPPT

**32 A**



1

## Innovated DC Coupling

Saving CAPEX of PV inverter  
Improving RTE by 2%

## 8X Faster Installation

Equipment & labor cost saving  
Fast commissioning

2

3

## Pack-level Safety Protection

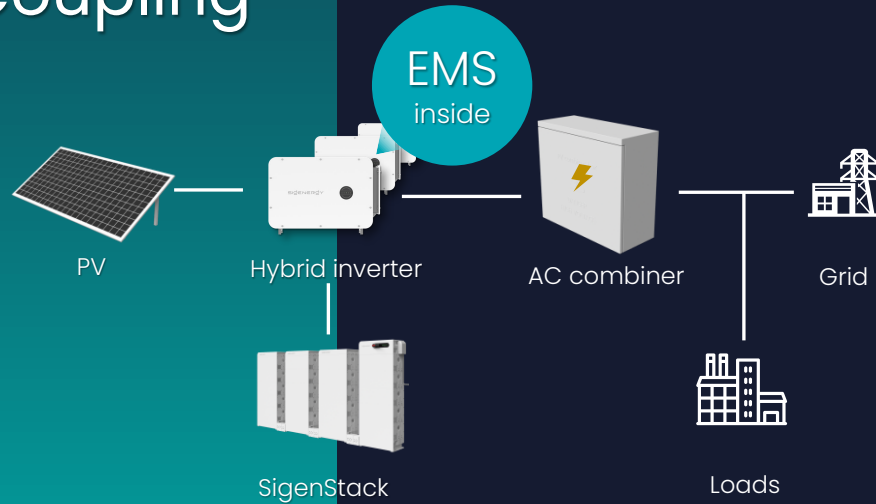
Improved 6-layer protection  
Accurate pack safety control

## Free of Regular O&M

IP66, Maintenance free  
No need for regular checks

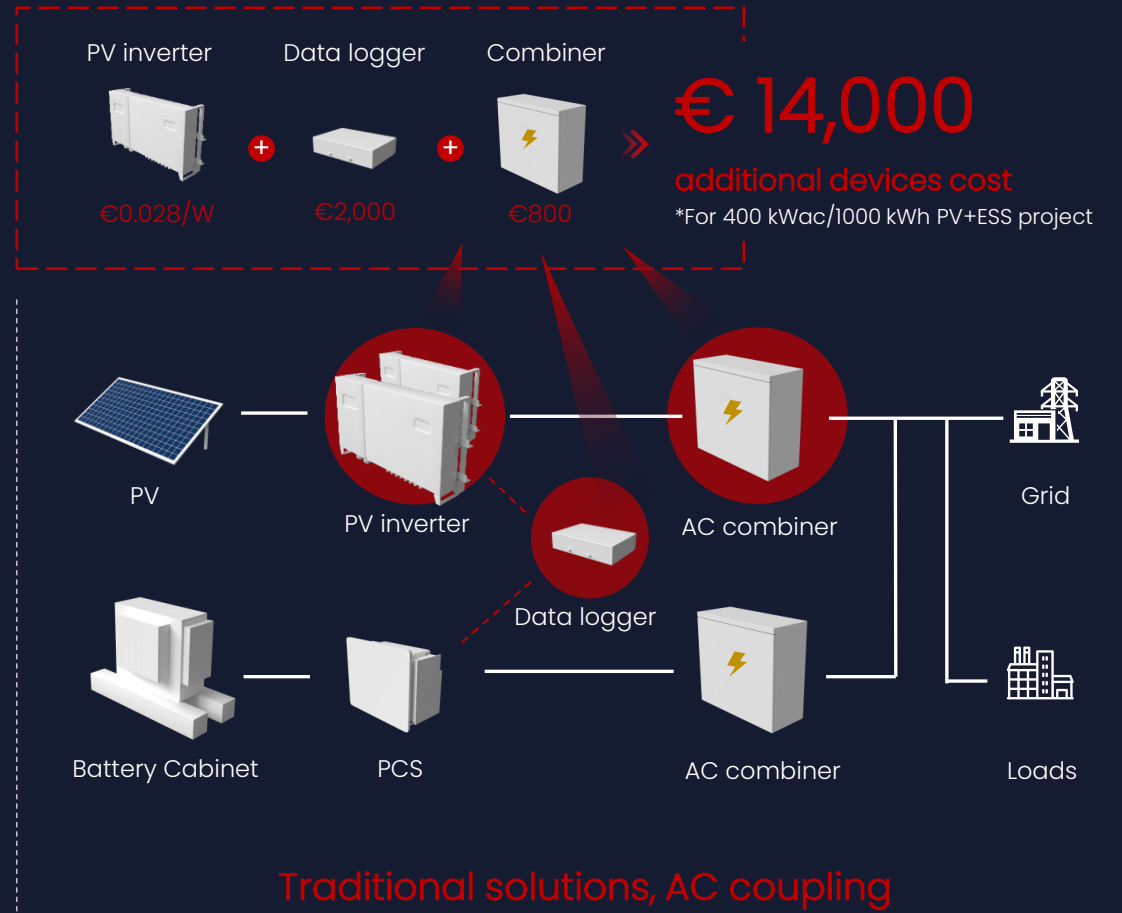
4

# Innovative DC Coupling



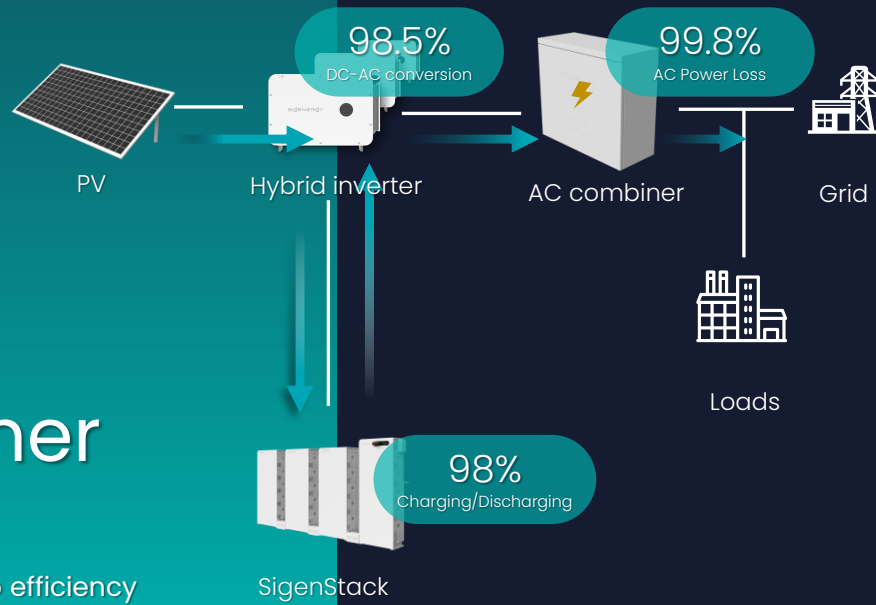
CAPEX Saving

Sigenergy



# Innovative DC Coupling

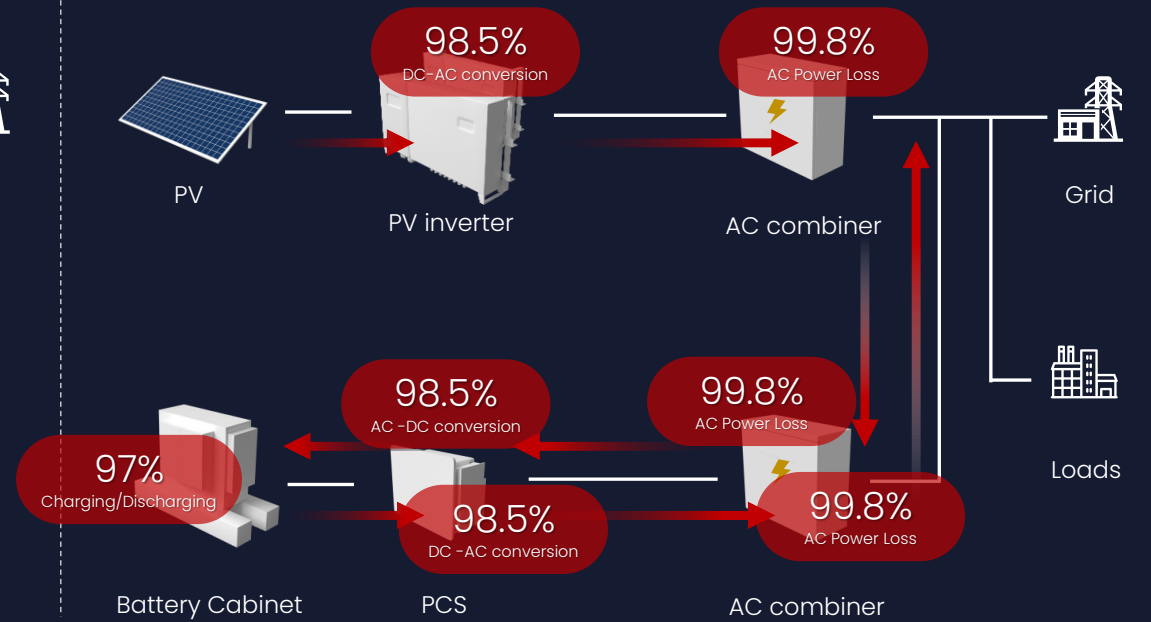
About **91%** RTE



# Higher RTE

Round-trip efficiency

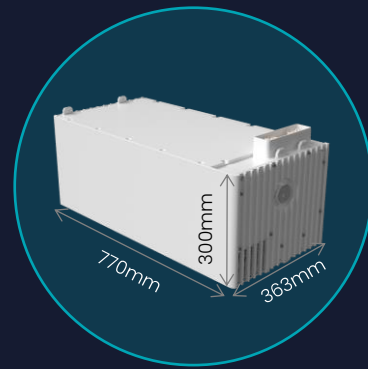
About **89%** RTE



# Easier installation, Equipment & Labor Cost Saving Lower CAPEX

SigenStack, stackable installation

**253 kWh**  
Capacity of one system

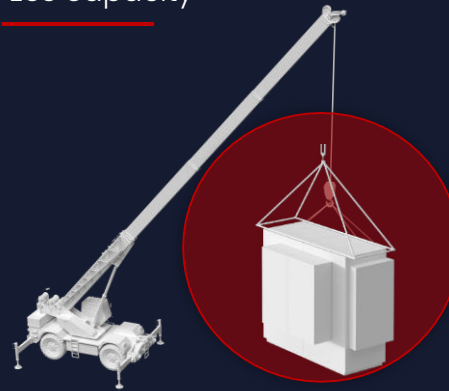


Quick connectors,  
Stackable installation

**1 hour needed**  
for each system

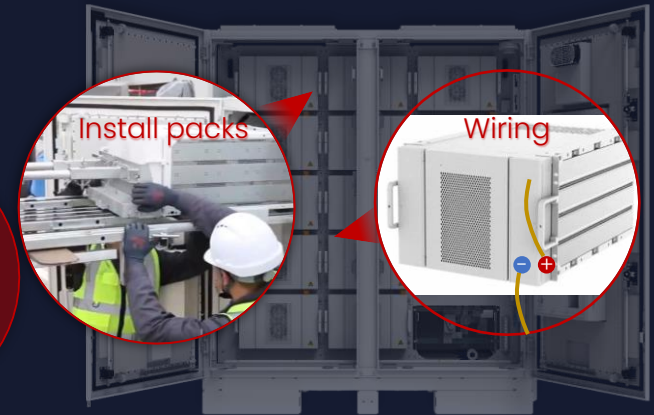
Traditional solutions, large & bulky

**200 kWh**  
ESS capacity



**€1,200/day**

Special cranes and forklift  
for ESS cabinet and packs



Install packs

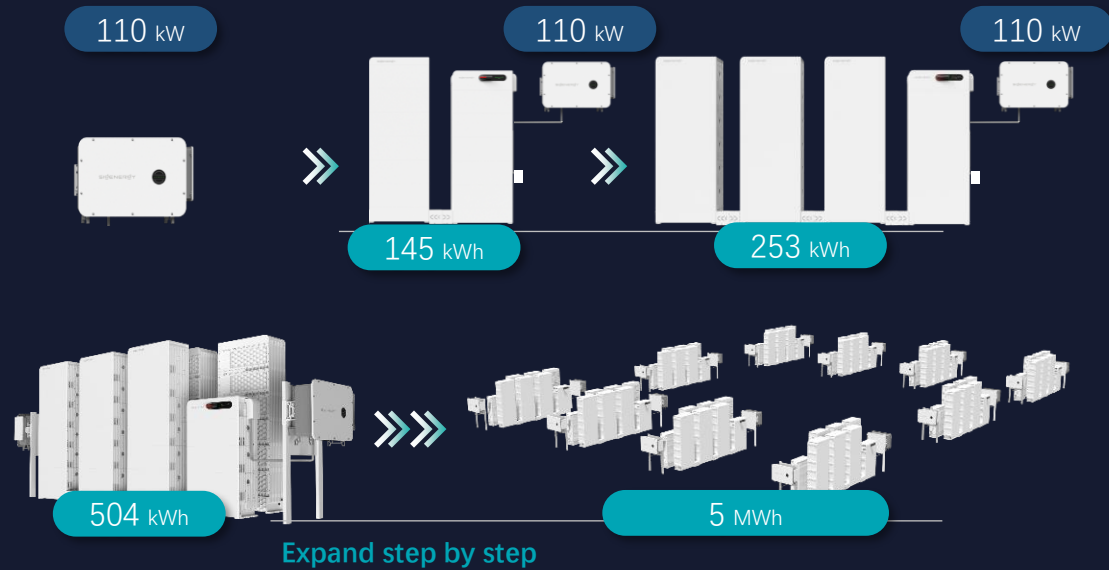
Wiring

**8 hours, €480**

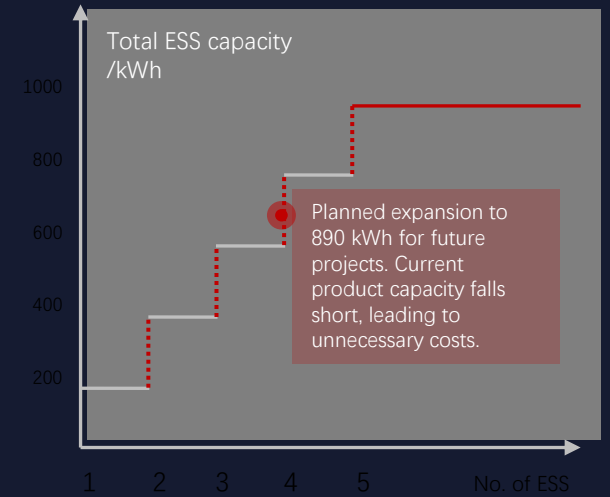
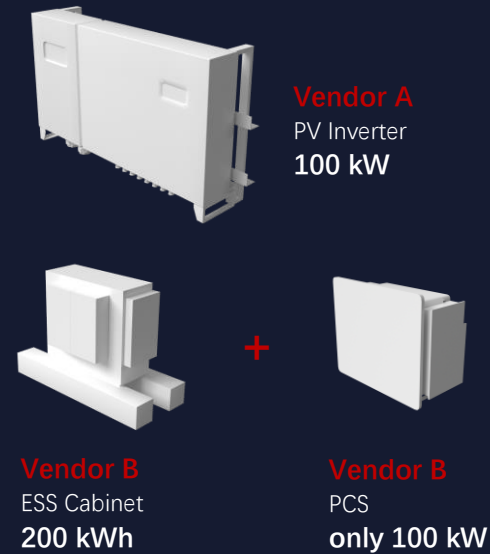
Labor cost for each system

# Modular design Flexible deployment, precise investment

## SigenStack fully modular design



## Traditional solar + ESS energy solutions



# Fast commissioning with system Auto-Networking Lower CAPEX

Ultra-fast commissioning

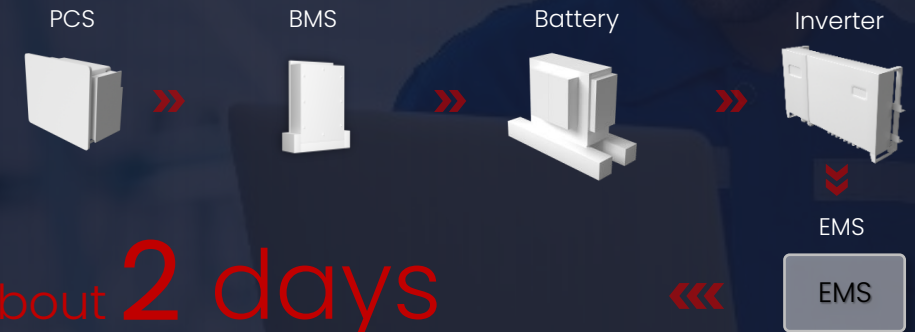
Auto

networking



about **15 mins**  
on the whole system

Time-consuming with one-by-one connection of devices



about **2 days**

commissioning, extensive manual parameter setting



Need supervisor service

About **€3,840** For 1 MWh project

- Onsite technical disclosure & training
- Installation and construction guide
- Grid-connection commissioning guide



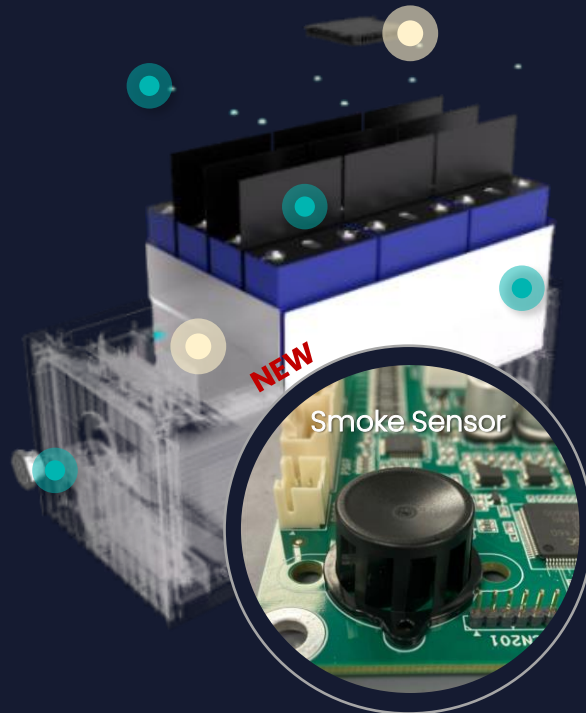
# Pack-level safety protection, accurate safety control Lower OPEX

## Pack-level fire extinguisher

Fire suppression system  
per **12 kWh**


**6** layers safety protection

- 1 Fire extinguisher kit
- 2 Full coverage temp. detection
- 3 Aerogel insulated pad
- 4 **Smoke Sensor**
- 5 Decompression valve
- 6 Resistance insulated pad



## Traditional Cabinet fire extinguisher

Fire suppression system  
per **200 kWh**

 Fire extinguisher

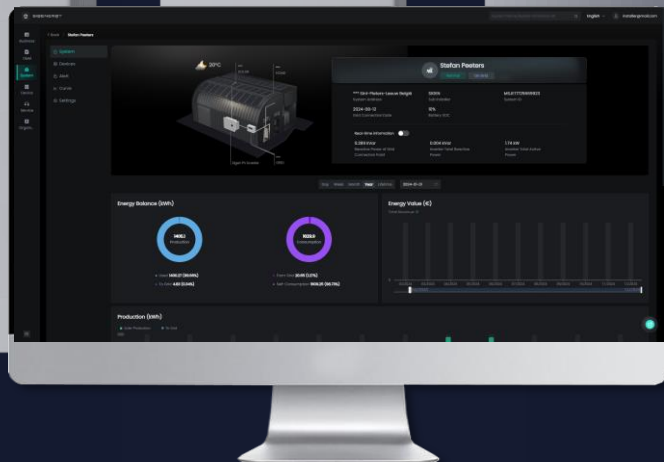
**Thermal Runaway**  
will spread throughout the whole cabinet.



# Free of complex & regular cabinet ESS O&M Lower OPEX

**IP66** SigenStack  
Build & forget, maintenance free

7/24 real-time monitoring



**IP55**

Traditional container ESS solutions  
Many frequent checks result in high OPEX

Check every 6 months

Air conditioner Power supply  
Smoke sensors Temp. sensors

Check every 12 months

Air inlet/outlet Wire connection  
Safety function SPD/Fan/Screw..

Check every 24 months

Battery capacity Internal resistance  
Switch box Refrigerant

Strainer Cleaning



Shutdown check



ESS fire safety check

Check every 1 month

Wiring Status Check



Annual Maintenance Cost

**€16,850**

\*Take a 1000 kWh ESS (200 kWh cabinet x 5) as an example

# Higher Revenue with Sigen Cloud

## Cloud-native architecture, effective energy mgt.



### Cloud: Sigen Cloud

Data storage base + Training & inference center

#### Simplified structure

Easy to access & fast to commission

#### Rich metrics

Support for customised data push

#### More flexible

Expandable for more protocols



### VPP Integrations



### Dynamic Tarriff



### Edge: EMS inside

Deploy edge computing for real-time calculation



### End: Sigen devices

Data collection, and mgmt. for AI applications

1.5 seconds

Power response time, support fast FCAS

1 second

Fast alarm and system info push capability

30 seconds

Reporting frequency

# SigenStor is the Ideal Solution for On- and Off-grid Projects

## SigenStor



Energy Controller

Single Phase (kW)

5.0 6.0 **8.0 10.0 12.0**

Three Phase (kW)

5.0 10.0 15.0 20.0 25.0 30.0

EV DC Charging Module

12.0 25.0

Battery Module (Kwh)

5.0 8.0

*Coming soon*

| **Flexible**

| **Stackable**

| **Scalable**

| **Reliable**





# 5-in-One One for All

The world's first 5-in-1 energy system  
Solar + ESS + EV Charging  
Safe. Reliable. High Availability. Intelligent



All business: from residential to C&I system  
All systems: from on-grid to micro-grid  
All places: from somewhere to anywhere

One for **All business**, Easily Expanding from Residential to C&I

One



SigenStor

Same

Installation



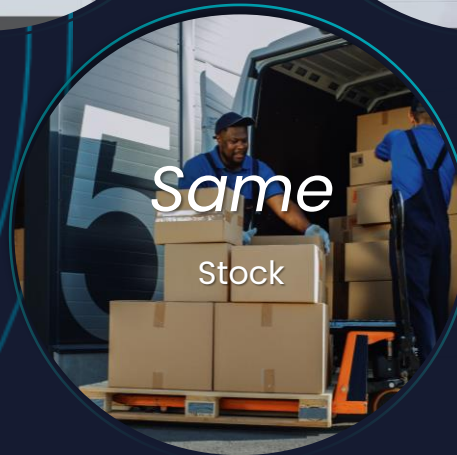
Same

Commissioning



Same

Stock



Same

Branding



# One for **All Systems**, from On-grid to Micro-grid, Meeting All Needs

SiGenStors  
One for All systems

VS

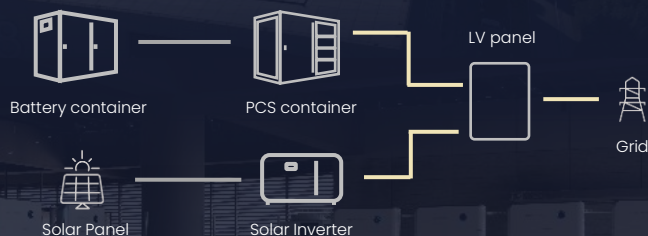


VS

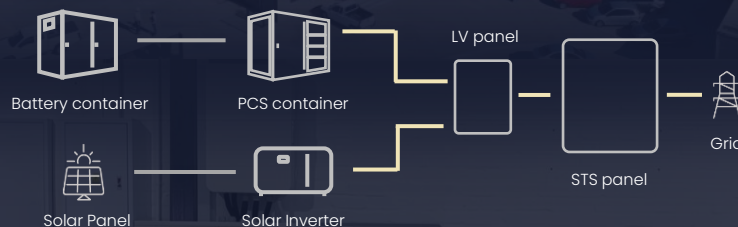
SiGen Energy  
Gateway

VS

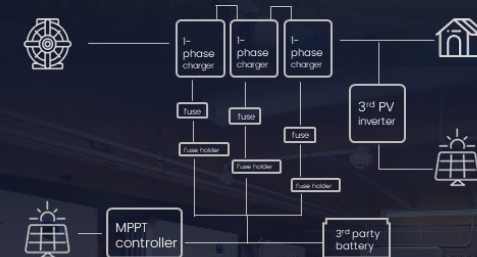
Other on-grid BESS solution



Other micro-grid BESS solution

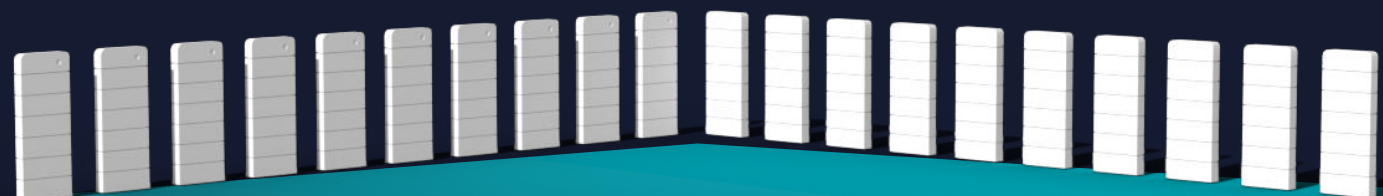


Other off-grid BESS solution





# One for *All Places*, Installation Freedom & Flexibility



More than  
Outdoor & Ground-mounted



Carports



Narrow Spaces



Against Walls



Corridors



On Rooftops



Campuses



For more information, Contact us!



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YouTube



Website



**INLANDETS**  
**SOLENERGI**



Check out Arlanda

Första delen av vår Marknadsplatskontrollen i Terminal 5 har öppnat. The first part of our Marketplace after the security check in Terminal 5 is now open. Welcome!

ROCKET BAR & RESTRO

APOTEK PHARMAC


ENJOY GREEN ENERGY

SOLENERGI  
PLATINUM  
INSTALLER

Inlandets Solenergi AB

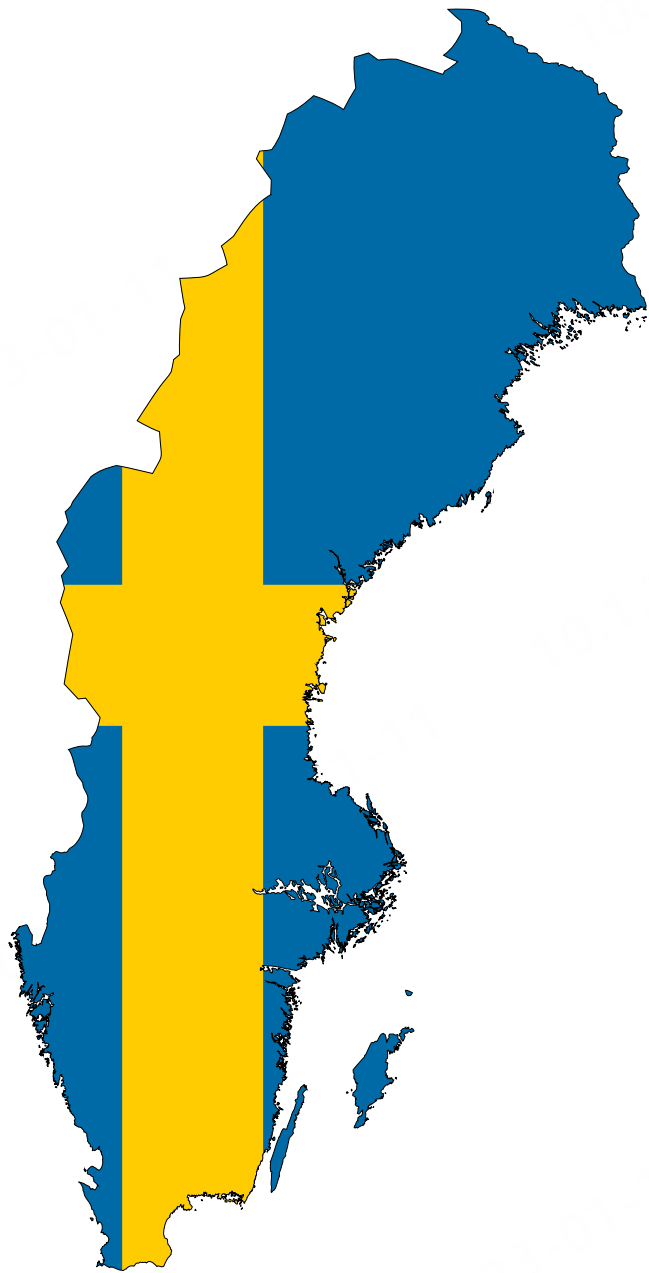


SOLENERGI  
PLATINUM  
INSTALLER

- 
- Heating pad
  - Operate in  $-25\sim 55\text{ }^{\circ}\text{C}$
  - IP66 rating
  - 5-layer battery protection



- **Easy and flexible installation**
- **Stackable and scalable design**



**More to Come!**



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# The impact of modularity on cost-efficiency of battery storage systems

## Q&A



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## Solid-state batteries enter pilot production, costs expected to drastically drop

by Marija Maisch



**Most-read online!**

## Tesla releases Powerwall 3 expansion units for more capacity at lower price

by Marija Maisch





# Coming up next...

## Wednesday, 13 November 2024

8:00 am – 9:00 am EST, New York City  
2:00 pm – 3:00 pm CET, Berlin, Paris, Madrid

## Thursday, 14 November 2024

11:00 am – 12:00 pm EST, New York City  
5:00 pm – 6:00 pm CET, Berlin, Paris, Madrid

Many more to come!

**Mitigating the  
CO2 footprint in  
solar: low-  
carbon steel for  
PV**

**One-stop-software  
for scalable,  
efficient, and  
accurate PV project  
development**

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**Explore the latest developments  
and trends in the European  
solar + storage industries.**



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**Tristan Rayner**  
Editor  
pv magazine

**Thank you for  
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