LINDEMANN-REGNER

MegaCube LM-2.5MW-5MWh Technical Summary

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Definition of Terms

AC: alternate current.

BMS: battery management system; the electronic system that ensures optimal performance of the overall battery system by monitoring and controlling it in real time.

BOL: beginning of life; the date of issuance of the Factory Acceptance Test report.

COD: commercial operation date of MegaCube; the date that MegaCube is put into operation/commissioned.

DC: direct current. Duty Cycle: the amount of equivalent full charge/discharge cycles carried out during a specific period of time.

Factory Acceptance Test (FAT): A series of tests were conducted in the manufacturing plants in China to ensure its optimal and safe performance.

Installed AC Power: the sum of the nameplate powers (MVA) of all AC/DC inverters included in the package.

Installed DC Capacity: the sum of the nameplate capacity (MWh) of all the batteries included in the package.

Point of Interconnection (POI): Is the electrical frontier of the package and the end of the scope of supply for LND Energy.

RTE: Roundtrip Efficiency; the ratio between the energy needed to charge any battery system fully, and the energy retrieved after full discharge of that same battery system.

SOC: state of charge; the value used to measure the amount of energy stored by MegaCube at any given time, where SOC=100 % is considered completely charged, and SOC=0% is considered completely discharged.

SOH: The value used to measure the capacity degradation of MegaCube, where SOH 100% is considered as the minimum possible degradation (factory new).

Usable AC Capacity: The energy measured at the POI in a complete discharge cycle at the battery BoL.

1. Company Profile

1.1. Company Structure

LND Energy GmbH is headquartered in Munich, Germany and is a world-leading manufacturer of transformers and solid-state transformers (SST), as well as a top Engineering, Procurement, and Construction (EPC) partner in the European energy system sector. The company focuses on power infrastructure solutions, with business covering renewable energy grid integration, grid modernization, industrial high-reliability power distribution, and commercial power supply systems, among other fields.

1.2. Production and Manufacturing

The company adopts a global integrated model of "German headquarters + Chinese production" and has a joint production center in Jiangsu Province, China. The production base integrates digital smart factory information systems such as SAP, PLM, MES, and WMS, realizing efficiency optimization throughout the entire chain from design, production to control.

1.3. Project Performance

As of September 2025, LND Energy has deployed energy storage solutions with a total DC capacity exceeding 5 GWh in Europe, the Middle East, and China. LND Energy has signed global project contracts totaling over 10 GWh, and its energy storage system solutions have been widely applied in scenarios such as distributed energy storage, urban peak shaving and valley filling, and off-grid power supply in remote areas. With its innovative "plug-and-play" design and reliable performance, it has gained recognition from global customers.

1.4. Digital Platforms

For more information, please visit ;

- Official Website: www.LND-Energy.de

2. Package Technical Summary

2.1. System Overview

MegaCube LM-5MWh features an integrated “battery container + E-House” design: PCS, dry/oil-type transformer and RMU come pre-installed inside the E-House, while DC bus, protection and SCADA are factory-wired and commissioned. Fully compliant with IEC/UL and mainstream protocols (Modbus, IEC 61850), the system arrives plug-and-operate—only basic setting and grid hookup are required on site. It delivers fast deployment, predictable quality and high reliability for C&I peak-shaving, campus storage and distribution-level flexibility. As a modular capacity unit within the MegaCube family, it keeps your upgrade path straightforward.

System Overview			
Rated energy	5.016 MWh	Rated power	2.5 MW-3MW
DC Voltage	1330V	AC Voltage	0.69 – 10.5/21/35kV
System Architecture	Battery container + E-house container (PCS + transformer + RMU)	Dimension	6058×2438×2896 + 6058×2438×2591
Weight	55t	IP level	IP55 + IP54 (converter IP65)

Table 2-1:System Overview

Figure 2-1:MegaCube 2.5MW-5MWh System

2.2. Core Advantages

• **Ultimate Installation Efficiency, Significantly Shortening Construction Period**: Relying on the core advantage of factory pre-installation and commissioning, the product's installation efficiency has achieved a leap-forward improvement. The shortest installation time for a 5MWh energy storage system is only 48 hours, and for a 10MWh system, it is only 72 hours. Compared with the traditional on-site assembly and commissioning mode, the construction period is shortened by more than 80%, which can effectively avoid the risk of on-site construction delays and help projects put into

production and achieve results quickly.

- **Ultra-Short Delivery Cycle, Ensuring Project Progress**: With a mature supply chain system and efficient factory production process, the product achieves rapid delivery guarantee. The entire cycle from the customer placing an order to the product being delivered to the European project site does not exceed 15 weeks, which is much lower than the industry average delivery level. It provides a stable time expectation for project planning and advancement and effectively improves the overall operational efficiency of the project.

- **Plug-and-Play Feature, Lowering On-Site Threshold**: The factory has completed all wiring, commissioning, and system joint commissioning work. Customers do not need to deploy a professional technical team for complex operations on-site; they can start operation only after completing basic fixing and connection work. This feature not only reduces the technical requirements for on-site construction personnel but also completely eliminates the investment in manpower and material resources for on-site commissioning, significantly reducing project implementation costs.

- **Adaptation to European and American Standards, Global Market Compatibility**: The product is designed and commissioned in strict accordance with the most mainstream wiring standards (such as IEC, UL standards) and communication protocols (such as Modbus, IEC 61850) in Europe and the United States. It can be directly connected to the power grid systems and monitoring platforms in Europe and the United States without additional standard adaptation modifications, perfectly meeting the access requirements of the world's major markets and expanding the customer's market layout space.

- **Factory-Level Commissioning Guarantee, Improving System Reliability**: Compared with the disadvantages of on-site commissioning being affected by multiple factors such as environment, personnel, and equipment, the factory has a standardized commissioning environment with constant temperature, humidity, and dust-free conditions, equipped with professional commissioning equipment and technical teams. It can conduct comprehensive and detailed multi-scenario simulation tests on the system, timely identify and solve potential problems, so that the system reaches the optimal operating state when leaving the factory, significantly improving the stability and reliability of long-term operation and reducing later operation and maintenance costs.

- **Integrated Structural Design, Adapting to Diverse Scenarios**: Adopting the combined structure of E-House and containerized battery cabinets, it has highly integrated and modular characteristics. It is not only convenient for transportation but also can adapt to different project scenarios. Whether it is an off-grid energy storage project in remote areas or a peak-valley regulation project of urban power grids, it can be flexibly deployed and has strong scenario adaptability.

• **Full-Series Certifications**: The entire series has EU CE certification and US UL certification, and meets the additional certification requirements of European member states such as Germany's VDE.

2.3. Energy Storage System Warranty Terms

2.3.1. Core Basic Information

• **Applicable Products: MegaCube** series products and designated auxiliary components (excluding auxiliary parts that require separate agreement).

• **Beneficiaries**: Limited to the original purchaser and the final system owner; when sold directly to the final owner, the two are the same. For B2B scenarios, consumer protection laws do not apply.

• **Applicable Regions**: EU member states, non-EU European countries such as Albania, the United Kingdom, the United States, and the overseas territories of the aforementioned countries. Terms vary for other regions.

2.3.2. Warranty Eligibility and Registration Requirements

• **Claim Eligibility**: Limited to the final system owner or their authorized representative; if the original purchaser goes bankrupt or the installation location is remote, an application for changing the representative can be made (subject to the manufacturer's written consent and the new representative having technical qualifications).

• **Product Registration**: Registration must be completed via email to info@lindemann-regner.de within 3 months after installation, providing product model, serial number, customer name, installation information, etc. Failure to register will result in automatic termination of the warranty.

• **Data Compliance Requirements**: The original purchaser shall ensure the communication channel between the manufacturer and the final system owner, comply with GDPR data protection regulations, and fulfill obligations such as data notification and consent acquisition.

2.3.3. Warranty Period and Scope

(1) Main System Performance Warranty

• Cabinet/Container Type: 10 years or 6000 times the rated capacity throughput (whichever comes first), calculated from the installation date or 3 months after delivery.

(2) Component Warranty (by Category)

Category	Key Components	Basic Warranty Period	Extendable to
Battery-Related	Battery modules, BMS	10 years	15 years
Non-Consumables	Cabinet structure, transformers, ring main units	8 years	12 years (for transformers)

Non-Consumables	PCS, PCU, EMS, etc.	5 years	8 years
Consumables	Air filters, fire extinguishing agents, etc.	1-2 years	-

Table 2-2： Component Warranty

2.3.4. Exclusions from Warranty Liability (Core Scenarios)

- **Human Factors**: Unauthorized installation/repair, modification, use of non-original accessories, tampered serial numbers, improper maintenance.
- **External Risks**: Force majeure (natural disasters, etc.), environmental/voltage conditions exceeding specifications, physical damage, third-party integration issues.
- **Normal Wear and Tear**: Appearance wear, natural aging of consumables, normal capacity attenuation within 6000 cycles.

2.3.5. Other Key Terms

- **Limitation of Liability**: Only liable for repair/replacement, not for indirect losses (such as loss of profits), and the total compensation shall not exceed the paid purchase price.
- **Warranty Transfer**: The warranty can be transferred along with the ownership of the site/product only if the product remains at the initial installation site.
- **Data and Disputes**: Comply with data regulations such as GDPR; disputes shall be governed by German law (with additional applicable US-related laws for installations in the US). In case of failure to reach an agreement through negotiation, disputes shall be submitted to DIS for arbitration.

3. Equipment Description

3.1. Battery Cabin

The battery cabin is equipped with Lithium Iron Phosphate (LFP) battery packs, battery racks, and related auxiliary equipment to realize the protection, maintenance, and control functions of the battery modules.

Battery Energy Storage System			
Layout	1 × C173F5016		
Nominal Capacity	5.016 MWh	CH/DCH Rate	0.5/0.5 C
Nominal Voltage	1330 V	Voltage Range	1160–1480 V
Maximal Current	2160 A @Vmin	Cycle Life	≥6000 cycles @80% SOH
Service Life	20 years	Charging Temperature	20–50 ℃
Dimension	6058×2438×2896 mm	Discharging Temperature	10–50 ℃
Weight	43 t	Storage Temperature	-30–55 ℃
IP Level	IP55	Relative Humidity	≤95%(non-condensing)
Altitude	≤3000 m		

Table 3-1：Battery Energy Storage System

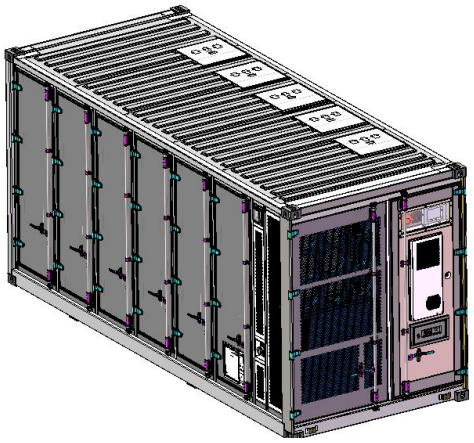

Figure 3-1:Container schematic diagram

3.1.1. The key features of the battery enclosure are as follows

- One standard platform for multiple power/duration applications, designed to meet global market performance and safety requirements.
- All components are shipped with the product after factory testing, simplifying the installation and commissioning process onsite.
- A cutting-edge liquid cooling system with a de-humidification chamber maintains optimal

temperature and humidity throughout the lifetime of the project.

- Explosion prevention systems via gas detection, active venting and deflagration panels as optional.
- All external wirings are available in a central location at the bottom of the enclosure.
- Active balancing BMS on cell level with several simultaneous balancing channels per pack ensures a balance between all batteries during daily operation.
- UPS back-up time of 2 hours for control and communication systems and 24 hours for fire detection and alarm system.

3.1.2. The thermal management of the battery enclosure has the following features

- Integrated liquid designed to optimize battery temperature throughout product lifetime.
- Liquid cooling/heating for battery system, with cooling pipe go through battery pipe to provide better cooling/heating capacity.
- De-humidification chamber for assuring an outstanding performance of the internal ambient humidity.

The battery enclosure has a built-in fire management system including detection, alarm, and protection to meet the requirements of NFPA69 and NFPA68 under request.

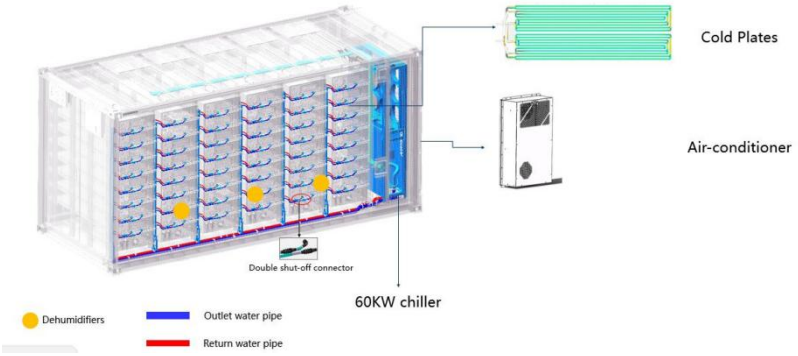

Figure 3-2:Thermal management system

Type	Quantity	Remarks
Liquid cooling plate	48	Each battery pack contains one liquid cooling plate
Air-conditioner	1	1.5kW for busbar room of power circuit
Chiller	1	60kW
Pipeline Assembly	1	Includes return water pipe and outlet water pipe, Connect the Chiller to

Type	Quantity	Remarks
		the battery pack
Dehumidifier	3	Reduce air humidity to prevent condensation

Table 3-2: List of thermal management system component

3.2. String-type Energy Storage Converter (PCS)

The energy storage PCS by MegaCube LM-2.5MW-5MWh adopts an advanced three-level topology, achieving a maximum conversion efficiency of up to 99% while significantly optimizing power quality to inject stable and reliable clean energy into the power grid. Leveraging a modular design concept, the equipment maintenance process is greatly simplified; post-fault restoration can be completed quickly, with the return-to-operation time controlled within 1.5 hours, effectively minimizing downtime losses. Equipped with an intelligent multi-level fan speed control system, it boasts excellent wide-temperature operation capability and can maintain full-load stable output without derating even in high-temperature environments up to 45°C. With industry-leading energy density, the product not only significantly reduces the footprint but also enables more convenient and efficient transportation, hoisting, and installation processes, adapting to the deployment requirements of various application scenarios.

PCS			
Layout	2 parallel × EH-1725-HA-UD		
Max. DC Voltage	1500 V	DC Voltage Range	1000–1500 V
Max. DC Current(per PCS)	1936 A	System DC Current Capability	3872 A
DC Loading Ratio	56%	DC Operating Margin	43%
AC Output Power(per PCS)	1897.5kVA@30℃, 1725kVA @45℃, 1509kVA@50℃	System AC Output Power	3795kVA@30℃, 3450kVA@45℃, 3018kVA@50℃
Max. AC Output Current(per PCS)	1588A@30℃, 1443A@45℃, 1263A@50℃	System max. AC Output Current	3176A@30℃, 2886A@45℃, 2526A@50℃
Nominal AC Voltage	690V,3W+PE	AC Voltage Range	607–759 V
Nominal Grid Frequency	50/60 Hz	Harmonic (THD)	<1.5% at 100% load
Power Factor	-1 to +1	Ingress Protection rating	IP65 (converter)
Max. Efficiency	99%	European Efficiency	98.5%
Cooling	Forced air	Operating Temperature Range	-40–+60 ℃ (derating above 45 ℃)

Relative Humidity	0–100% (non-condensing)	Max Altitude	5000 m (derating above 3000 m)
Dimension	2300×1435×2350 mm	Weight	2800 kg

Table 3-3:PCS Technical parameters

Figure 3-3:EH-1725-HA-UD

3.3. Transformer

Utilizing European-standard insulating oil and a high-silicon steel core, they offer heat dissipation efficiency 15% higher than the industry average and short-circuit resistance 1.8 times that of IEC standards. All products are guaranteed to be TÜV certified upon delivery. They can be widely used in large-scale power stations, transmission and distribution networks, industrial parks, and construction industries, and can operate stably in extreme environments ranging from -30°C to 50°C.

Transformer			
Isolation mode	Dry/Oil type	Rated Power	Isolation mode
LV/MV	0.69/21kV (Optional: 11/35kV)	Transformer Vector	LV/MV

Table 3-4:Transformer Parameter

Figure 3-4:Transformer

3.4. Ring Main Unit (Optional RMU)

Our RMU offer two technical pathways: SF6 gas insulation and clean air insulation.

- The SF6 gas-insulated models fully utilize the excellent insulating and arc-quenching properties of SF6 medium, sealing all high-voltage components within stainless steel gas compartments to achieve full insulation, complete sealing, and maintenance-free operation.

- In response to European environmental regulations, we simultaneously introduce clean air-insulated models, which use dry air or nitrogen as the insulating medium. While maintaining a compact structure and sealing advantages, they completely eliminate potential risks of gas pollution, making them more environmentally friendly and safe.

RMU (Optional)			
Rated Voltage	24 kV	3s Short-time Withstand Current	21 kA / 3 s
Rated Frequency	50/60 Hz	Peak Making Current	54.6 kA
Rated Power Freq Withstand (1 min)	50/60 kV	Grounding Circuit Making Current	21/54.6 kA（rms/peak）
Lightning Impulse Withstand	125/145 kV	Short-circuit Breaking Current	21 kA
Rated Current	630 A	Earth Fault Current	48 A
Internal Arcing Level	AFLR	Enclosure Protection Class	IP54/IP4X
Protection Grade of Airbox	IP67	Gas	SF6 or Eco AIr

Table 3-5:Technical Parameter table of Ring Main Unit

Figure 3-5:Ring Main Unit

3.5. Energy Management System (EMS)

This energy management system is specifically designed for the dynamic needs of industrial, commercial, and large-scale energy storage fields. It provides flexible control strategies and precise algorithms to optimize system performance under different operating scenarios. It supports core functions such as peak shaving and valley filling, time-of-use electricity price arbitrage, and self-consumption of photovoltaic power. It is equipped with advanced analysis capabilities, simplified operation and maintenance tools, and a modular architecture, which can adapt to the specific needs of different sites.

Parameter	Value

Model Name	MegaCube-EMS
Power Supply	480VAC, 50/60 Hz
Communication Protocols	Modbus, IEC 61850, DNP3, MQTT, REST API
Storage Capacity	240GB mSATA SSD
Operating Temperature	-25℃ to 60℃
Protection Class	IP66, IK10, NEMA 4X
Dimensions (H×W×D)	847mm × 636mm × 300mm

Table 3-6:EMS Main Parameters.

Figure 3-6:Indicative EMS Panel Overview

3.6. Bill of Materials

The following table lists the equipment provided by LND Energy. All materials required for installation that are not included in this list are not within the company's supply scope. The services provided by the company are not included in this list; for details, please refer to the relevant terms in the official quotation document.

Item	Model	Quantity
Battery Container	MegaCube Battery Cabin	1
Energy Management System (EMS)	MegaCube-EMS	1
Prefabricated Cabin (E-House)	Integrated with RMU and other equipment	1
Transformer	Oil-immersed transformer (0.69/21kV, 11/35kV optional)	1
AC-DC Converter (PCS)	EH-1725-HA-UD	2

Item	Model	Quantity
Ring Main Unit (RMU, optional)	Customized model	1

Table 3-7:Bill of materials for “LM-2.5MW-5MWh” Package.

4. Long-term Performance of the Package

For purely indicative purposes, we have included a table below showing the package's long-term performance under the conditions shown in “Table 2-1: Package Summary”, and assuming 1 full charge & discharge cycle/day.

It should be noted that these values are NOT guaranteed, and that the guaranted performance values are at equipment level. For further understanding of the guaranteed performancevalues, please refer to the LND Energy GmbH Warranty.

Year	Cumulative Cycles	AC Usable Capacity at POI [MWh]	AC RTE at POI (no aux) [%]
0 (COD)	0	5.016	98.50
1	365	4.765	98.45
2	730	4.640	98.40
3	1095	4.515	98.35
4	1460	4.415	98.30
5	1825	4.340	98.25
6	2190	4.290	98.20
7	2555	4.225	98.15
8	2920	4.140	98.10
9	3285	4.070	98.05
10	3650	4.000	98.00
11	4015	3.930	97.95
12	4380	4.865	97.90
13	4745	3.795	97.85
14	5110	3.725	97.80
15	5475	3.655	97.75
16	5840	3.590	97.70
17	6205	3.520	97.65
18	6570	3.450	97.60
19	6935	3.380	97.55
20	7300	3.315	97.50
21	7665	3.245	97.45
22	8030	3.175	97.40

Table 4-1: "LM-2.5MW-5MWh" Package Indicative Long-Term Performance