RENERA
ROSATOM

RENERA ENERGY STORAGE SOLUTIONS

Lithium-Ion Traction Batteries and Battery Energy Storage Systems

“Lithium-ion batteries have revolutionized our lives since they first entered the market in 1991. They have laid the foundation of a wireless, fossil fuel-free society, and are of the greatest benefit to humankind.”

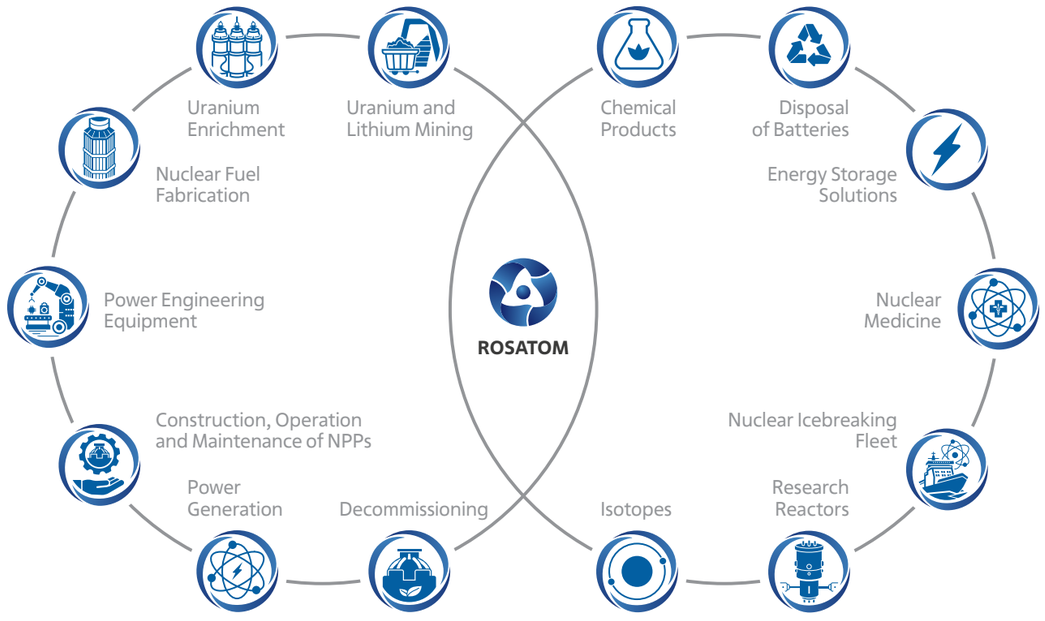
Nobel Committee of the Royal Swedish Academy of Sciences

ROSATOM

State Atomic Energy Corporation Rosatom

ROSATOM is a diversified Russian holding that unites more than 300 enterprises and organizations in various industries. Besides generating electricity at large capacity Nuclear Power Plants (NPP), the Corporation also constantly developing new business lines: wind energy, energy storage systems and others.

ROSATOM is mining the electric vehicle industry in Russia, providing a production cycle "from lithium mining to battery recycling"



450 enterprises and organizations

370+ K employees in the State Corporation

19,1 % share of electricity generated by NPPs in Russia

40 % of revenue in 2023

TVEL
ROSATOM

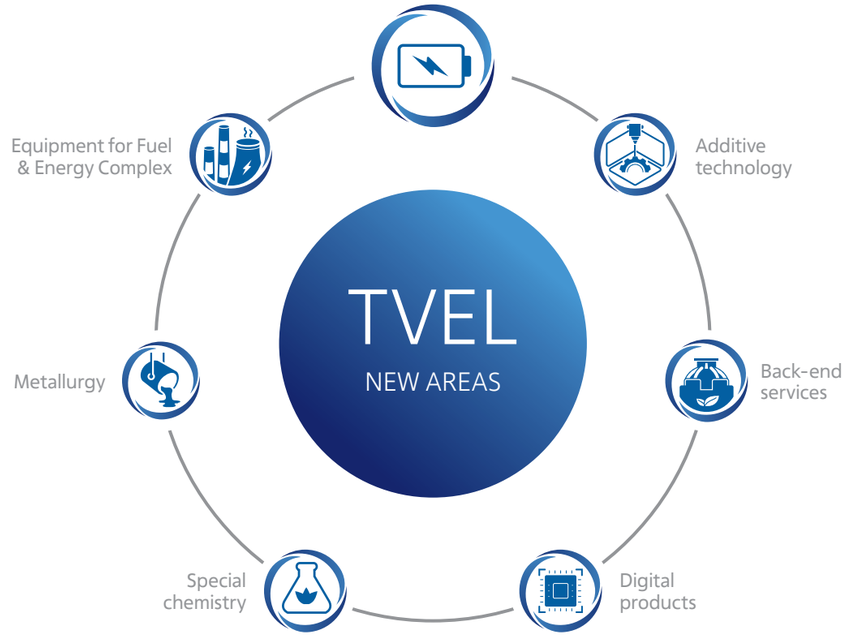
ROSATOM's TVEL Fuel Company

ROSATOM's TVEL Fuel Company is one of the world's largest producers of nuclear fuel. The Fuel Company is the monopoly supplier of nuclear fuel for all Russian NPPs, marine and research reactors in Russia. NPPs in 14 countries around the world operate on fuel produced by TVEL and every 6th nuclear power reactor operates on TVEL fuel.

The Fuel Company includes enterprises specializing in the production of gas centrifuges, uranium enrichment, nuclear fuel fabrication, as well as research and development companies.

ROSATOM's TVEL Fuel Company is actively developing new business areas, such as metallurgy, decommissioning of various facilities, digital and additive technologies, energy storage systems, equipment for fuel and energy complexes, and chemical industry.

Energy Storage Solutions

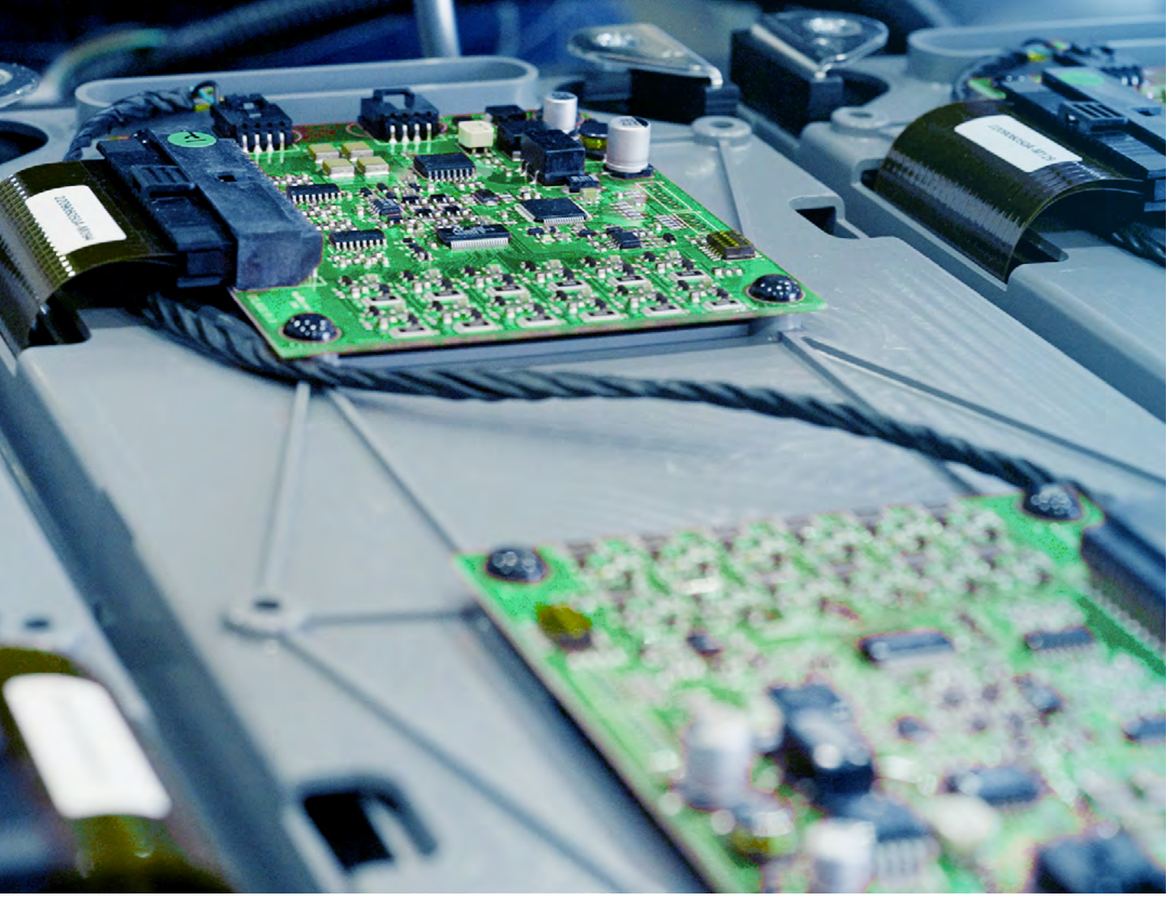


14 production sites

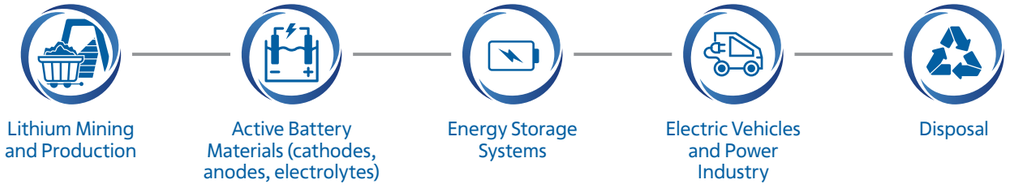
25.4 K employees in the company

17 % of the global nuclear fuel fabrication market

31.4 B ₽ revenue from new products



One of the new business areas of ROSATOM is the development of a full-cycle production chain of energy storage systems in Russia "from a lithium mine to disposal".



ROSATOM takes a leading position in the lithium-ion batteries production technology in Russia

ROSATOM is actively developing a network of its own research and development centers (R&D). This approach ensures up-to-date and energy-efficient technologies, rapid implementation of new solutions, diversity of service options, high scientific competence and innovation at the nexus of modern technologies and current market trends.

RENERA is a leader in the development of energy storage technology

Current developed technologies

- Contemporary lithium-ion technologies – development and evolution of existing lithium-ion technologies
- Post-lithium technologies – development of promising chemical current sources
- Localization of components for the prompt manufacture of lithium-ion batteries in Russia (development of new scientific and engineering solutions for the localization)

The company is constantly improving its production methods and researching alternative energy storage technologies.

RENERA
ROSATOM

RENERA is responsible for energy storage business within ROSATOM

RENERA combines constantly improved lithium-ion technology with the ongoing research of new energy storage methods.

RENERA develops and manufactures lithium-ion batteries used for stationary battery energy storage systems and traction batteries for electric vehicles.

Our Assets

Moscow

- Current production capacities up to 500 MWh/year
- Research and development center
- Test laboratories
- Full-cycle 4,000 MWh/year production starting 2026

Saint Petersburg

- Service center

Kaliningrad

- Full-cycle 4,000 MWh/year production starting 2025

Novosibirsk

- Production of cathode materials

Key Business Lines

- Battery Energy Storage Systems (BESS) and Uninterruptible Power Supply (UPS)

- Traction batteries for various types of electric vehicles

470 MWh/year
current production capacity

3
scientific and technology centers

63
patents

8.4 GWh/year
total capacity of production sites from 2026

5
production sites

50
know-how

Production assets growth over the years

2021
Pilot and commercial production in Moscow
15-30 MWh

2022
Assembly site at the Moscow Polymetal Plant
150 MWh

2023
Launch of the production site in Moscow
470 MWh

2025
Launch of the gigafactory in Kaliningrad
4 400 MWh

2026
Launch of the gigafactory in Moscow
8 400 MWh

2030
Plan
>16 000 MWh

Key RENERA Advantages

RENERA contributes to the active development of a new industry in Russia – the manufacture of high-tech lithium-ion batteries of traction batteries and energy storage systems for various purposes.

Technological sovereignty
→ Deep localization of energy storage systems manufacture

Comprehensive Project Support
→ Feasibility study, warranty service, consumer services

Technology Authorship
→ Proprietary patents and know-how

Energy Consulting
→ Development of energy-efficient tailored applications of BESS for our clients

R&D
→ Corporate scientific and research facilities

Flexibility
→ Customized and flexible approach to cooperation

In-house Production
→ Multiple own production sites

Sustainability
→ Application of sustainable practices in the company's environmental, social and governance practices

Two own gigafactories in Russia

RENERA will launch two gigafactories in 2025–2026 with 4 000 MWh (4 GWh) annual production capacity each. One gigafactory will be able to provide traction batteries for 50 000 EVs.

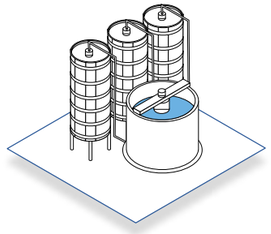
8 GWh per year | Total annual capacity of the two gigafactories (total capacity of produced batteries)

Gigafactories input

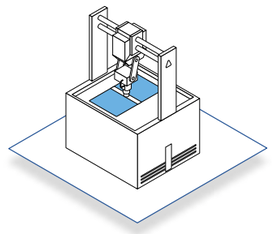
The first Russian gigafactory will start its operation in the Kaliningrad Region in 2025. The second gigafactory will start in Moscow in 2026. Both these factories will provide a full-cycle production from the electrode manufacturing to finished battery.

RENERA's gigafactories will produce traction batteries for electric vehicles and battery energy storage systems for power industry.

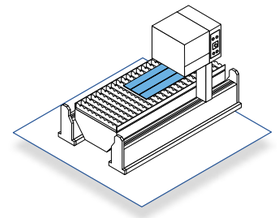
Full production cycle



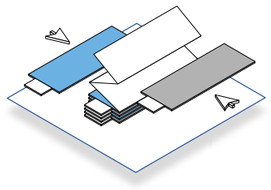
1 Preparation of the cathode and anode mixture, electrolyte



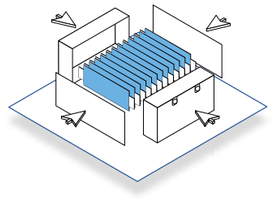
2 Application of materials on the electrode tape



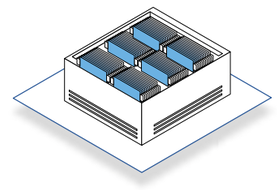
3 Electrodes slitting and cutting



4 Cell formation



5 Module formation



6 Battery assembly

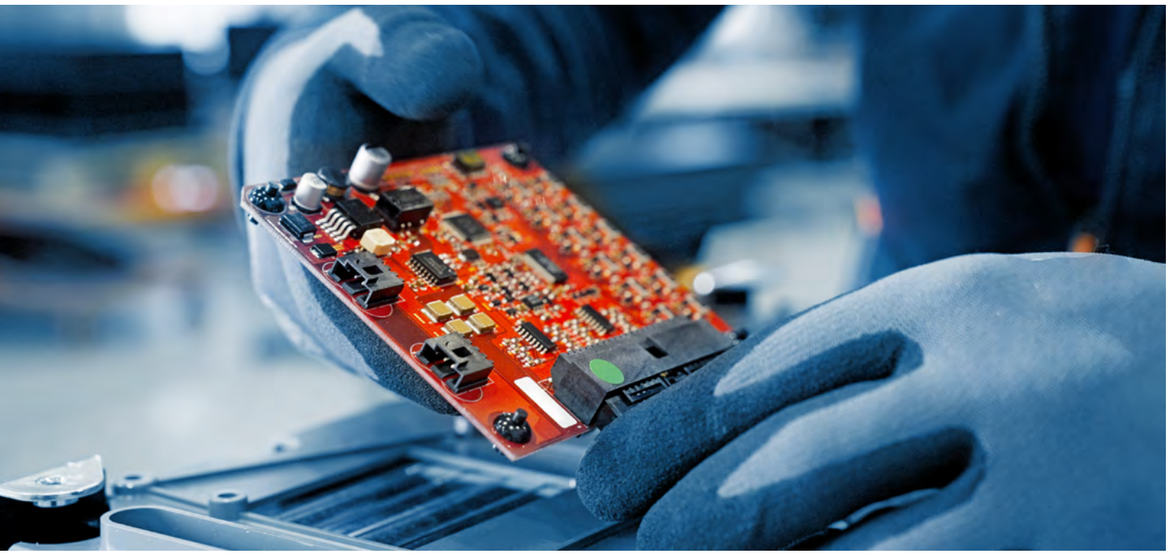
Advantages of RENERA Lithium-Ion Batteries

Lithium-ion batteries are able to store a significant amount of energy in compact dimensions while providing the fast charge and potent discharge capabilities.

RENERA's expertise in all stages of battery manufacturing and the modular architecture of its energy storage systems enables to provide both standard and customised solutions to meet any project requirement.

Advantages

- High energy and power density
- Proprietary battery management system (BMS)
- Long cycle life
- Low capacity degradation rate
- Fast charging
- Modular architecture
- High power and high energy designs
- Wide operating temperature range – from -60 to +55 °C[1]



Four stages of the safety system for RENERA storage systems

1 **Cell level**
Modern materials and versatile test methods

2 **Management and monitoring**
Proprietary BMS

3 **Design**
In accordance with international safety standards UNECE 100.2, UN DOT 38

4 **Fire safety**
Fire extinguishing module with fire extinguishing agents microencapsulation technology

Optional
Access control system, remote monitoring and control

[1]With a thermal management system (TMS).

RENERA Lithium-Ion Cells

The in-house R&D and production facilities allow RENERA to create a wide range of lithium-ion cells-based solutions.

Thanks to the updated form factor of lithium-ion cells, they can form batteries for any type of low-floor passenger EVs, battery energy storage systems (BESS) and uninterruptible power supplies (UPS). The single form factor of lithium-ion cells contributes to the unification of architectural solutions and better product versatility.

260 Wh/kg
high energy density

Model	123100302E1	123100302_P50A (under development)
Type of cathode material	NMC (nickel-manganese-cobalt)	
Rated capacity	60 Ah	55 Ah
Energy density	260 Wh/kg / 598 Wh/l	239 Wh/kg / 527 Wh/l
Rated voltage	3,70 V	
Maximum charge / discharge currents	1,5C (90 A) / 2C (120 A)	2C (110 A) / 4C (220 A)
Operating voltage range	2,7 ~ 4,2 V	
Operating temperature range[1]	Charge 0 °C ~ 55 °C I Discharge -20 °C ~ 55 °C	
Dimensions (length x height x thickness)	303 x 100 x 12,3 mm	

[1]With a temperature control system. Charge and discharge currents may be limited in some temperature ranges.

Multi-Purpose Battery Module

Multi-purpose battery module for power industry and electric vehicles

Proprietary design of RENERA multi-purpose battery module allows its application as a part of a traction battery for electric vehicles as well as in stationary energy storage systems for various purposes.

The diversity of design versions due to various cell connection options within the module allows to select battery parameters in strict accordance with a particular application.

RENERA traction batteries are used in various means of transport that use electric propulsion: passenger cars and buses, freight transport, water and rail transport, as well as special types of vehicles for mining, warehousing and utility applications.

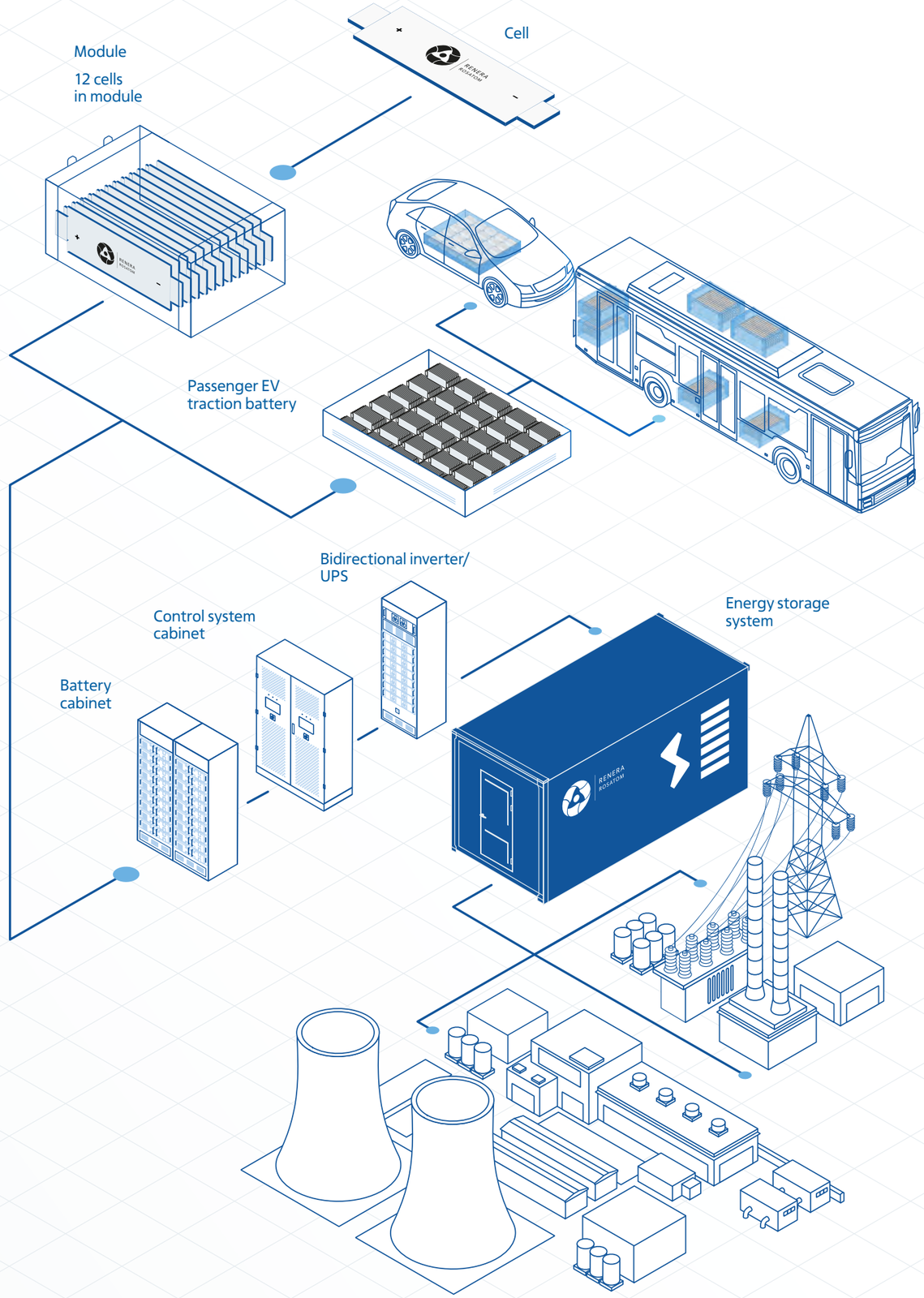
Modular batteries are used in stationary energy storage systems used in the power industry – distribution and transmission, oil and gas sector, industrial enterprises, as well as in industrial class UPS1, data centres and other facilities.

VDA battery module with 60 Ah lithium-ion cells

Model	NE600-044	NE180-014	NE120-022
Configuration	12S1P	4S3P	6S2P
Rated capacity	60 Ah	180 Ah	120 Ah
Rated energy	2,66 kWh	2,66 kWh	2,66 kWh
Rated voltage	44,4 V	14,8 V	22,2 V
Operating voltage range	32,4 ~ 50,4 V	10,8 ~ 16,8 V	16,2 ~ 25,2 V
Gravimetric energy density	216 Wh/kg	216 Wh/kg	216 Wh/kg
Maximum charge currents	1,5C (90 A)	1,5C (270 A)	1,5C (180 A)
Maximum discharge currents	2C (120 A)	2C (360 A)	2C (240 A)
Weight	~12 kg	~12 kg	~12 kg

VDA battery module with 50 Ah lithium-ion cells (under development)

Model	NE500-044 (under development)	NE150-014 (under development)	NE100-022 (under development)
Configuration	12S1P	4S3P	6S2P
Rated capacity	55 Ah	165 Ah	110 Ah
Rated energy	2,44 kWh	2,44 kWh	2,44 kWh
Rated voltage	44,4 V	14,8 V	22,2 V
Operating voltage range	32,4 ~ 50,4 V	10,8 ~ 16,8 V	16,2 ~ 25,2 V
Gravimetric energy density	198 Wh/kg	198 Wh/kg	198 Wh/kg
Maximum charge currents	2C (110 A)	2C (330 A)	2C (220 A)
Maximum discharge currents	4C (220 A)	4C (660 A)	4C (440 A)
Weight	~12 kg	~12 kg	~12 kg



[1]UPS – uninterruptible power supply.

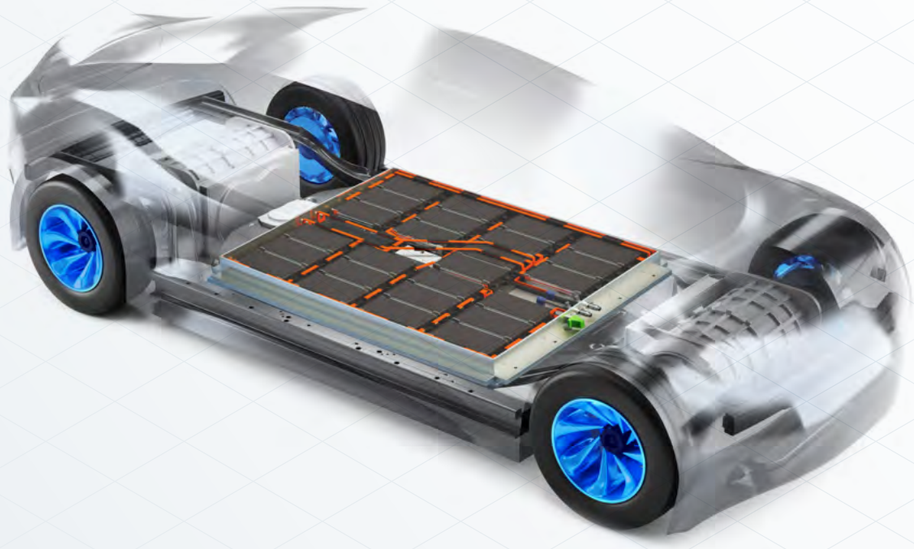
Solutions for Electric Vehicles

Advantages of RENERA traction batteries:

- high energy density of proprietary NMC 811 lithium-ion cells;
- fast charging;
- compliance with standards: UNECE, CU TR, GB/T. Modules are based on international battery design type VDA;
- CAN control (J1939);
- aluminum or composite casing for reduced battery weight;
- multilevel safety system.

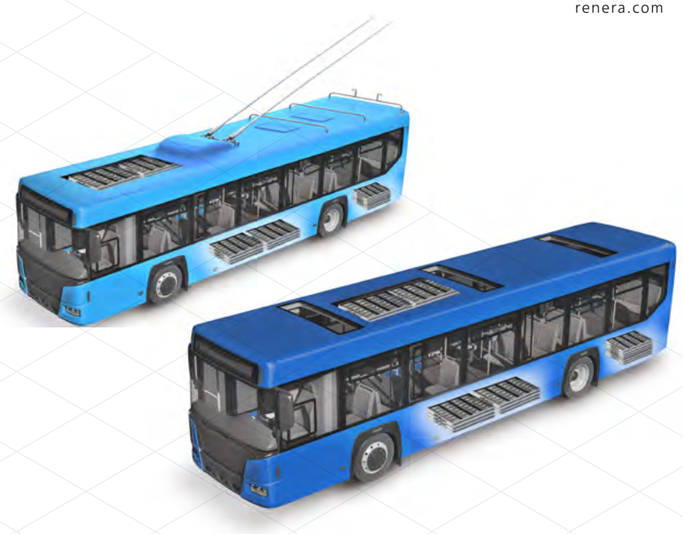
A wide range of solutions for passenger electric vehicles.

Solutions for passenger electric vehicles: HEV[1], PHEV[2], BEV[3], FCEV[4].



[1]HEV — hybrid electric vehicle.
[2]PHEV — plug-in hybrid electric vehicle.
[3]BEV — battery electric vehicle.
[4]FCEV — fuel cell electric vehicle.

Solutions for electric buses



Solutions for other types of transport:

- water transport (river and sea)
- railway transport
- commercial electric vehicles (LCV[1] and cargo)
- personal mobility devices.

Competence and experience gained from implemented projects enable RENERA to offer a full range of services for equipping any electric vehicle with customized traction batteries.

- Integration of the RENERA battery into the electric transport platform at the development stage
- Selection and scaling of battery parameters according to customer requirements.

Flexible design of the total energy of the traction battery

from 40 kWh **to** 500 kWh

[1]LCV — light commercial vehicle.

Power Industry Solutions

Battery Energy Storage Systems (BESS) are used in the power systems in various areas: distribution and transmission power grids, power stations and substations, data centers, oil and gas sector, industrial enterprises and other facilities. BESS[1] allow balancing the generation and consumption of electricity and improve energy efficiency.

Purpose:

- energy management: abruptly variable load compensation, consumption peak levelling, load profile optimization
- ensuring reliable power supply and backup power
- provision of backup power supply for substation's operational direct current systems
- provision of additional power for EV[2] charging stations
- integration of RES[3] facilities into the grid
- elimination of active-power shortage
- arrangement of hybrid microgrids
- electric power quality assurance
- organization of autonomous hybrid energy complexes

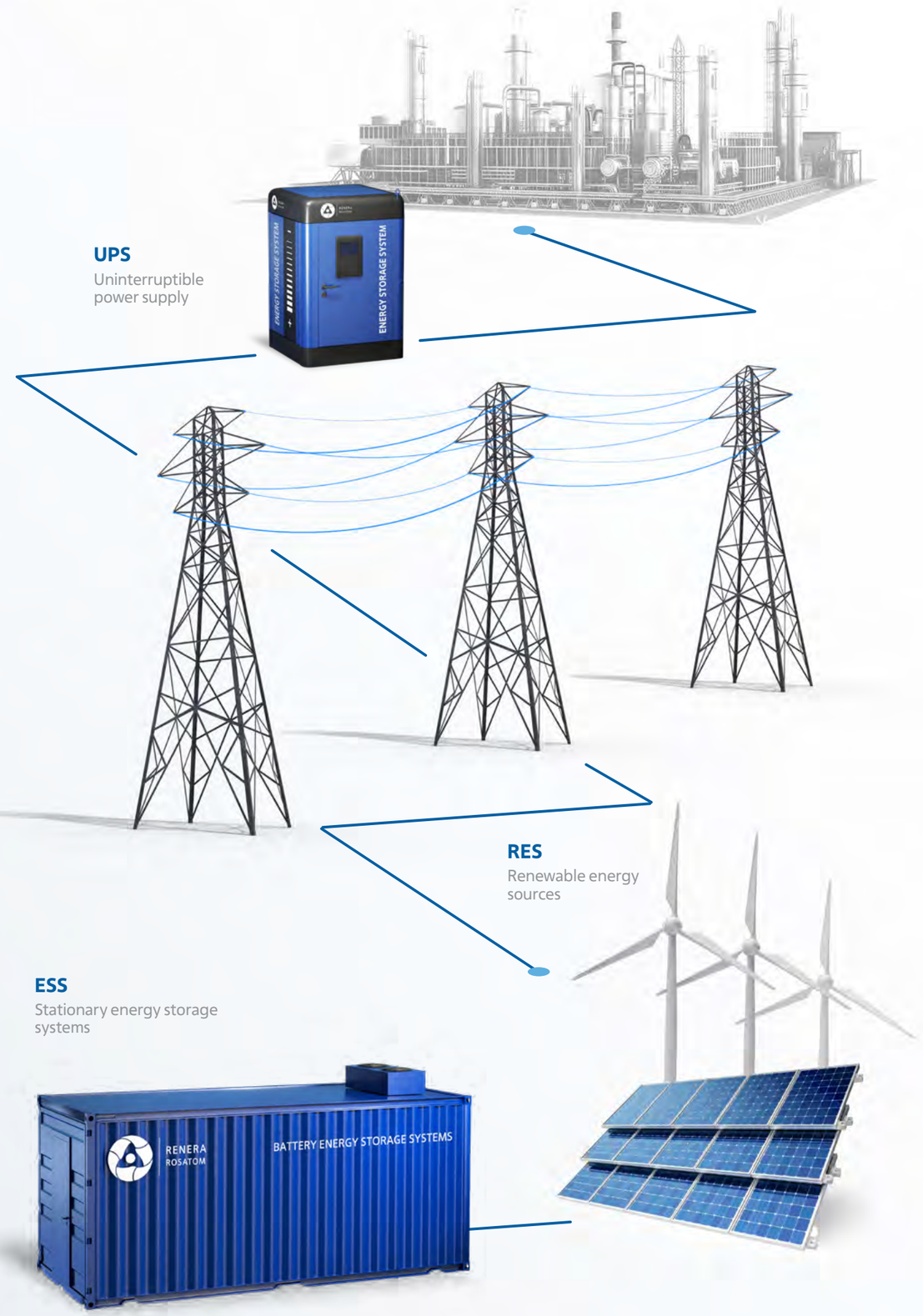
The use of RENERA BESS solutions helps to improve efficiency of the generating equipment as well as ensure uninterrupted power supply.

The use of energy storage systems in modern grids makes it possible to implement intelligent control algorithms for the transmission, distribution and consumption of electricity and make the process of grid monitoring and control easier.

Application:

- electric power grids
- industrial enterprises
- renewable energy sources
- fossil fuel power generation replacement

[1]BESS — battery energy storage systems.
[2]EV — electric vehicles.
[3]RES – renewable energy sources.



Power Industry Solutions

The modular architecture of RENERA energy storage systems allows easy scaling ranging from compact systems for local consumers to large-scale UPS[1] for data centers and industrial BESS[2].

RENERA stationary energy storage systems for power industry facilities

Easy integration with UPS unit of any manufacturer

Design variants

Industrial energy storage system

Key features:

- functionality and flexibility of operating model
- up to 3 MWh in one container
- easy scalability of power and energy due to modular architecture
- remote monitoring and control
- built-in climate control system, firefighting system and access control system

Compact energy storage system for local grids and small enterprises

Key features:

- power backup for critical loads
- power quality assurance for end consumers
- power: up to 100 kVA
- enegry: up to 144 kWh
- online UPS – instantaneous transfer to a backup power source
- compatible with any inverter with voltage up to 900 V and MODBUS RTU/TCP support

Modular uninterruptible power supply (UPS) with lithium-ion battery

Key features:

- double conversion UPS (online UPS)
- UPS unit power from 100 to 1200 kW
- UPS scaling up to tens of MW/MWh
- any load redundancy time

[1]UPS – uninterruptible power supply.

[2]BESS — battery energy storage systems.

Solutions for Special Machinery

RENERA offers to:

- upgrade existing vehicles by replacing a lead-acid traction battery with a lithium-ion one
- design a battery for new machinery
- develop a feasibility study for upgrade to a lithium-ion battery

Wide range of solutions for:

- warehouse vehicles
- utility vehicles
- mining vehicles
- airport ground vehicles
- robots
- underwater machinery
- railway transport

Advantages of lithium-ion batteries for special machinery:

- high energy density
- minimum scope of maintenance
- stable voltage output during the discharge
- possibility of charging from household power supply add
- fast charging capability
- low self-discharge rate
- payback period 2-3 years when replacing a lead-acid battery
- no memory effect
- convenient battery state monitoring

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