



SKELE+ON TECHNOLOGIES

GLOBAL LEADER IN **ULTRACAPACITOR**
-BASED ENERGY STORAGE

+ Corporate Introduction

NAMED IN



WINNER OF



FEATURED IN



Handelsblatt

VentureBeat

Bloomberg



Leading European Ultracapacitor Manufacturer

German **engineering** & Estonian **IT**



Großbröhrsdorf, Germany | Skeleton Technologies GmbH

- + **Industrial scale** manufacturing facility
- + Ultracapacitor **Research & Development** center
- + **Application** Engineering
- + Electrode Center of **Excellence**

Tallinn, Estonia | Skeleton Technologies OÜ

- + **Software** development
- + **Electronics** Engineering
- + **Module & System** Development



11 Patent Families

From **raw material** to **product design** and **manufacturing**

+190+ Employees

Skeleton Technologies **ultracapacitors**

Key enabling **technology** to **power electrification across industries**



AUTOMOTIVE

- + **High power applications**, solution to stringent weight & space requirements

TRANSPORTATION

- + **Decreasing CO2 & NOx** emissions
- + Increasing **energy efficiency** through **energy recuperation & decreasing downtime**

GRID & RENEWABLES

- + **Protecting** grid infrastructure and enabling **higher** and **faster** adoption rate for **renewables**
- + Providing **solutions** to more stringent **grid code requirements**

INDUSTRIAL EQUIPMENT

- + Enabling **electrification**, **energy efficiency**, and further **automation**
- + **Immediate backup power**
- + **Tens of MWs** even with tight space constraints

A Qualified Supplier & System Provider

To Automotive, Grid, Transportation, and Industrial Companies, OEMs & Tier 1s

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Over 170 Million Euros invested

A **strong investor** base, committed to **support** the company becoming a **global market leader** by 2023



Marubeni

- + Marubeni is one of the largest trading houses in Japan, with >\$7 bn yearly revenues.



- + Innovation investments company
- + 27 major industrial companies as shareholders (ABB, Wattenfall, EDF, Iberdrola, Total...)



- + One of the largest investment companies in the Baltics, focus on cleantech venture capital



- + European Union non-profit long-term lending institution has financed Skeleton through a quasi-equity loan.

FIRSTFLOOR CAPITAL

- + Venture capital fund of Khazanah Nasional, which manages a \$30bn fund
- + Investing in high-growth technology companies (information technology, mobility, communications and life sciences).



- + Tallinn Nasdaq listed giant of manufacturing and real estate in the Baltic and Nordic regions.

The Management Team

Industry experts, entrepreneurs, and experienced leaders



Oliver Ahlberg
Chairman of the Board

- + Co-Founder of Skeleton Technologies
- + Successfully co-founded and sold local e-commerce company to market leader
- + Serial entrepreneur



Taavi Madiberk
CEO

- + Co-Founder of Skeleton Technologies
- + Former Chairman of the Supervisory Board of Estonian Railways
- + Serial entrepreneur



Ants Vill
CCO

- + Prior experience includes production management and Kaizen consulting. Knowledge of lean manufacturing acquired by studying renowned senseis like Taiichi Ohno's apprentice, Sensei Nakao from Shingijitsu USA Corporation



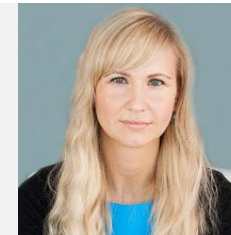
Erkki Raasuke
CFO

- + Long experience in finance and banking as CFO at Swedbank, Managing Director at LHV Bank, and CEO at Luminor Bank
- + Previously Chairman of Estonian State-Owned Companies Nomination Committee
- + Previously Chairman of the Board at Eesti Energia and Estonian Air



Dr. Daniel Weingarth
CTO

- + Former Head of Application Engineering at Heraeus Battery Technology GmbH
- + PhD from ETH Zürich
- + Author of more than 30 publications about ultracapacitor technology



Nele Leht
Chief of Staff

- + Formerly Lawyer & Councillor of the Supervisory Board at LHV, the largest domestic financial group and capital provider in Estonia
- + Former Lawyer at Eversheds Ots&Co in corporate law



Jüri Raatma
Legal Adviser

- + 20+ of legal experience in private and public sectors
- + Former Adviser to Minister of Finance, Minister of Economy, and Minister of Justice in Estonia
- + Has served as Council member in companies such as Elering, Eesti Telekom, Estonian Railways, EVR Cargo



Dr. Sebastian Pohlmann
VP of Innovation

- + PhD from the University of Münster, Germany
- + Author or co-author of 8 publications on ultracapacitor technology
- + Has together with his team developed the highest energy density ultracapacitors to date



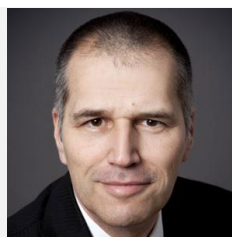
Oliver Kotkas
VP of Supply Chain

- + A seasoned procurement and purchasing professional, who spent almost 10 years at Stoneridge in various roles in for example commodity management and sourcing. Oliver's latest position at the company was Global Director of Commodity Strategy.



Aleksandra Kell
VP of Human Resources

- + Various HR roles at Schlumberger, Shell, Melexis, and other industry leaders in Russia, Great Britain, Germany, and the United States.
- + Member of the Chartered Institute of Personnel and Development, UK



Dr. Oliver Genz
Head of Quality

- + Head of Supplier Quality at Roche Diagnostics
- + Group Head of Material Quality at Roche Diagnostics
- + Quality Team Lead at Infineon



Kristjan Kõrgmaa
Finance Director

- + Formerly managing the Transaction Advisory Department at Ernst & Young Estonia
- + Former Senior Financial Controller at Eesti Energia, Estonian energy incumbent

What is an **ULTRACAPACITOR**?



SLOW

Li-ion Batteries

use a **chemical reaction** to store energy

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- + **Chemical** storage of energy
- + Limited power density (0.5 kW/kg)
- + **High energy density** (205 Wh/kg)
- + Limited cycle life (<3000)
- + **Slow charge** rate (1.5 C)
- + **Scarcity** of raw materials
- + **Difficult to recycle**



FAST

Ultracapacitors

use an **electric field** to store energy

.....

- + **Physical** storage of energy
- + **High power density** (up to 60 kW/kg)
- + Limited energy density (up to 20 Wh/kg)
- + **Extreme cycle life** (>1 million)
- + **Extremely fast charge** rate (2000 C)
- + **Abundance** of raw materials
- + **Easy to recycle**

What makes us **different?**

4x

POWER DENSITY
vs COMPETITION

64,3
kW/L

15,6
kW/L

1. HIGHEST LEVEL OF QUALITY CONTROL

- + Skeleton Technologies controls the entire production chain from raw materials to end solutions
- + Entire production chain in Germany

2. FOUR TIMES THE POWER DENSITY

compared to competition, which means for example:

- + 30% less modules needed for Kinetic Energy Recuperation Systems in trams
- + 50% less cells used in 10MW grid stability solution compared to competing solutions

3. LARGEST ENGINEERING AND SOFTWARE DEVELOPMENT TEAM IN THE INDUSTRY,

enabling fast and agile solutions for complex projects, quick time to market for our customers

4. We have the building blocks that, combined with a **UNIQUE ADVANTAGE** from **CURVED GRAPHENE** raw material, allow to achieve **BREAKTHROUGH TECHNOLOGY ROADMAP.**

From single cells to full energy storage systems

The **only full value-chain manufacturer** on the market

RAW MATERIAL



Curved Graphene

INDUSTRIAL MODULES



SkelStart 12V & 24V
Ultracapacitor engine module



SkelMod 17V
Ultracapacitor module



SkelMod 51V
Ultracapacitor module

SYSTEMS



SkelGrid
Ultracapacitor-based energy storage system



SkelGrid Omni
Ultracapacitor-based energy storage system

SINGLE CELLS



SkelCap SCA Series
300-3200F
Industrial ultracapacitors



SkelMod 102V
Ultracapacitor module



SkelMod 131V
Ultracapacitor module



Custom SkelPacks
Laser-welded ultracapacitor packs



SkelKERS
Ultracapacitor system



ElevatorKERS
Ultracapacitor system

Fully integrated manufacturing

High quality & performance energy storage solutions made in Europe

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TECHNOLOGIES



The **largest ultracapacitor factory** in **Europe**

(Grossröhrsdorf, **Germany**)

Capacity after current scale-up:

3.5m

Cells per year

400k

Modules per year

Ultracapacitors Electrifying Trams in Germany

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Kinetic Energy Recovery **reduces costs** and **protects infrastructure**



30%
Energy **savings**



ŠKODA ELECTRIC a.s.

- + Skeleton Technologies ultracapacitor modules will be installed in Skoda Transportation trams in Mannheim, Heidelberg, and Ludwigshafen in Germany.
- + The ultracapacitor system captures braking power and re-uses it for acceleration, saving 30% of energy, as well as decreasing wear on brakes. Ultracapacitors also protect infrastructure by shaving peaks of power.
- + Skeleton's advantage is very low internal resistance, resulting in the **long application lifetime** due to **lowest operating temperature** on the market. The **high power density of our ultracapacitors** enables **space and cost savings** compared to competing products.

Automating Intralogistics Shuttles

Recharging in **seconds** enables **continuous operation**



24/7

Operation

FOR

15+ YEARS

Lifetime

- + Laser-welded SkelCap ultracapacitor pack **powers automated intralogistics shuttles**
- + **Long lifetime of 15+ years or 130,000+ working hours**
- + Compared to batteries, ultracapacitors provide **3-4x the lifetime with no maintenance** or charging area requirements
- + **Opportunity charging** along a predetermined route **enables continuous operation**

Kinetic Energy Recovery in Port Cranes

Use Case | HHLA Port in Muuga, Estonia



Fuel consumption
decreased by

34%

HHLA

- + A 40t Kalmar E-One RTG crane retrofitted with SkelMod 170V ultracapacitor modules and a DC/DC converter
- + Kinetic energy captured as containers are lowered, and re-used to lift containers
- + During a 3-month measurement period, fuel consumption decreased from 16,7 l/h to 11,0 l/h
- + Several pilot installation in progress in EMEA

Ultracapacitors **Protect** Power **Grids**

Grid stability and peak shaving **reduce costs**



50%

Less

**ultracapacitors
needed**

for 10mw grid power quality
application **compared to
Maxwell / Tesla**

- + SkelGrid ultracapacitor system used to **maintain power quality** and **prevent** brown- and **black-outs**
- + Ultracapacitors **react instantly to voltage issues, stabilizing** the grid for even sensitive manufacturing processes
- + Skeleton's advantage is the **lowest ESR** on the market, resulting in the **long application lifetime** due to **lowest operating temperature** on the market
- + **High power density** enables **space and cost savings** compared to other power quality solutions

Key Benefits

To working with us



- + **The most modern ultracapacitor factory** in the world, located in the heart of Silicon Saxony in **Germany**



- + **Fully integrated manufacturing** from **raw materials** to **full systems** – Skeleton Technologies is the only ultracapacitor energy storage manufacturer in the world with **control over the entire manufacturing chain**
- + **Stringent quality control** processes have ensured Skeleton is a qualified **supplier to** some of the **largest OEMs in the world**
- + **Lean production processes** enable **fast & cost-effective** production ramp-up and **short lead times**

WE ARE
SKELE+ON
TECHNOLOGIES

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WE HELP TO **SAVE ENERGY**

Skeleton Technologies GmbH | info@skeletontech.com | +49 3595 2416 040