ENSURGE™

Investor Presentation

March 10, 2024

Safe Harbour Statement

This presentation includes "forward-looking" statements, including, without limitation, projections and expectations regarding Ensurge and its subsidiaries (the "**Group**") and its future financial position, business strategy, plans and objectives (the "**Forward-looking Statements**").

All Forward-looking Statements included herein are based on information available to the Group, and views and assessments of the Group, as of the date of this presentation.

Ensurge can make no assurance as to the correctness of such Forward-looking Statements and readers are cautioned that any Forward-looking Statements are not guarantees of future performance.

By their nature, Forward-looking Statements involve and are subject to known and unknown risks, uncertainties and/or assumptions as they relate to events and depend on circumstances that may or may not occur in the future.

Readers and prospective investors of the Group's shares are cautioned that Forward-looking Statements are not guarantees of future performance and that the Group's actual financial position, operating results and liquidity, and the development of the industry in which the Group operates, may differ materially from those made in or suggested by the Forward-looking Statements contained herein.

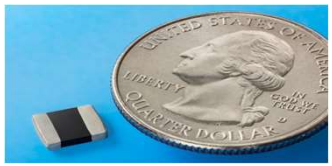
No guarantees are given that the intentions, beliefs or current expectations upon which its Forward-looking Statements are based will occur.

Given the aforementioned uncertainties, prospective investors are cautioned not to place undue reliance on any of these Forward-looking Statements.

Content

Investment Case

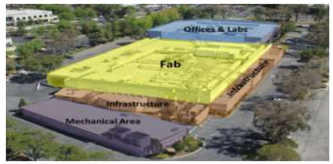
Introduction



UNIQUE PRODUCT

Safe **solid-state battery with best-in-class** ***performance***

Affordable **price**



DESIGNED FOR SCALE

Incubation Center in ***Silicon Valley***

Apply different ***levers*** **to scale up volumes**

ATTRACTIVE MARKET

$10bn+ **market growing at** ***26% cagr***

Smaller **and more** ***functional*** **devices requiring** ***unique*** **batteries**

HIGH ENTRY BARRIERS

>$350 million **invested over** ***15 years***

Extensive ***IP*** **portfolio**

Accumulated ***knowledge***

FRAGMENTED COMPETITION

Weak ***incumbent products***

Different **designs and architectures**

Investment Case

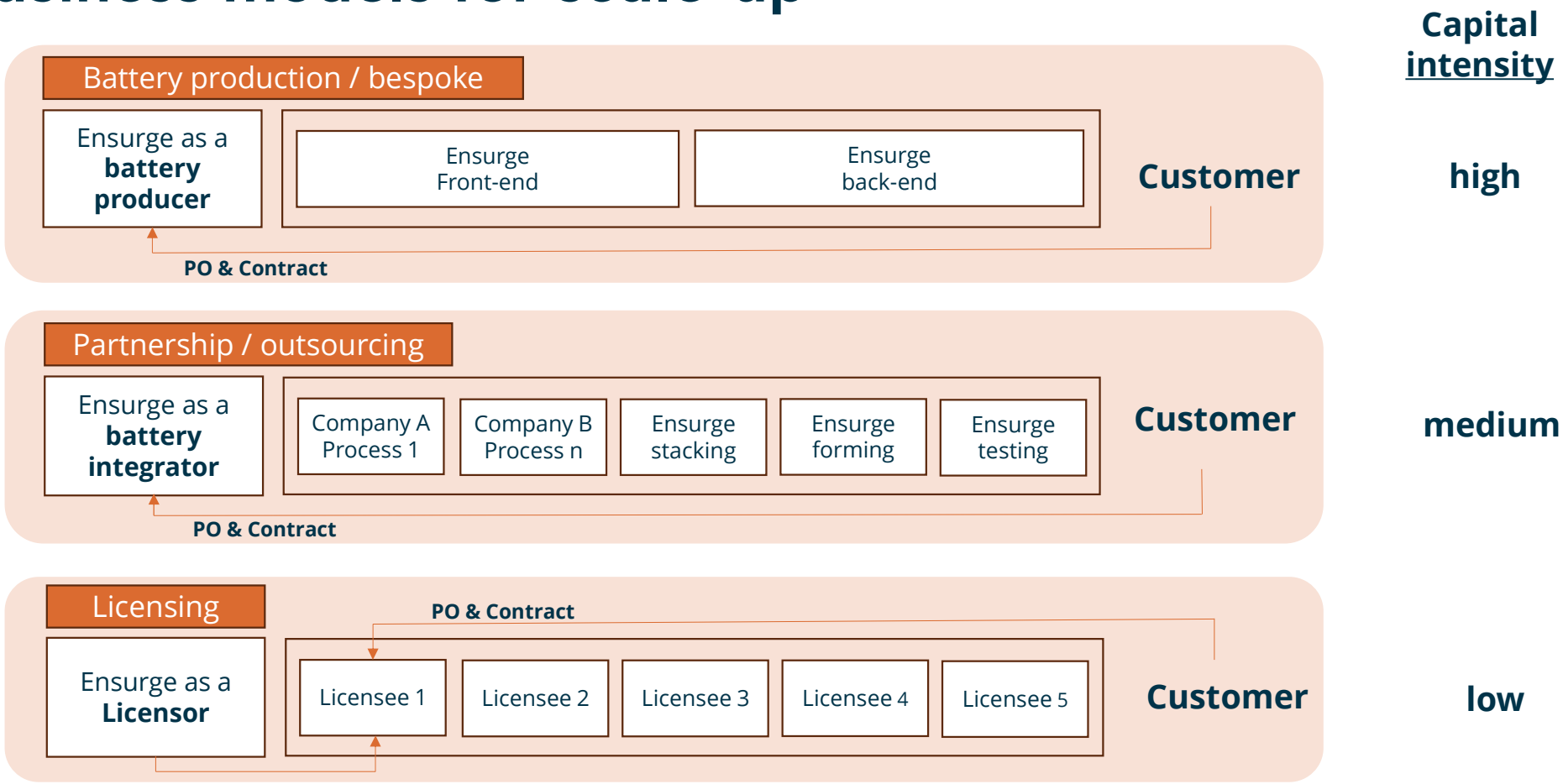
Solid State Micro battery by Ensurge Micropower

Capacity (mAh)	Size mm (l x w x h)	Stainless Steel substrate
1.2	5 x 6 x 1.2	75µm
4.5	5 x 6 x 0.8	10µm
6.5	5 x 6 x 1.2	10µm

	energy density more battery life per unit volume	**recharge cycles** longer lasting	**charging speed** improved user experience	**safety** no fire, explosion, heat risk	**form factor** enabling unique end products
 **Ensurge SSLB**	2x	2-3x	2x	⊘	rectangle ultra thin
vs.					
 **Li-ion button cell**	1x	1x	1x	⊗	thick circle

Investment Case

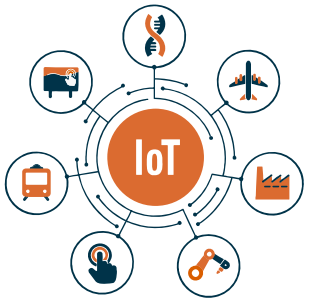
Business models for scale-up



Investment Case

$10bn+ microbattery market growing at 26%* p.a.

Hearables



Smart sensors

Wearables

Medical implants

Supply side – technological progress

- Smaller, lighter devices – increased functionality
- IoT / sensing and transmitting information wirelessly
- Value of device increase over time
- Renewable energy technologies – energy harvesting

Demand side – customer needs and preferences

- Reliable and long-lasting power solutions, and faster charge
- Enhanced safety features
- Vanity / focus on wearable device design
- Health consciousness / sharing on social media

(*) Sources: IDTEchEx, Global Market Insights 2022 & Data Bridge Market Research 2022

Investment Case

$350 million invested in knowledge, IP and equipment

1995

Opticom, precursor to Thin Film, founded

1998

Fast Search and Transfer spun out and later sold to Microsoft in 2008

2007

Thin Film spun out from Opticom

2014

Acquired **Kovio** – key to build up battery competence and capability having invested $120 million from 2000 – 2015

2017

$100 million invested in the **San Jose factory**, R2R and clean room.

2019

Battery strategy formulated and put in motion | changed name to **Ensurge Micropower** in 2021

2023

- **Evaluation** agreements
- First battery **patents** granted
- SSB on **75µm proven**
- Peer-review of **manufacturing process**
- Awarded **DOE grant**

Investment Case

Fragmented competition in micro batteries

Li-Ion

VARTA

China

ZeniPower

EVE 亿纬锂能

Mic-power

- Premium alternative enabling new capacities and user experience impossible with lithium-ion
- Form factor flexibility – customized segmented design
- Faster charge, higher pulse discharge, wider operating range, higher energy density and charge cycles

µmAh Solid-State

ilika

TDK

- Offer 100um to 1mAh capacity
- Majority of the microbattery applications require 1mAh to 100mAh capacities
- µmAh microbatteries target a narrow subset of the market
- Ensurge addresses the full spectrum of microbattery applications

1-100mAh Solid-State

muRata

INNOVATOR IN ELECTRONICS

- Focused on the same markets as Ensurge
- VED ca 150Wh/L (Volumetric Energy Density)
- Ensurge microbattery VED is 3-4 times higher

Investment Case

Offers an attractive value proposition

- Capitalize on **unique technology** at an **affordable** price
- Fit for the **smaller multifunctional devices** trend
- **Leading position** in an industry with **strong fundamentals**
- Positioned for **substantial growth**

Content

Technology Roadmap

Innovative Microbattery Architecture

Ultra-thin 10 µm steel substrate

- High energy density
- High mechanical strength

Roll-to-Roll manufacturing facility

- High throughput, low cost
- Conventional manufacturing environment

Innovative cell-stacking & packaging

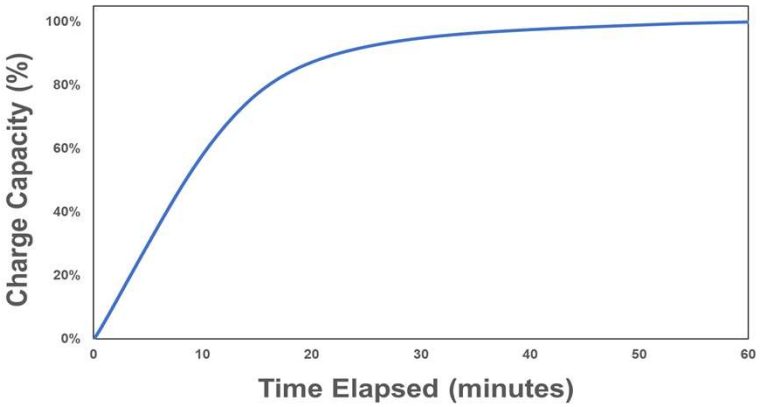
- Maximizes energy density
- Customizable
- Contacts for direct PCB connection

Established anode-less solid-state chemistry

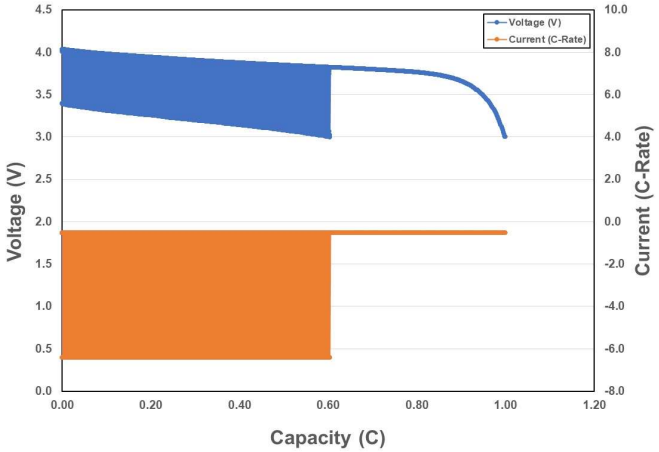
- Lower cost
- 1,000+ cycles
- Rapid charging and high pulse discharge

Technology Roadmap

Fast charging and pulse discharge



4.2V CV charging 80% Capacity <20min



>5C Pulse Discharge

Product Benefits

- Simplified CV Charging @ 4.2V
- Faster Charging compared to Li Polymer or Li-ion
- mA Pulse Discharge for Communications (5C)

Technology Roadmap

Solid state battery safety

Shorting Thermal Test

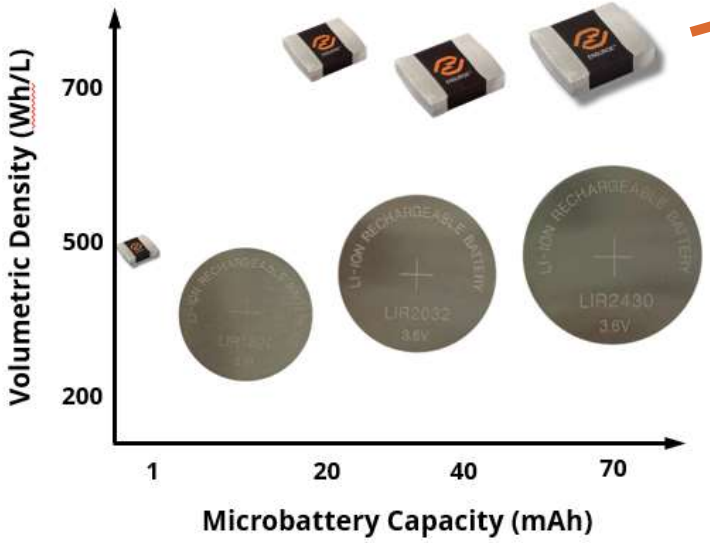
Shear cut

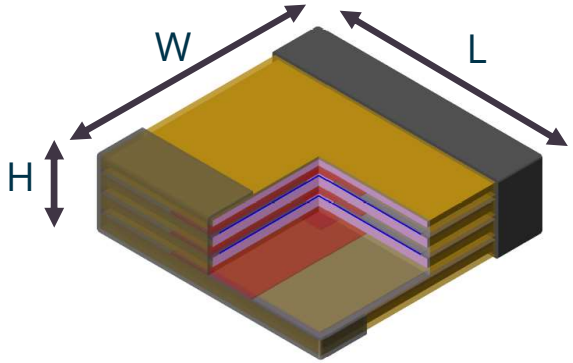
Product Benefits

- Does not overheat during shorting event
- Not flammable from shear cut

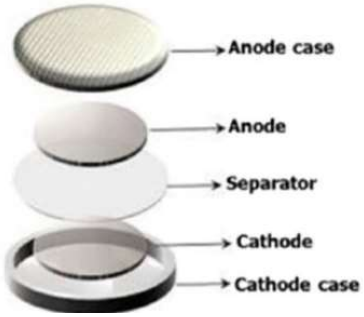
Technology Roadmap

Comparing Energy Density





Ensurge Solid State minimizes substrate and packaging relative to cathode to maximize Energy density with increasing capacity

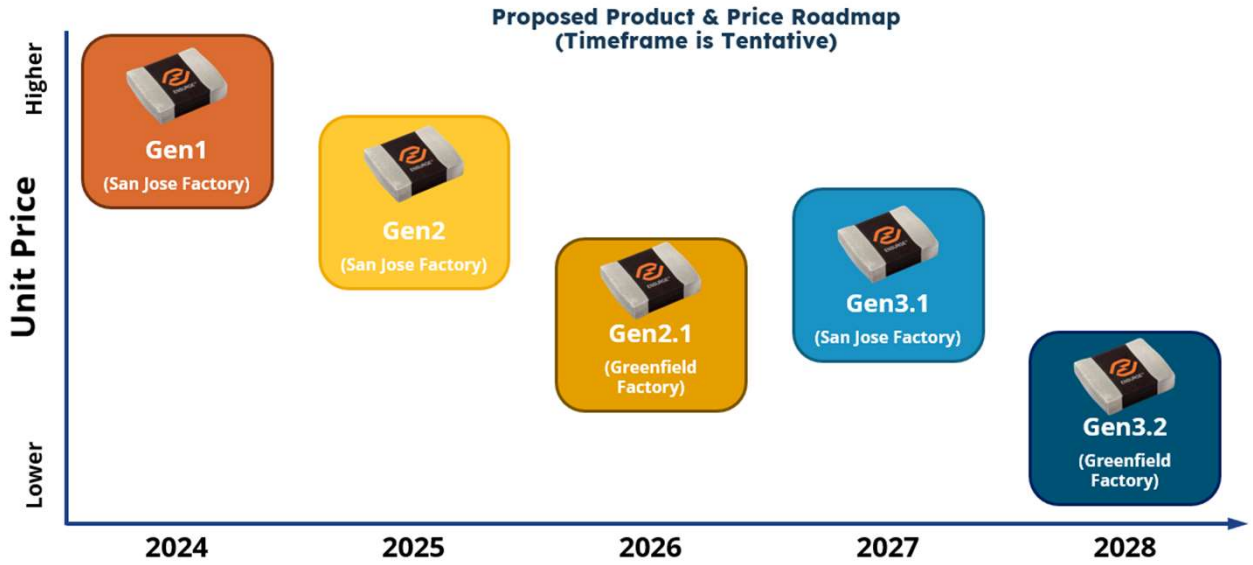


Li Ion is limited at smaller capacities by safety casing and overhead

Technology Roadmap

Four-pronged approach to cost reduction

- Increase machinery utilization
- Reduce material cost
- Reduce labour cost
- Reduce energy cost



Technology Roadmap

Energy Density and Cost Roadmap

Capacity
VED
Cost

650-750

- Cycles > 500 @80%
- 10 µm steel substrate

2023

700-850

- Cycles > 1,000 @ 80% Capacity
- Thinner Metallization
- Thinner Electrolyte

2024

850-1,000

- Higher Cathode Thickness
- Double Sided Cathode
- Lower Cost Cathode
- >100mAh applications

Collaboration Cathode Supplier 1

2025

> 1,200

- Cathode layer engineering
- > 500mAh applications

FORTUNE 500

Collaboration Cathode Supplier 2

2026

Technology Roadmap

Form Factor and Cathode Roadmap

Application	Cathode
Labels Medical	Gen 1, 2, 3.2
Medical IoT	Gen 1, 2, 3.1
Wearables Hearables Medical IoT	Gen 1-2, 3.1, 3.2

Curved/Flex

Wound Coin Cell (Patent filed)

Stack (patent received)

2023 2024 2025 2026

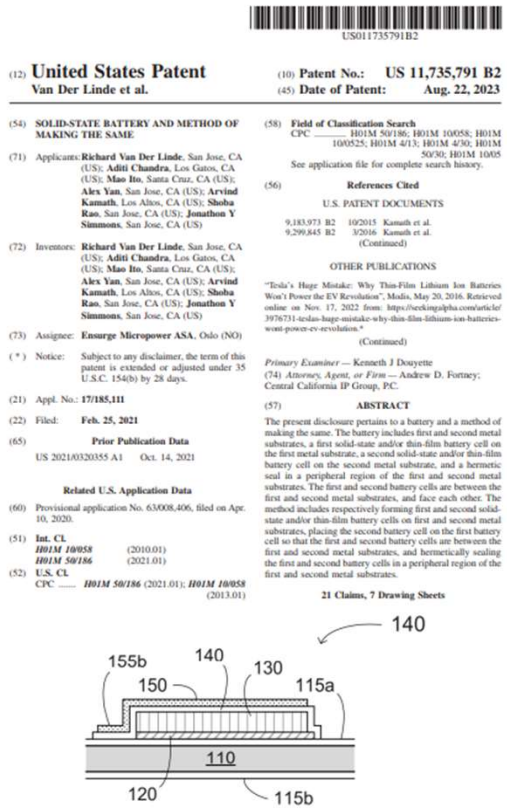
Technology Roadmap

Areas of Focus – user applications

Key Battery Attribute	Smart label smart card	Connected sensors	Medical devices	Wearables	Hearables	Watch/ Phone	Premium Drone	EV
								
Capacity (mWh)	0.1-200	4-800	0.1-800	4-80	40-400	1,400-5,600	4,800	60M
VED (volume)	●	●	●	●	●	●	●	●
GED (weight)			●				●	●
Low Cost					Form Factor	●		●
Fast Charge	●	●	●	●	●	●		●
Safety	●	●	●	●	●			
ENSURGE	Gen 1	Gen 1	Gen1	Gen 1	Gen 1	Gen 2.5	Gen 2	n/a

Technology Roadmap

Securing Intellectual Property Rights (IPR)



US011735791B2

(12) **United States Patent**
Van Der Linde et al.

(10) **Patent No.: US 11,735,791 B2**
(45) **Date of Patent: Aug. 22, 2023**

(54) **SOLID-STATE BATTERY AND METHOD OF MAKING THE SAME**

(71) Applicants: **Richard Van Der Linde**, San Jose, CA (US); **Aditi Chandra**, Los Gatos, CA (US); **Mao Ito**, Santa Cruz, CA (US); **Alex Yan**, San Jose, CA (US); **Arvind Kamath**, Los Altos, CA (US); **Shoba Rao**, San Jose, CA (US); **Jonathon Y Simmons**, San Jose, CA (US)

(72) Inventors: **Richard Van Der Linde**, San Jose, CA (US); **Aditi Chandra**, Los Gatos, CA (US); **Mao Ito**, Santa Cruz, CA (US); **Alex Yan**, San Jose, CA (US); **Arvind Kamath**, Los Altos, CA (US); **Shoba Rao**, San Jose, CA (US); **Jonathon Y Simmons**, San Jose, CA (US)

(73) Assignee: **Ensurge Micropower ASA**, Oslo (NO)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 28 days.

(21) Appl. No.: **17/185,111**

(22) Filed: **Feb. 25, 2021**

(65) **Prior Publication Data**

US 2021/0320355 A1 Oct. 14, 2021

Related U.S. Application Data

(60) Provisional application No. 63/008,406, filed on Apr. 10, 2020.

(51) **Int. Cl.**
H01M 10/058 (2010.01)
H01M 50/186 (2021.01)

(52) **U.S. Cl.**
CPC ***H01M 50/186*** (2021.01); ***H01M 10/058*** (2013.01)

(58) **Field of Classification Search**
CPC H01M 50/186; H01M 10/058; H01M 10/0525; H01M 4/13; H01M 4/30; H01M 50/30; H01M 10/05
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,183,973 B2 10/2015 Kamath et al.
9,299,845 B2 3/2016 Kamath et al.
(Continued)

OTHER PUBLICATIONS

"Tesla's Huge Mistake: Why Thin-Film Lithium Ion Batteries Won't Power the EV Revolution", Modis, May 20, 2016. Retrieved online on Nov. 17, 2022 from: https://seekingalpha.com/article/3976731-teslas-huge-mistake-why-thin-film-lithium-ion-batteries-wont-power-ev-revolution."
(Continued)

Primary Examiner — Kenneth J Douyette
(74) *Attorney, Agent, or Firm* — Andrew D. Fortney; Central California IP Group, P.C.

(57) **ABSTRACT**

The present disclosure pertains to a battery and a method of making the same. The battery includes first and second metal substrates, a first solid-state and/or thin-film battery cell on the first metal substrate, a second solid-state and/or thin-film battery cell on the second metal substrate, and a hermetic seal in a peripheral region of the first and second metal substrates. The first and second battery cells are between the first and second metal substrates, and face each other. The method includes respectively forming first and second solid-state and/or thin-film battery cells on first and second metal substrates, placing the second battery cell on the first battery cell so that the first and second battery cells are between the first and second metal substrates, and hermetically sealing the first and second battery cells in a peripheral region of the first and second metal substrates.

21 Claims, 7 Drawing Sheets

- > 100 patents issued for NFC products manufacturing processes
- Large portion of the portfolio has found application in the solid-state micro-battery product strategy
- Other key components of IP include trade secrets and know-how
- Continue to grow hard IPR (patents) and soft IPR (trade secrets, know-how) in the field of solid-state batteries
- **First U.S. patents on solid-state battery issued in Aug 2023**
- **100% track record to date**
- 12 pending patent applications
- Continue to file in 2024

Technology Roadmap

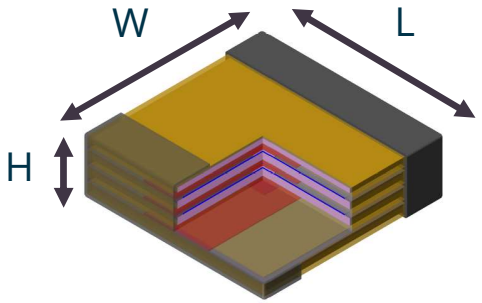
Solid-state battery patents

- **100% track record to date** – all accepted for novelty, innovation and commercial potential
  - Battery control circuitry
  - Encapsulation of SSB on foil
  - Barriers for flexible Stainless Steel foil
  - SSB Stacking
  - Multilayer electrolyte

- More patent applications to be **submitted in 2024**
  - Product Engineering
  - Product Integration

- **Submitted further 12 patent applications** in 2023 – expect USPTO decision in 2025/2026

Ultrathin Packaging



New Form Factors

Materials Processing

Manufacturing Step Reduction

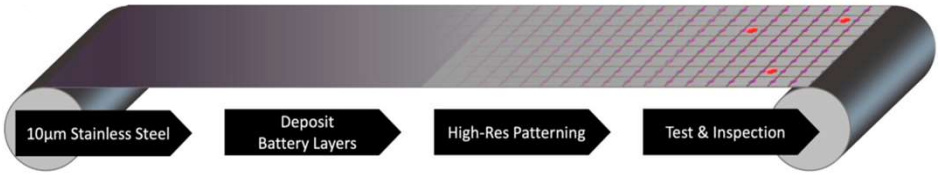
Content

Manufacturing Scale-Up Roadmap

R2R manufacturing line simplifying customization

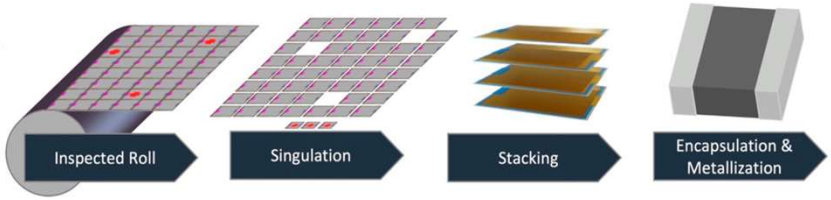
FRONT END

R2R deposition of cathode and solid electrolyte



BACK END

Multiple same size unit cells stacked (H) to form a single Ensurge microbattery,



SMT Compatible

Unit cells cut from roll, customizing L x W

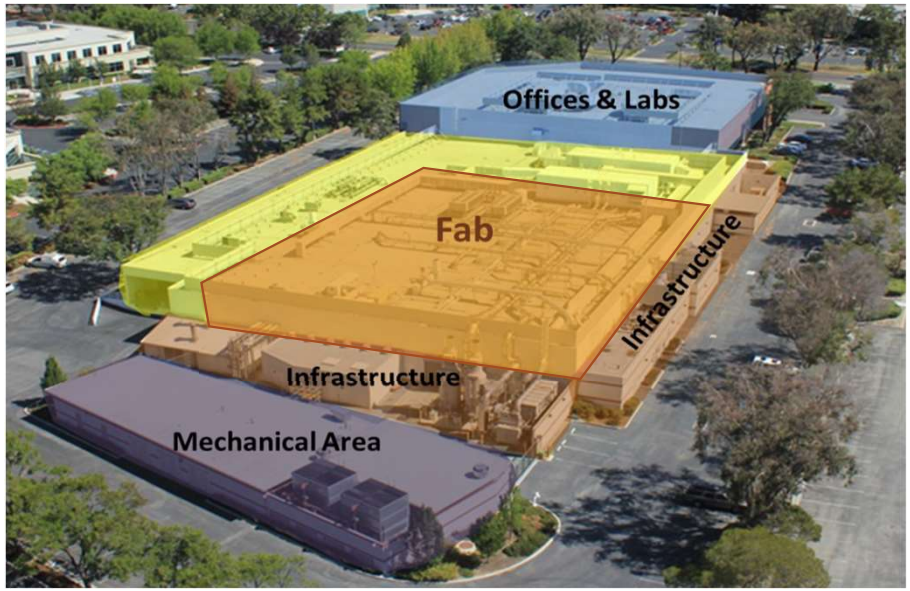
Stacked cells encapsulated and connectors added on both sides

Schematic of the high-throughput roll-to-roll deposition (left) and the dry-process manufacturing flow (right). More details can be found on this link:
Manufacturing Scale-Up of Anodeless Solid-State Lithium Thin-Film Batteries for High Volumetric Energy Density Applications | ACS Energy Letters

Manufacturing Scale-Up Roadmap

Highly automated fab in the heart of Silicon Valley

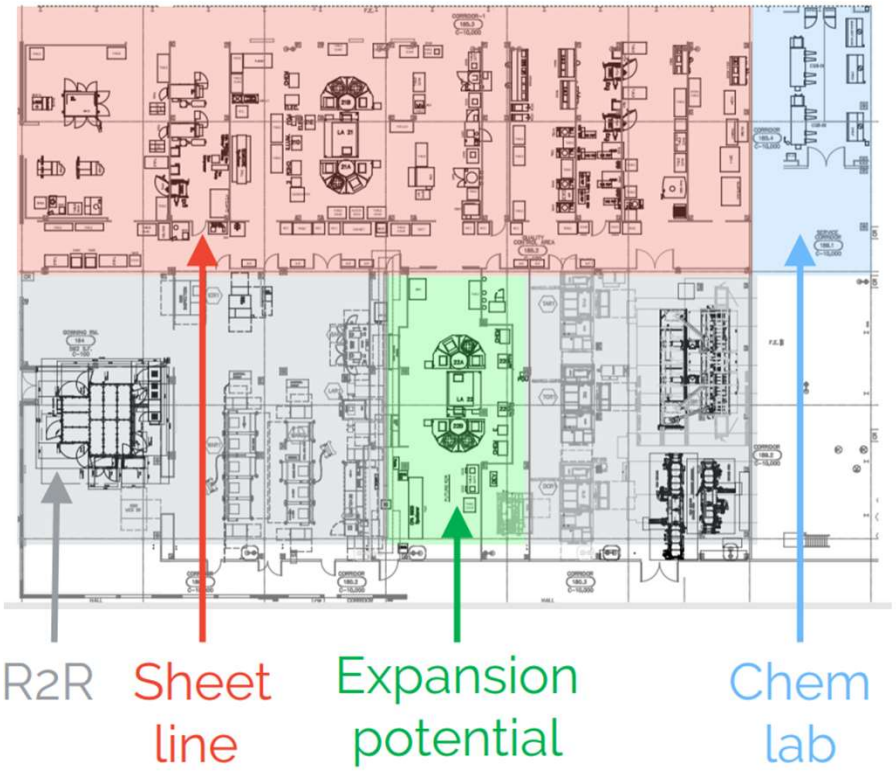
2581 Junction Avenue | San Jose, CA



- 20,000 ft^2 - fab/cleanroom (Orange)
- 20,000 ft^2 - Class H5 manufacturing (Yellow)
- 50,000 ft^2 (6,500 m^2) office & light labs (Blue)
- 14,500 ft^2 Infrastructure & Mech Area
- Rented since 2017
- > $100m invested in Facility and Machinery
- Upside vs. book value
- Facilities exceed current requirements by about 50%
- Facility can deliver $1.5 million revenues per month under current investment program

Manufacturing Scale-Up Roadmap

San Jose fab can be scaled up

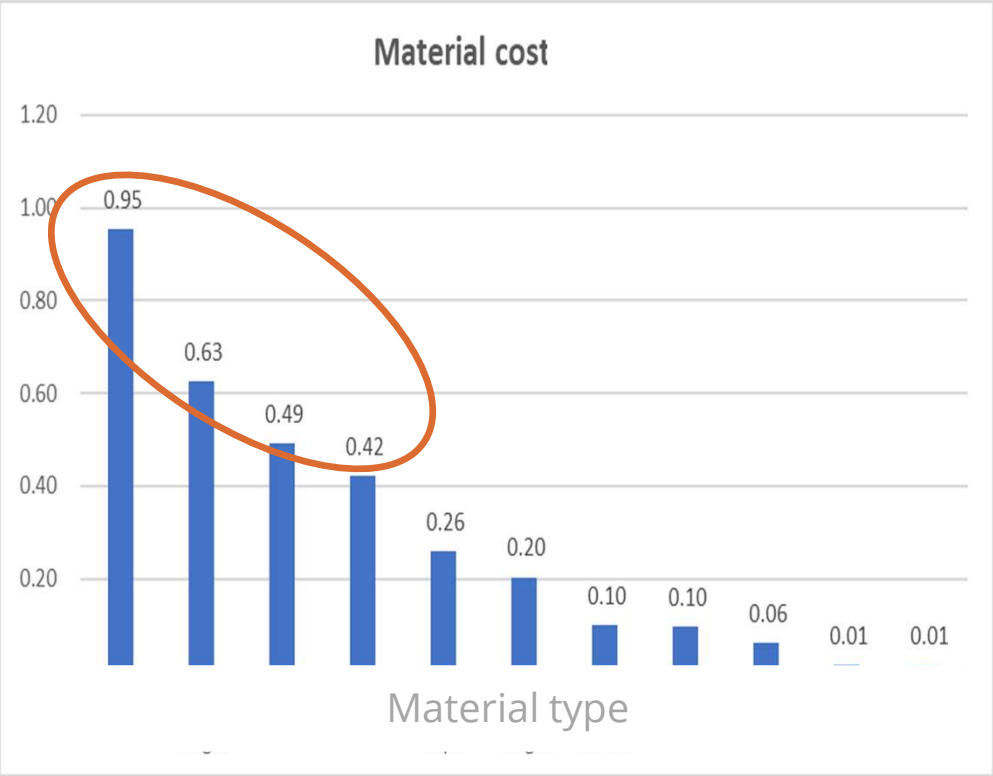


- **R2R manufacturing line**
  - R2R Lithography |coat – expose – develop
  - R2R vacuum deposition | PVD – High temp ALD – PECVD
  - R2R print & anneal | screen print – RTP 750^{oC} – RTP 950^{oC}
  - R2R etch | reactive Ion etch with endpoint – wet processes for metals, strip & oxide
  - R2R laser processing | crystallization – ablation, repair
  - R2R test & measurement | multi metrology

- **Sheet prototyping line 300 mm x 300 mm**

Manufacturing Scale-Up Roadmap

Material cost reduction



Four largest cost items make up **80%** of the material cost

- **Project A** | negotiate lower price or eliminate component → streamline process
- **Project B** | identified a cheaper supplier
- **Project C** | to be replaced with a cheaper process
- **Project D** | replace with other material resulting in a 90% cost saving

Content

Addressable market

Solid state – market segmentation

Gen1 focus

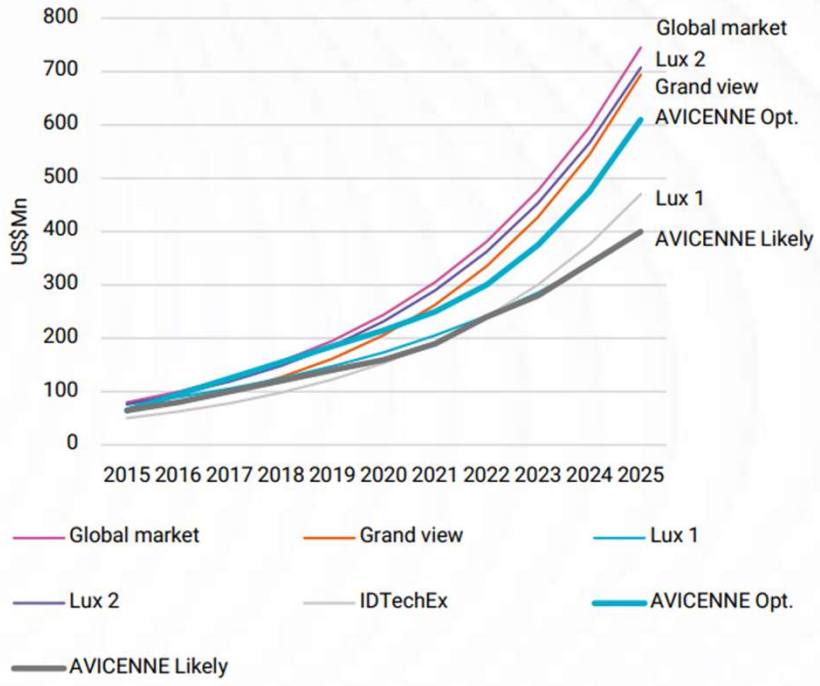
	IoT	Medical	Smart Cards	RFID	Sensors	Wearable, E-textile	Portable Electronics	Transport	Large scale energy storage
Capacity Range	1 mAh	1mAh	5-10 mAh	5-10 mAh	5-10 mAh	100 mAh	1 Ah	100 Ah	> 1 kAh
Feature	• Rechargeable • Small footprint • Life time • Rapid discharge • Energy harvesting		• Disposable or rechargeable • Laminar & thin • Low power • Cost sensitive		• Higher cost for special app (military) • High T°C	• High Energy density • Long working hrs • Flexible	• High energy density • Long working hrs • High power	• Safe • Reliable • High power • High capacity	• Cost • Life time • Reliable • High capacity
Status	Small volume production		Available, mostly customized			Prototype	Research, Prototype	Research (after 2025)	Early stage (after 2030)

Source: Avicenne Energy, 2024

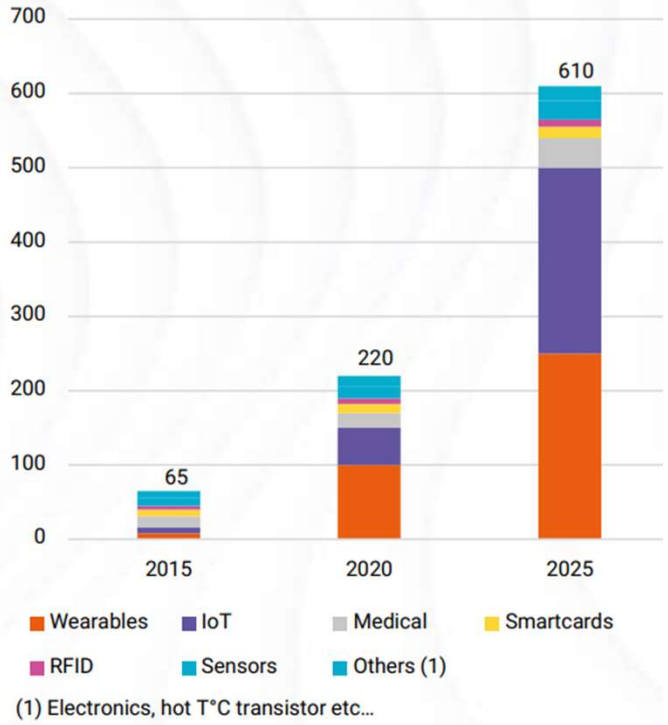
Addressable market

The solid state battery market

forecast from different sources are not convergent



IoT and wearable could become the most important market – Optimistic scenario



(1) Electronics, hot T°C transistor etc...

Source: Avicenne Energy, 2024

Addressable market

The solid state battery market

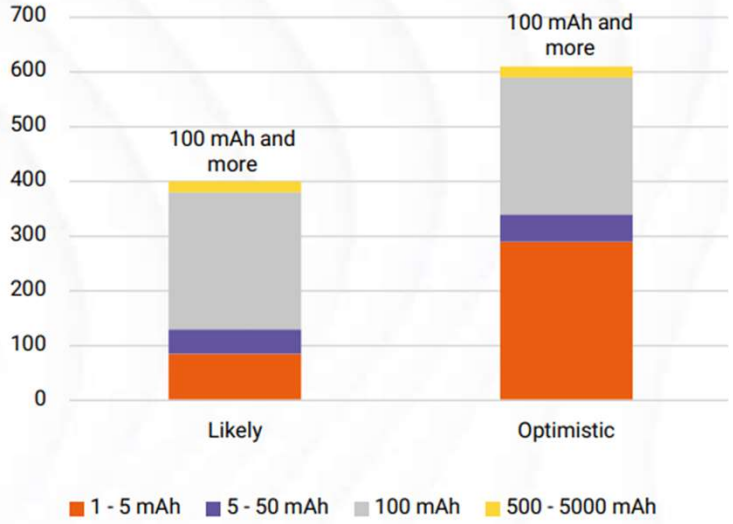
Solid-State batteries market –US$Mn

	Likely	Optimistic
Medical	40	40
Military, industrial sensors (High T°C)	20	20
Special Semiconductor (High T°C)	15	15
Wearables	250	250
IoT	30	250
Smart cards	15	15
RFID	10	10
Others	10	10
TOTAL	**400**	**610**

- 1-10 mAh: MEMs, sensors, CMOS, smart card, drug delivery system, medical implantable devices
- 100 mAh: wearables (watch, glass…), medical (pacemaker, hearing aid, capsule endoscope)

Source: Avicenne Energy, 2024

Market by battery size (Avicenne estimation)



Addressable market

Significant progress

Strategic Partners

Discussions with major technology partners

Licensing as a path for technology commercialization

Building and delivering samples

First shipments in Q1-2024

Commercial Customers

There is a significant market demand for microbatteries powering smaller and multi-function applications

Built up a solid pipeline with no marketing efforts

Technology Progress

75µm microbattery was proven in September 2023

10µm microbattery proven in February 2024

Improve yield through manufacturing opti-mization

2024 focus

Work on strategic and commercial customers in parallel

Deliver samples for evaluation

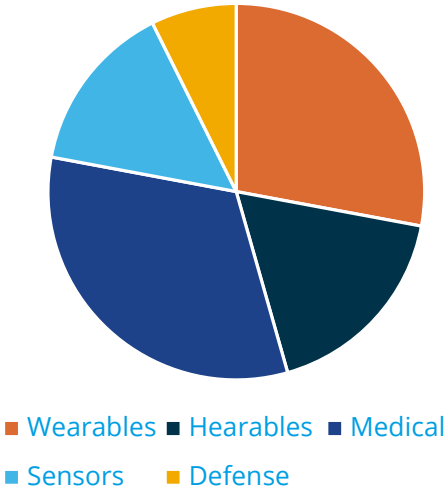
Start delivery of 150,000 unit contract

Further ramp up manufacturning

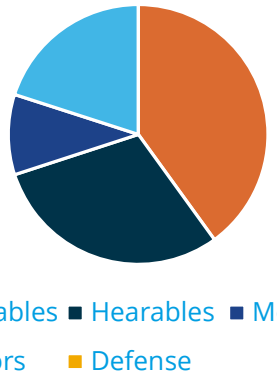
Addressable market

Commercial Customers

Pipeline (70)



Evaluation agreements (10)



Volume contract for standard batteries **(1)**

NRE or **Joint Development Agreement**

Deferral or **rejection**

License income

Content

Financial Projections

Preamble

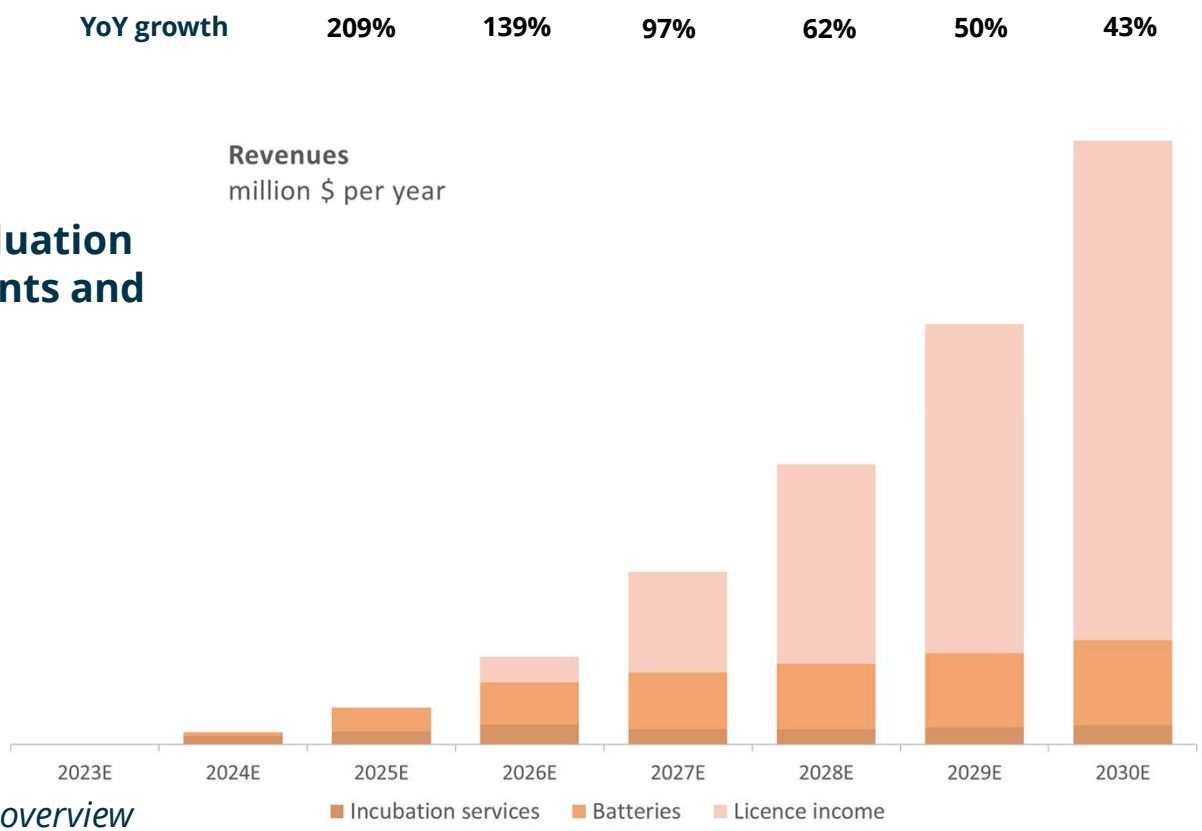
- Battery technology and manufacturing process validated
- A further investment of $13 million (Phase 1) to ramp up manufacturing
- San Jose facility focus on premium ASP and battery incubator activities
- Large volume applications (consumer electronics) and competitive ASP will be addressed through license agreements

Financial Projections

Strong revenue outlook from customer pipeline

Three revenue streams

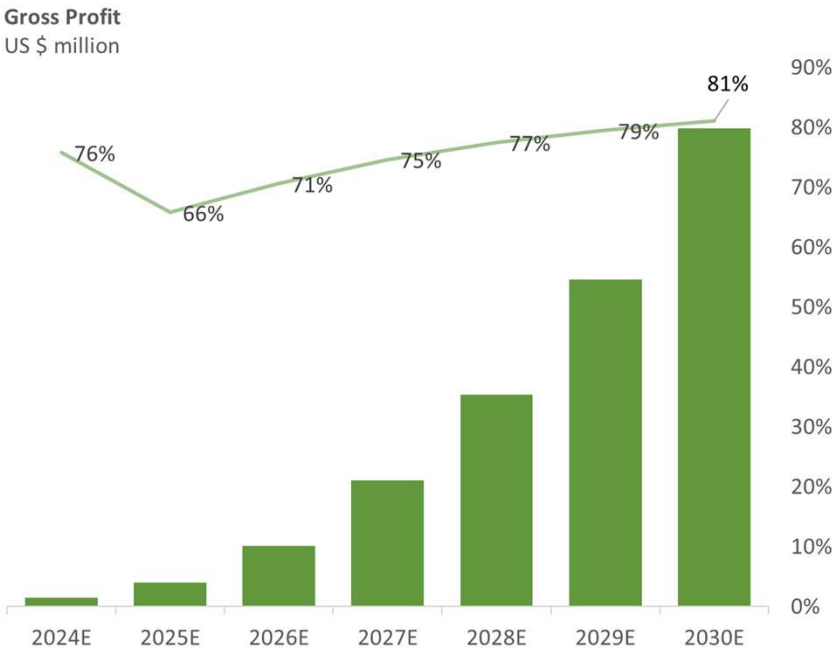
- **Incubation services** (evaluation agreements, development agreements and manufacturing services)
- **Direct SSB sales**
- **License income***

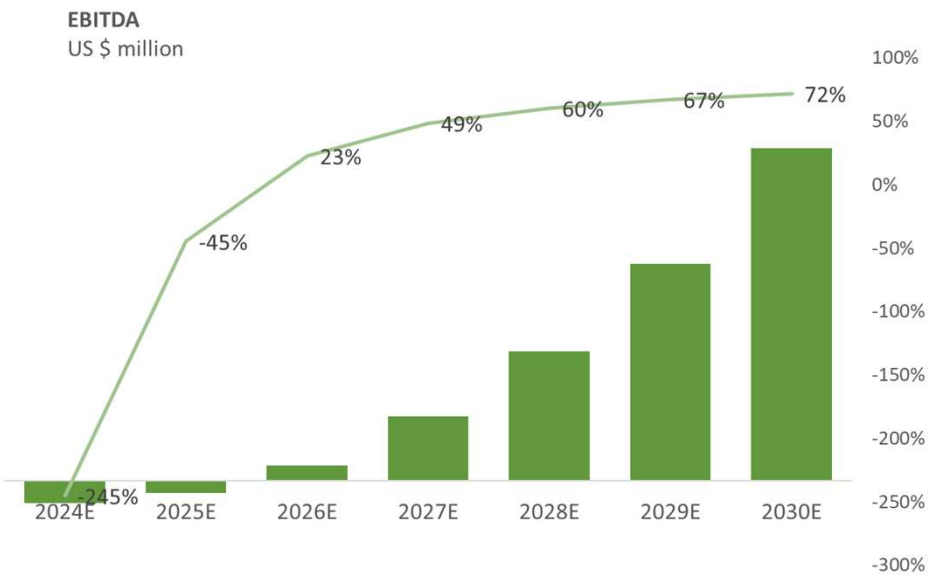


(*) Advance license payment not included in this overview

Financial Projections

Gross Profit and EBITDA margins*



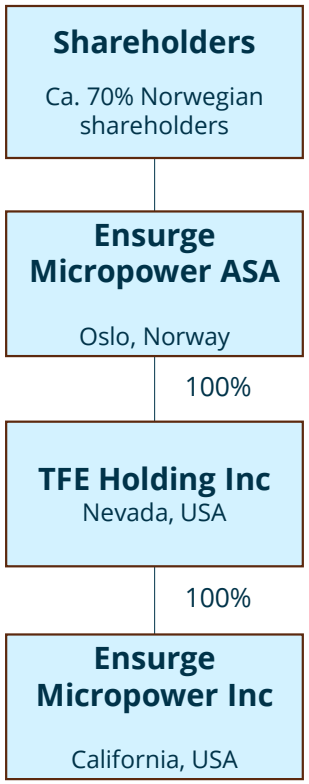


(*) Advance license payment not included in this overview

Content

Corporate Governance

Corporate Structure



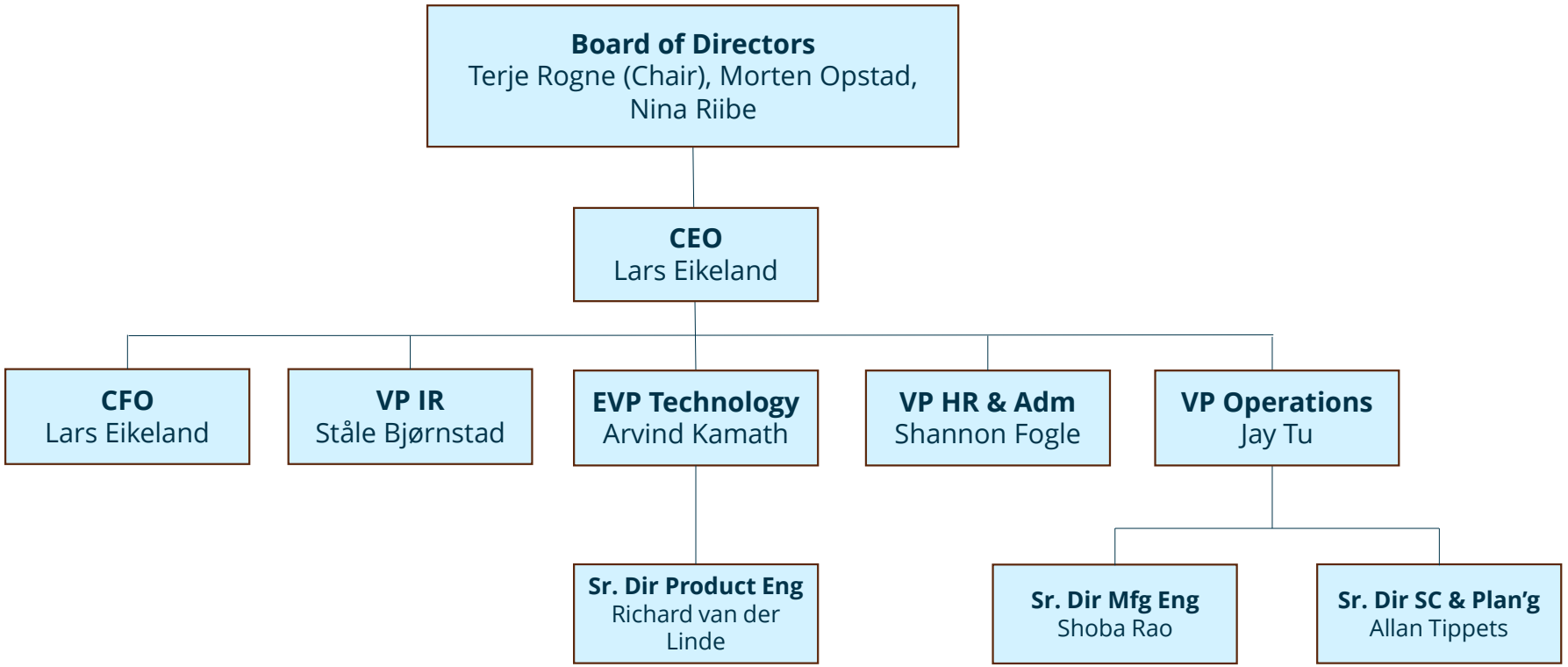
Shareholder structure | ca. 14,000 shareholders | Top 30 shareholders own 55% | Largest shareholder owns 15% of the outstanding shares

ASA | Legal HQ | owns the IP | Listed on Oslo Stock Exchange: ticker ENSU and on OTCQB: tickers ENMPF and ENMPY

Global HQ | all value adding activities carried in San Jose| R&D, manufacturing, sales and corporate overhead | intercompany agreements in place with AS

Corporate Governance

Board & Leadership Team



Corporate Governance

ESG focus on everything we do

Ethical Guidelines

- Code of Conduct
- Social Responsibility
- Whistleblower line

Download PDF ↗

2022 Transparency Report

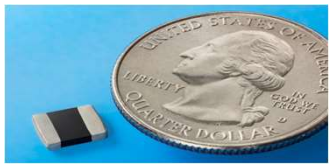
- Human Rights
- Working Conditions

Download PDF ↗

ESG in our products

- Safety
- ROHS
- Environmental
- CV charging
- Recyclability

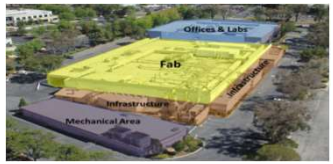
Summary



UNIQUE PRODUCT

Safe **solid-state battery with best-in-class** ***performance***

Affordable **price**



DESIGNED FOR SCALE

Incubation Center in ***Silicon Valley***

Apply different ***levers*** **to scale up volumes**

ATTRACTIVE MARKET

$10bn+ **market growing at** ***26% cagr***

Smaller **and more** ***functional*** **devices requiring** ***unique*** **batteries**

HIGH ENTRY BARRIERS

>$350 million **invested over** ***15 years***

Extensive ***IP*** **portfolio**

Accumulated ***knowledge***

FRAGMENTED COMPETITION

Weak ***incumbent products***

Different **designs and architectures**

Thank you!