



# Extreme Fast Charging Battery Technology for EV Mass Adoption

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**Corporate Overview**

April 2023

**CHARGING THE EV LIFESTYLE**

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A photograph showing a man and a young child sitting in the open rear hatchback of a dark-colored SUV. They are both looking down at a smartphone held by the man. The man has a beard and is wearing a black t-shirt. The child has curly hair and is wearing a light-colored shirt. The background is a blurred outdoor setting.

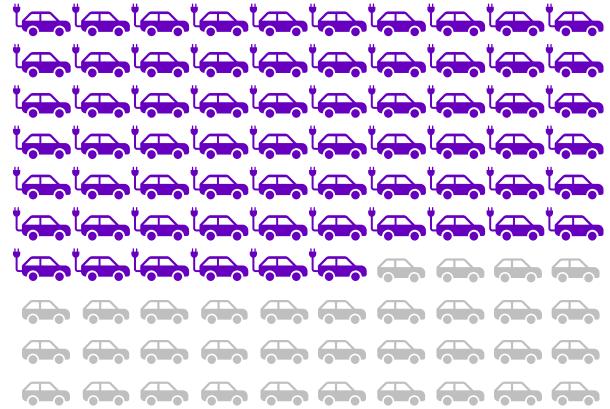
# ELECTRIC VEHICLES ARE AT AN INFLECTION POINT...

- Growing variety of models, performance, designs and **range offerings**
  - Drivers expect cars to fit their **fast-moving lifestyle**, be eco-friendly and fully support their driving needs
- **Charging speed** defines the **category leader**

Adoption of  
Battery Electric Vehicle (BEV)  
is expected to reach

>60%

of 2030 total new passenger vehicle sales in  
US (60.4%), EU (75.5%) and China (63.6%)



Source: UBS - Global Electric Vehicle Battery Makers, Monthly Recharge: IRA developments/Future of city transport

# But there are significant **roadblocks** and drivers aren't switching to an EV yet:

## Battery chemistry

- Battery chemistries today do not allow charging in minutes
- Drivers experience “charging anxiety”:

*The concern about the time spent charging a car, or the worry that charging outlets will not be available for a driver when arriving at the station.*

## Charging infrastructure

- Fast charging networks aren't widely accessible
- Lack of standardization: a given electric car model cannot accept all connector types



**>60%**  
Penetration in 2030

Drivers demand a worry-free  
**fast charging experience** that is similar  
to that of fueling a conventional car.

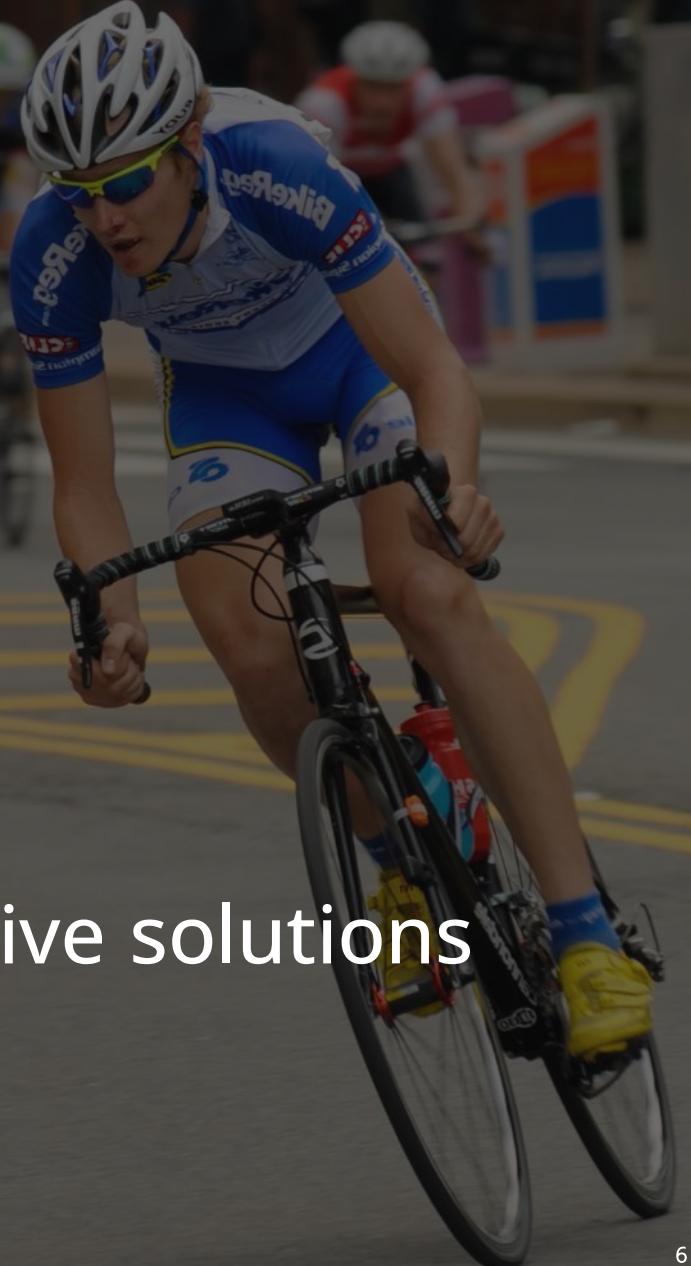
Extreme fast charging (XFC)  
capability will be a  
**necessary standard-**  
the only solution to bridge the gap.



# STAYING AHEAD OF THE PACK

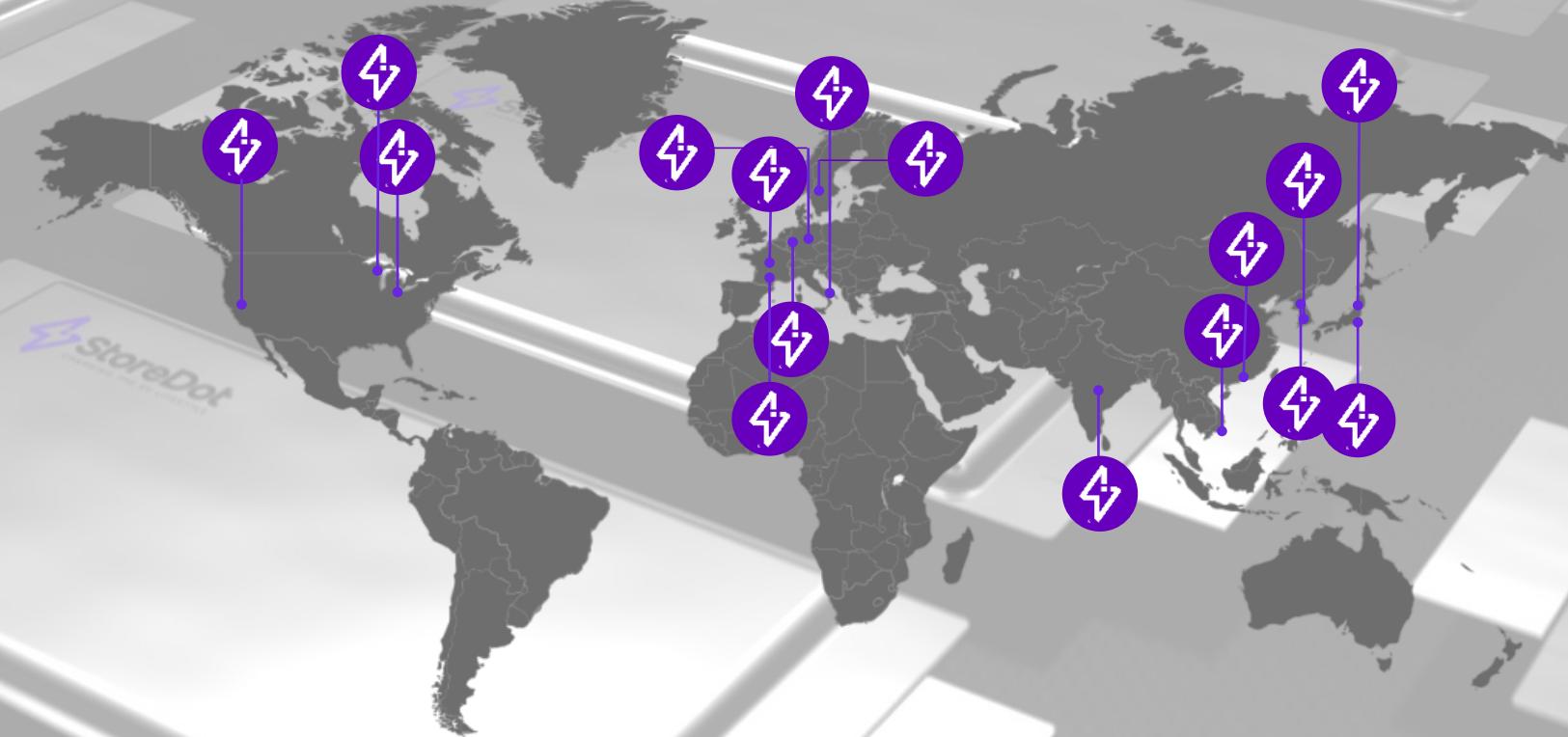
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- StoreDot has a **3-5 years' lead** on alternative solutions
- Commercially ready in 2025



# Proven technology

'100in5' extreme fast charging cells are in ongoing testing by >15 OEMs and manufacturing partners worldwide



# Groundbreaking, robust technology



Charged in 10min: >X2 faster than premium fast charging models



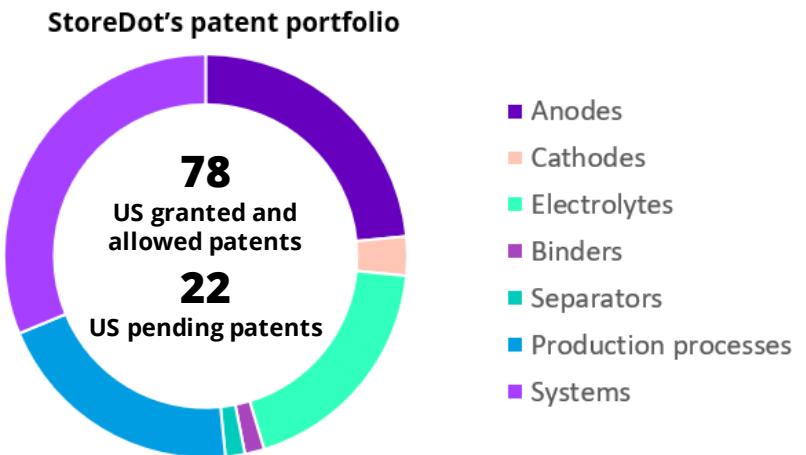
>1200 consecutive XFC cycles



No degradation due to fast charging



Consistent, reliable charging rate regardless of battery's state of charge



# Technology easily scalable

Utilizing standard Li-ion manufacturing lines

- Technology is scalable and fully compatible (drop-in) with existing lithium-ion battery technologies and equipment
- Available for licensing using existing deployed CAPEX
- Competitive cost structure aligned with industry's trajectory



# Competing technologies are not aligned with EV industry timeline

StoreDot's solution is superior to emerging technologies

Technology advancement as of 1H/23

	Category	State of the Art Li-ion battery (Gr/ Gr+Si)	Silicon-dominant anode Li-ion battery	Semi Solid State battery (After 2028)	All Solid State Battery (ASSB) (After 2030)
Performance	Gravimetric energy density >300Wh/kg	X	 StoreDot 100in5	✓	Other
	XFC capability	X	Best fit	Not optimized for XFC	N/A
	Cycle life > 1200 (consecutively XFC)	X	✓	X	X
Scalability	Process & manufacturability	Best fit	Best fit	Low	High CAPEX
	Cost	Optimal	Optimized	High	High
	Maturity	Optimal	Optimized	Low	Low

# Clear path: StoreDot's 100inX\* solution roadmap

PRODUCTION-  
READINESS  
IN 2024

PRODUCTION-  
READINESS  
IN 2028

PLANNED  
FOR 2032

**100in**  
Si-anode  
>300 Wh/kg  
(>700Wh/l)  
**5**

**100in**  
Semi-Solid  
400 Wh/kg  
(>900Wh/l)  
**3**

**100in**  
Post-lithium  
500 Wh/kg  
**2**

Production readiness

Sustainable  
production approach

Cobalt content reduction

Semi-solid, dry approach

\*100inX = 100 miles (160km) charged in X minutes; chemistry is compatible with all cell form factors

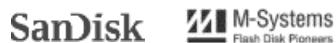
# Cohesive leadership



**Carl-Peter Forster**  
Chairman



**Doron Myersdorf, DSc**  
CEO and Co-founder



**Meir Halberstam**  
CFO



**Amir Tirosh**  
CBO



**David Lee, PhD**  
CSO



**Daniel Aronov, PhD**  
CTO



**Yaron Fein**  
Executive VP R&D



**Hilit Bar-lev**  
VP HR



**Nir Kedem, PhD**  
VP Cell Design



**Tamir Ben Moshe**  
VP Operations



Supported by a team of experts, >30% of employees hold a PhD

# Global advisory board: team of EV industry experts



**Joseph Walicki**

Battery commercialization  
expert



**Dennis Nobelius, PhD**

Automotive expert



**Prof. Dr. Andreas Docter**

Automotive disruptive  
innovation expert



**Roy Williamson**

Future mobility &  
infrastructure expert



**Joel Maryles**

Finance expert



**Xavier Dupont**

Automotive smart  
technology expert



**Mark Mathieson**

Engineering and  
powertrain expert



Mercedes-Benz

# Leadership in extreme fast charging and high energy density



**Founded  
2012  
Israel**



**Global Presence  
130 employees  
40 PhDs**



**100+ patents  
(granted and  
pending)**



**Global  
presence:  
Israel, USA,  
China, EU**



**World's first  
silicon-dominant  
Extreme Fast  
Charging (XFC)  
EV battery**



**\$200M  
invested**



**Strategic investors  
covering EV ecosystem**

DAIMLER

OLA

Polestar

EVE<sup>20</sup>

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# Deep Dive

**XFC Technology  
highlights**

**Scale up &  
manufacturing**

**Market**

**Corporate  
overview**

# **XFC TECHNOLOGY HIGHLIGHTS**



# XFC Silicon Battery - a highly differentiated solution for any electric vehicle

- **Silicon-dominant anode**
- **Proprietary additives and cell design**
- **Manufactured in standard production facilities**

**>50%**  
**reduction**  
in charging time



Same  
**energy**  
Density and  
**price** trajectory

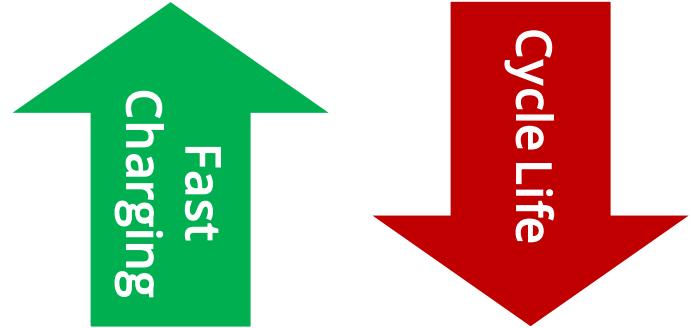


**100+**  
miles charged  
**in 5 min**

# Fast charging rapidly degrades the battery

## The challenge of fast charging

- Drivers sacrifice battery life for fast charging
- Actual user's feedback and manufacturer data confirms rapid battery degradation even if only occasionally fast charged



## EV-OEMs specifically warn users to limit the use of fast charging

### ! NOTICE

Fast charging with direct current (DC) uses a very high charging power. Frequent fast charging can permanently reduce the battery capacity of the high-voltage battery.

- Minimize the use of DC chargers (such as Superchargers) for optimal Battery health.

The peak charging rate of the Battery may decrease slightly after a large number of DC Fast Charging sessions, such as those at Superchargers. To ensure

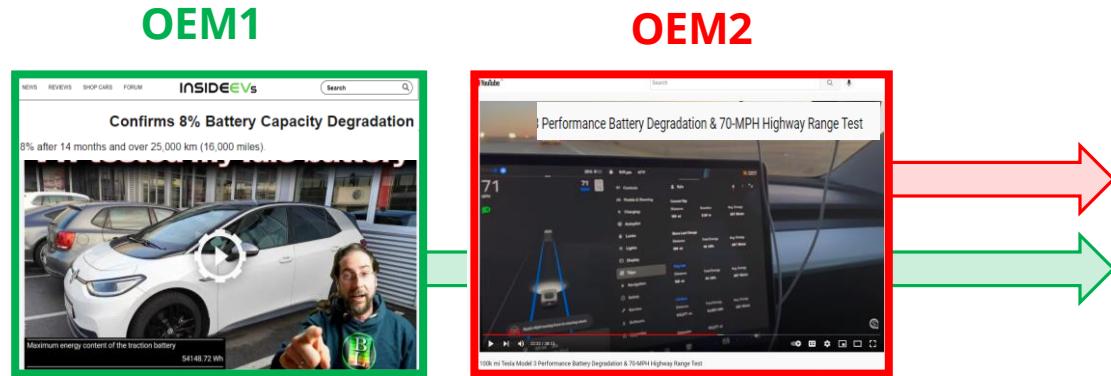
It is normal for estimated range to decrease slightly over the first few months before leveling off. Over time, you may see a gradual, but natural, decrease in range at full charge - this depends on factors such as Supercharging regularly or the mileage and age of the Battery. Your Model 3 will inform you in the unlikely event a hardware issue is causing excessive Battery or range degradation.

# With StoreDot's XFC no battery degradation due to extreme fast charging

Even when extreme fast charged consecutively

## Currently available fast charging

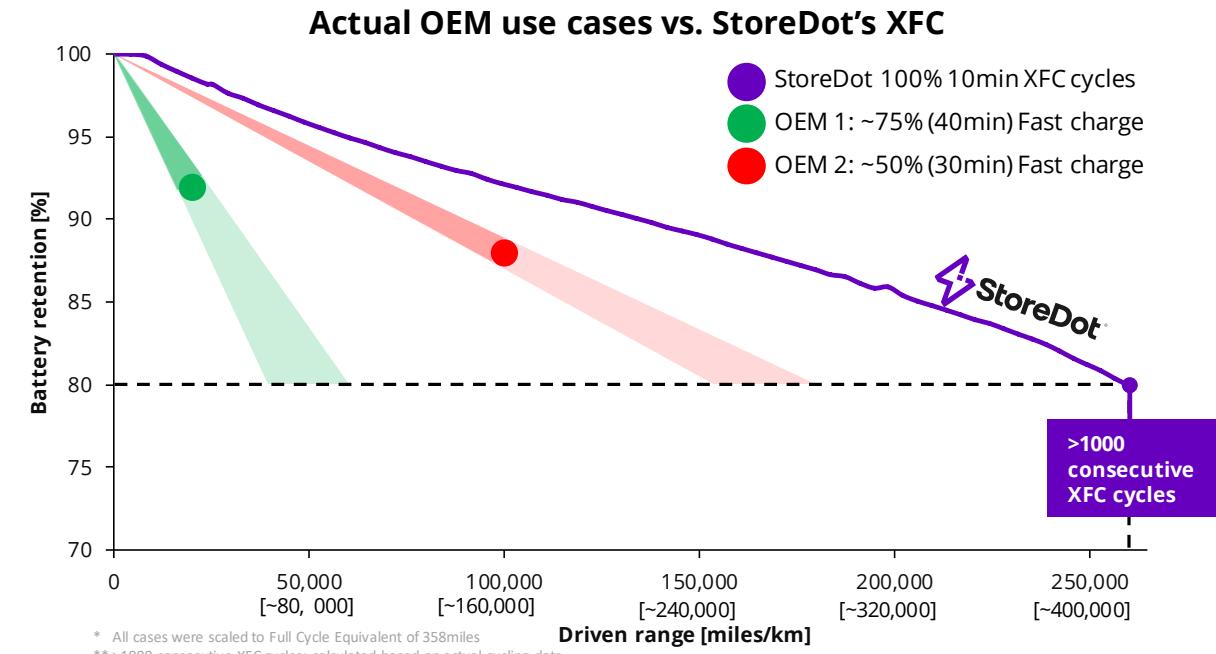
- OEMs sacrifice battery cycle-life for fast charging
- Actual user data confirms rapid battery degradation even if only occasionally fast charged



Sources:  
1) Insideevs.com: <https://insideevs.com/news/548404/volkswagen-confirms-8percent-degradation-id3/>  
2) YouTube: <https://www.youtube.com/watch?v=p9R8HXSnD5Y>

## StoreDot's extreme fast charging

- Game changer: drivers can fast charge every time
- >1000 consecutive XFC – extreme fast charges
- No degradation due to XFC



# StoreDot's XFC – the winning solution: >50% reduction in charging times

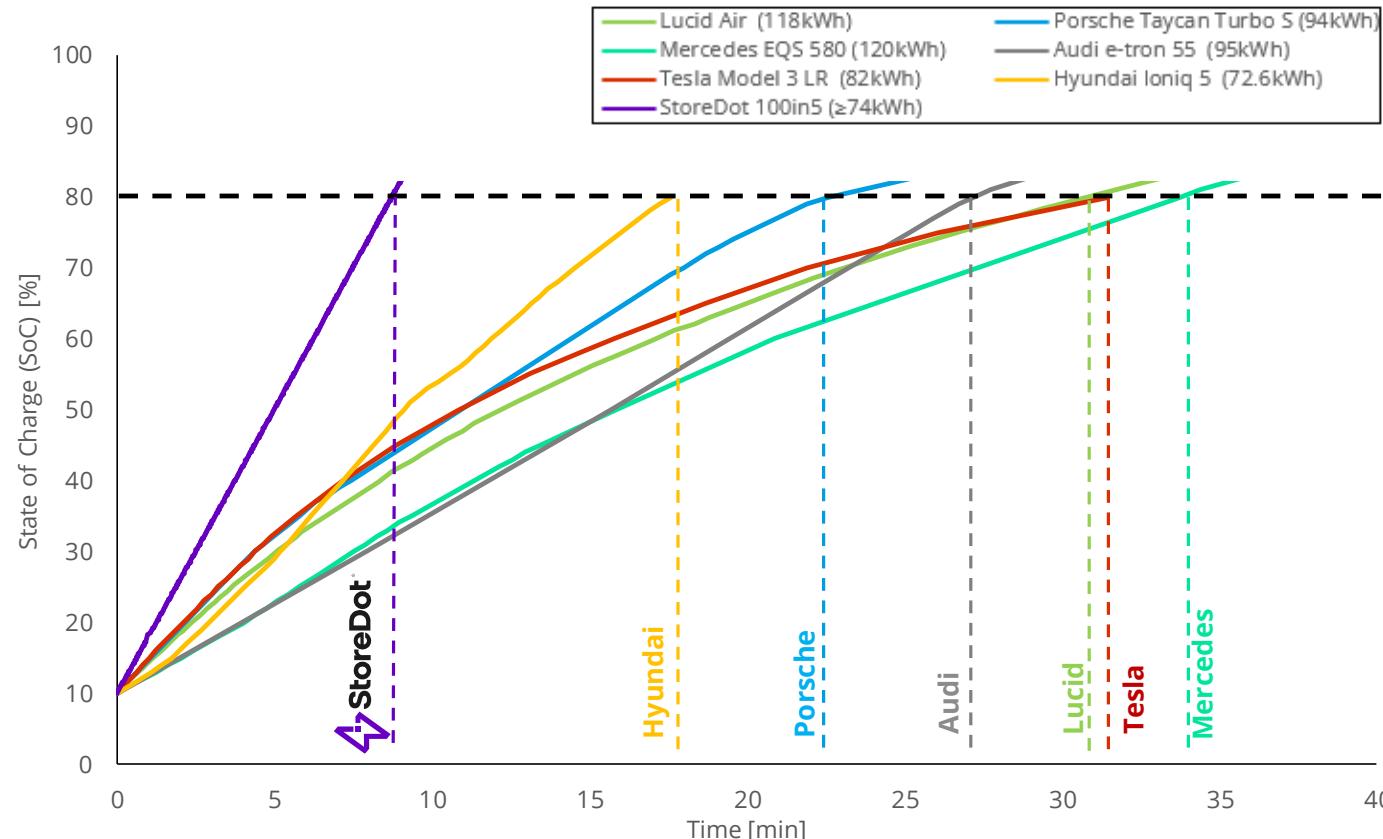
The highest charging power at any state of charge

## Currently available fast charging

- Cannot utilize full power of superchargers

## StoreDot's extreme fast charging

- >X2 faster than premium fast charging models
- 100 miles charged in 5 minutes



\* StoreDot 100in5 extrapolated from single cell test data, scaled to 74kWh pack using 350kWh-500A charging station

\* Thermal Management System (TMS) adaptation as required

Sources:

1) P3 group website: <https://www.p3-group.com/en/p3-charging-index-comparison-of-the-fast-charging-capability-of-various-electric-vehicles-from-a-users-perspective-update-2021/>

2) Insideevs.com: <https://insideevs.com/news/512344/porsche-taycan-fast-charging-analysis/>

3) <https://insideevs.com/news/550025/lucid-air-fast-charging-review/>

# With StoreDot's XFC consistent, reliable charging rate at any state of charge

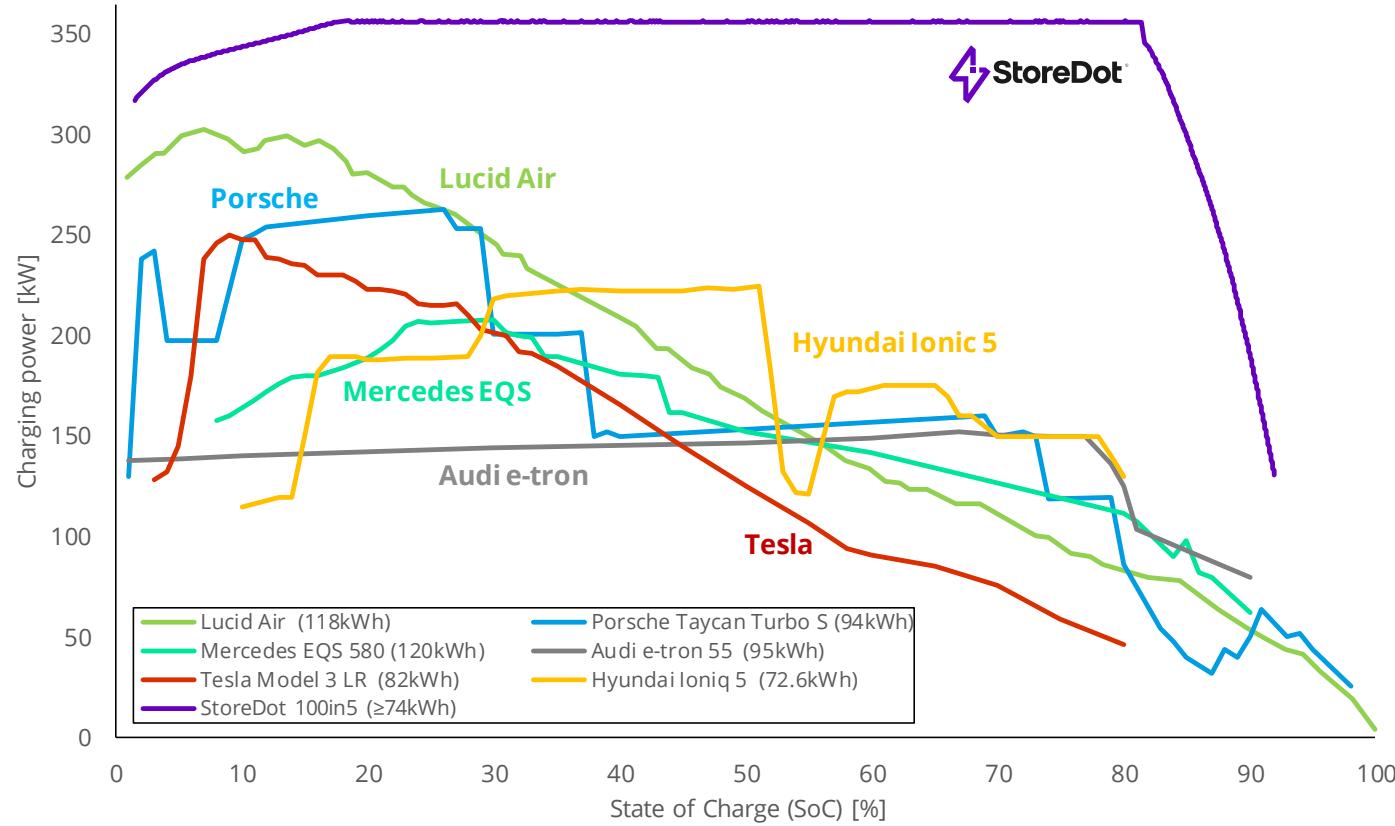
100in5: 100 Miles charged in 5 minutes

## Currently available fast charging

- Charge rate significantly slows down as battery's state-of-charge increases

## StoreDot's extreme fast charging

- 100 miles charged in 5 minutes at any state-of-charge, no matter how full or drained your battery is
- Chemistry enables high charge rate, even in the 60-80% SoC range
- Consistent 350kW charging for packs >75kWh



\* StoreDot 100in5 extrapolated from single cell test data, scaled to 74kWh pack using 350kWh-500A charging station

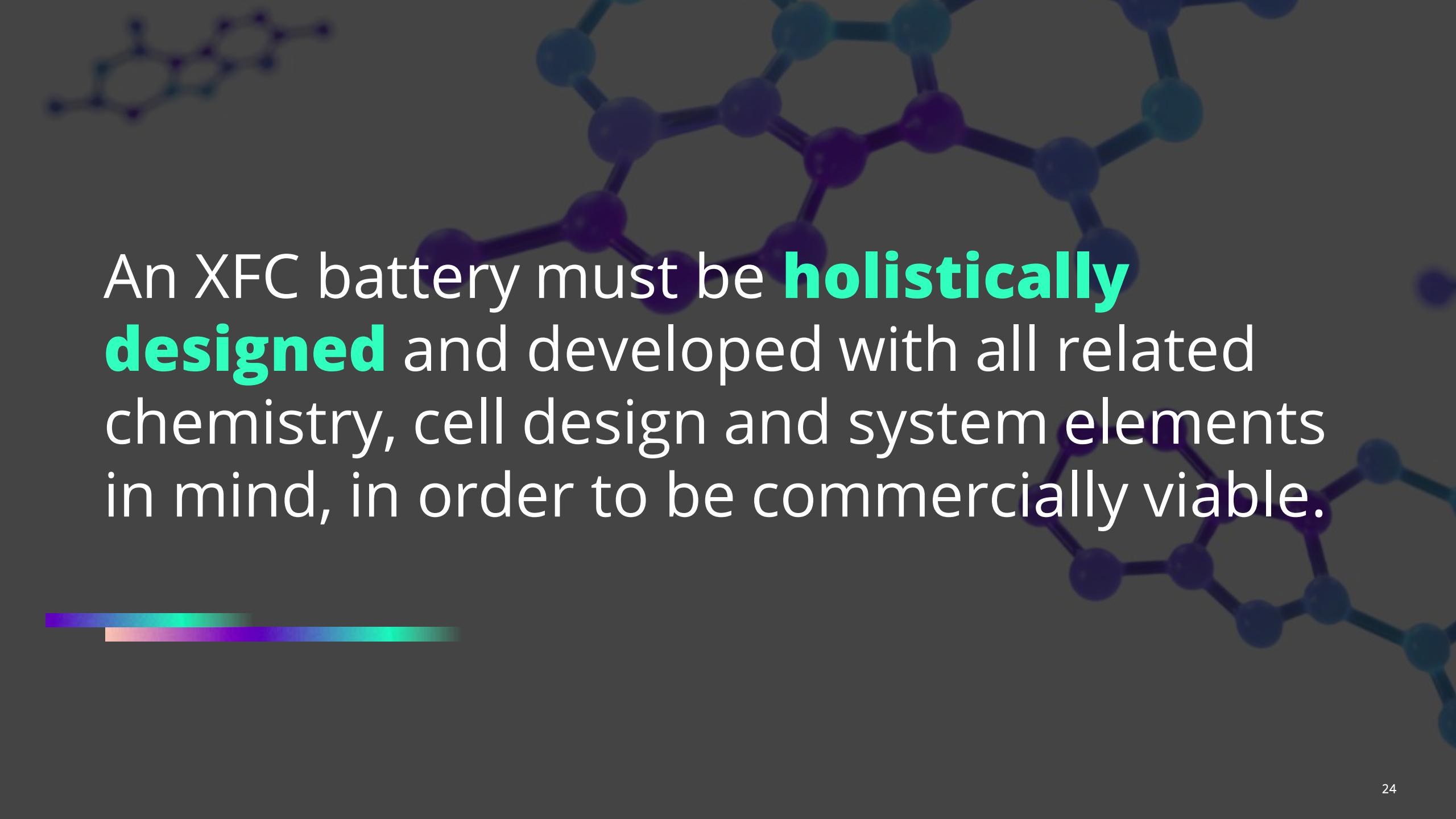
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1) P3 group website: <https://www.p3-group.com/en/p3-charging-index-comparison-of-the-fast-charging-capability-of-various-electric-vehicles-from-a-users-perspective-update-2021/>

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3) <https://insideevs.com/news/550025/lucid-air-fast-charging-review/>



An XFC battery must be **holistically designed** and developed with all related chemistry, cell design and system elements in mind, in order to be commercially viable.

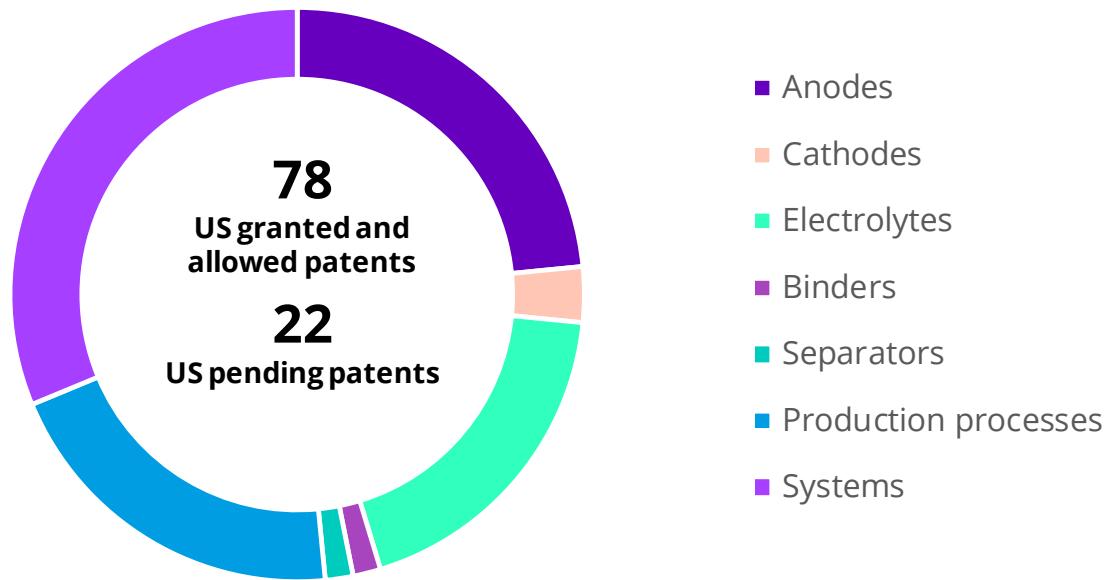


# Holistic solution and IP

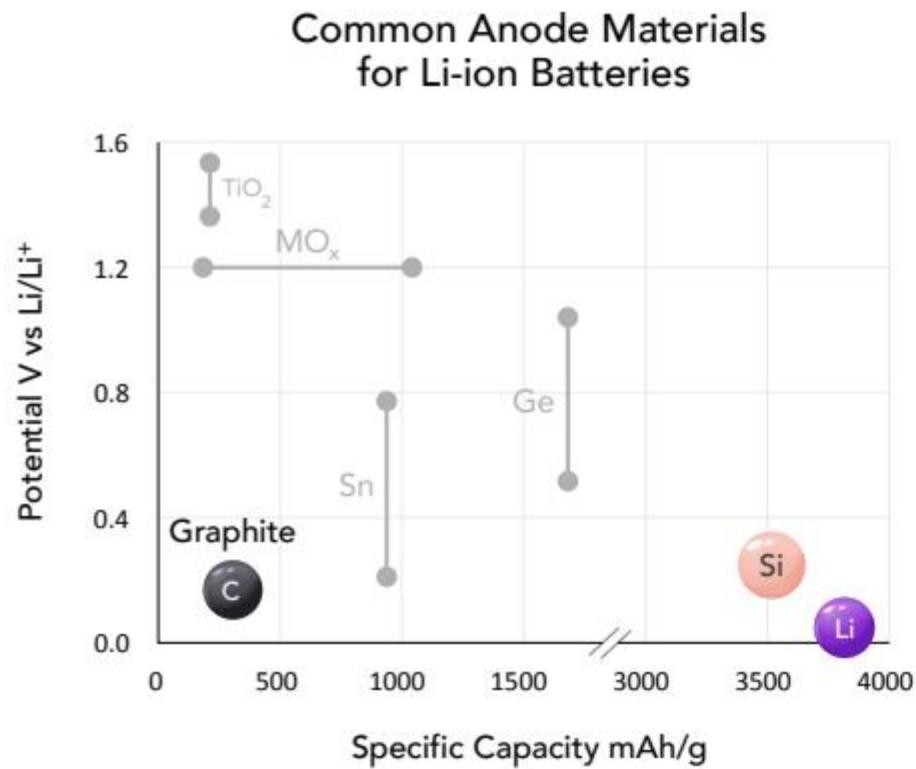
Well differentiated multidisciplinary solution and IP strategy



StoreDot's patent portfolio



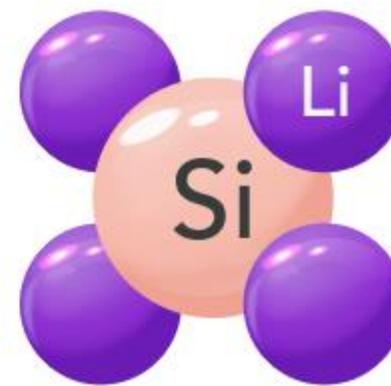
# Clear advantages for nano-silicon over graphite as anode active material



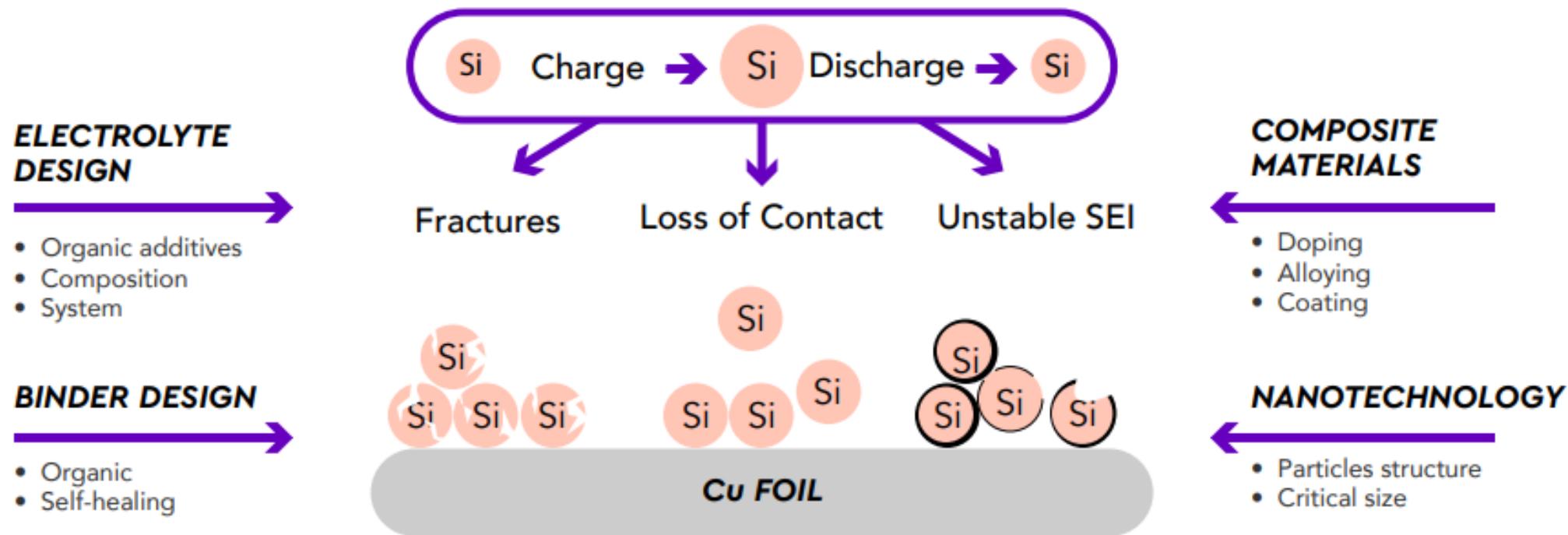
In a conventional graphite anode, it takes SIX carbon atoms to hold ONE lithium atom



In a silicon anode, ONE silicon atom can hold ~FOUR lithium atoms



# Systematically addressing silicon challenges

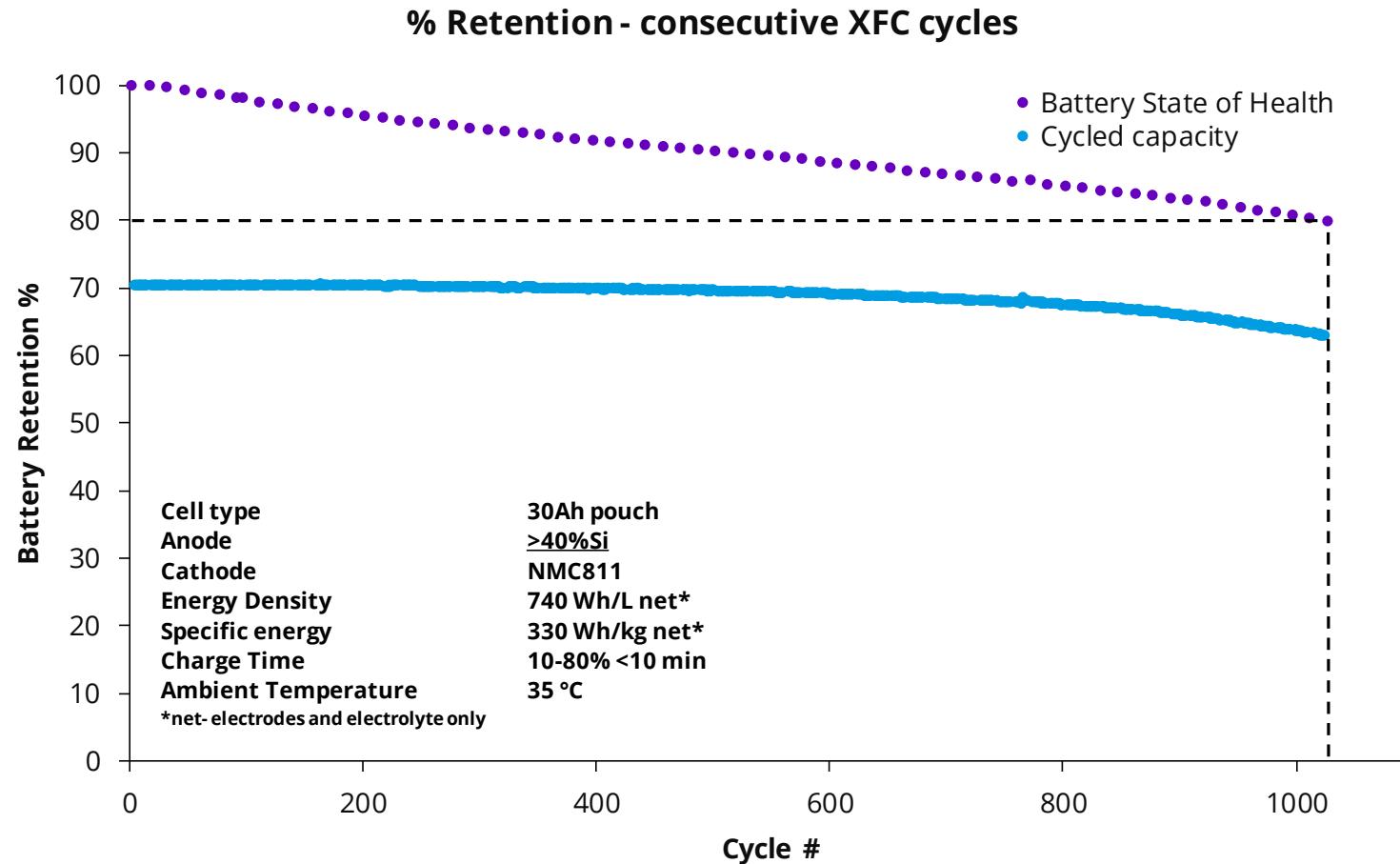


# 30Ah EV form factor proven solution

>1000 consecutive XFC cycles (10%-80% in 10 minutes) high energy cell



- 30Ah @C/3
- Energy density > 300Wh/kg
- 10-80% in 10 minutes (1C discharge)
- SoH measured every 15 cycles
- An improved formulation already validated on a 3Ah cell



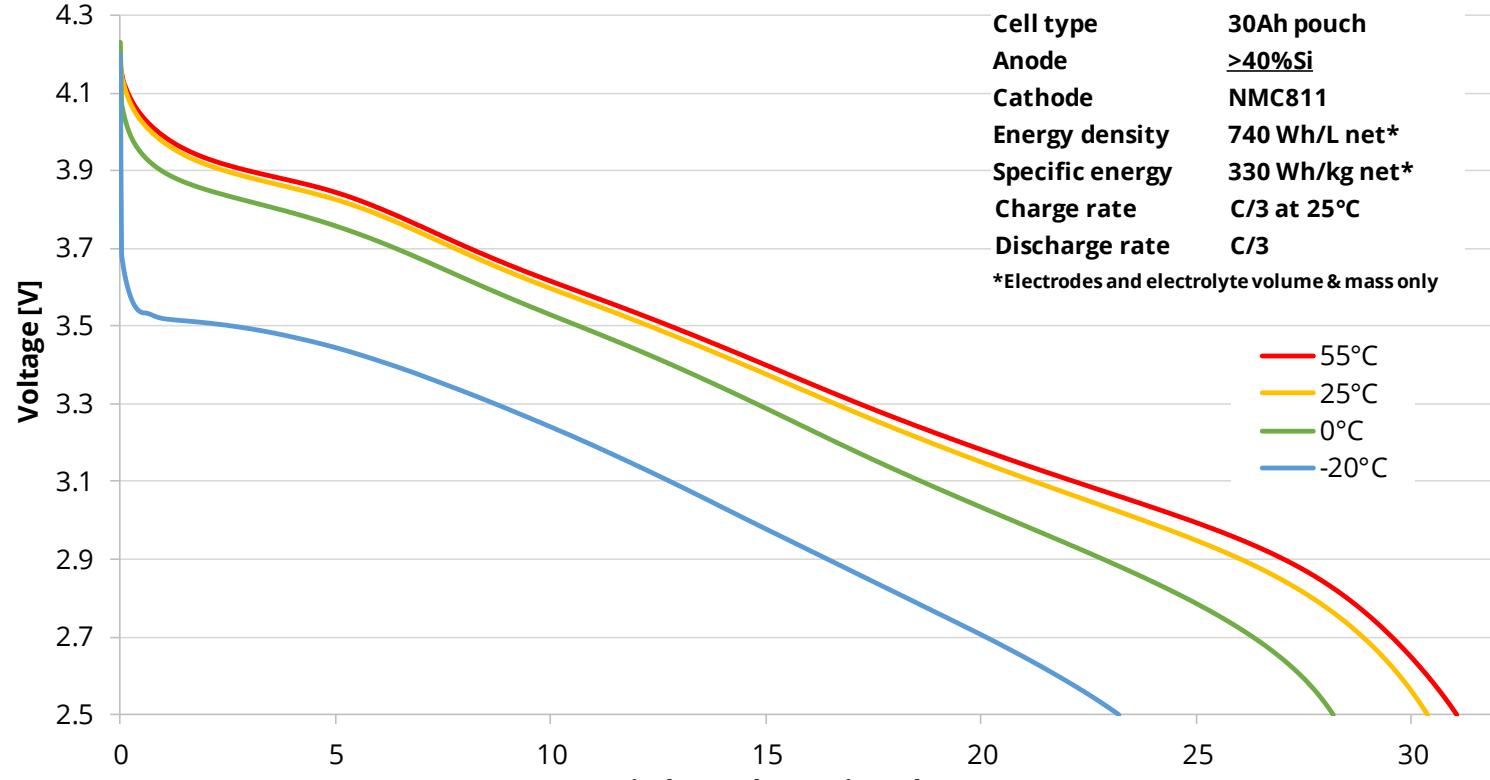
# Outstanding low temperature performance (-20°C)

30Ah pouch cell



- 76% discharge capacity @ -20°C
- Similar to high-end graphite based solutions

Discharge capacity vs. Temperature



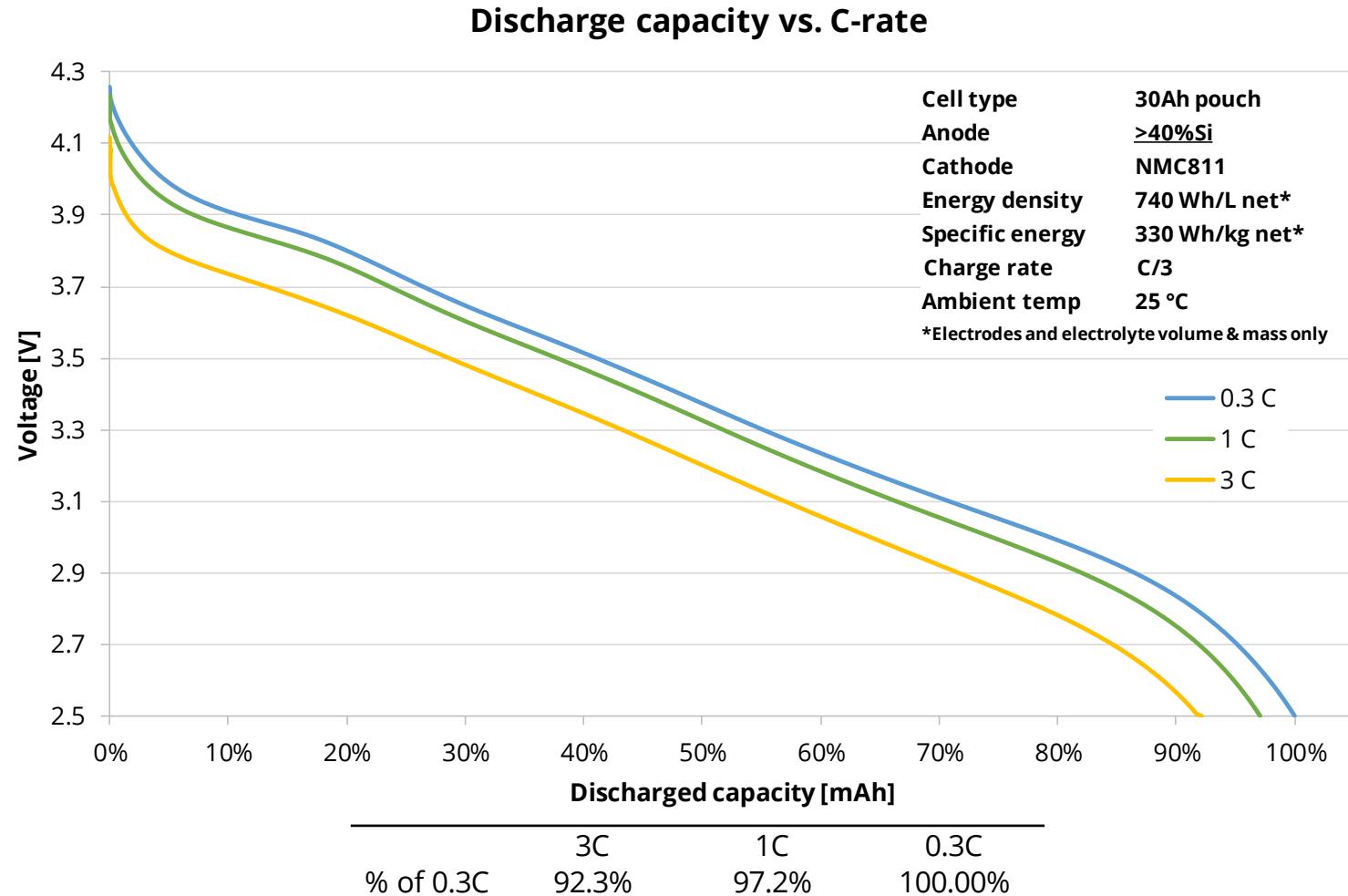
	-20°C	0°C	25°C	55°C
% of 0.3C	76.4%	92.8%	100.00%	102.2%

# Outstanding high power (3c) discharge performance

30Ah pouch cell



- 92% discharge capacity @ 3C discharge rate
- Similar to high end graphite-based solutions



# Extreme fast charging driving sustainability



## XFC battery is a key enabler for EV mass adoption

High energy, extreme fast charging EV batteries eliminate drivers' range & charging anxiety - the main barrier to EV adoption



## Roadmap focused on materials with neutral environmental impact

StoreDot roadmap optimizes the use of materials and manufacturing processes towards carbon-neutrality



## Monitoring carbon footprint with Battery Tracking System

Manufacturing and supply chain traceability system, in collaboration with industry-wide consortia aligned with global sustainability initiatives



## Driving decarbonization through innovation and IP

Reducing time-to-market of next-gen EV battery technology, through holistic innovative approach addressing environmental aspects of battery ecosystem



## Extended battery cycle life for second life applications

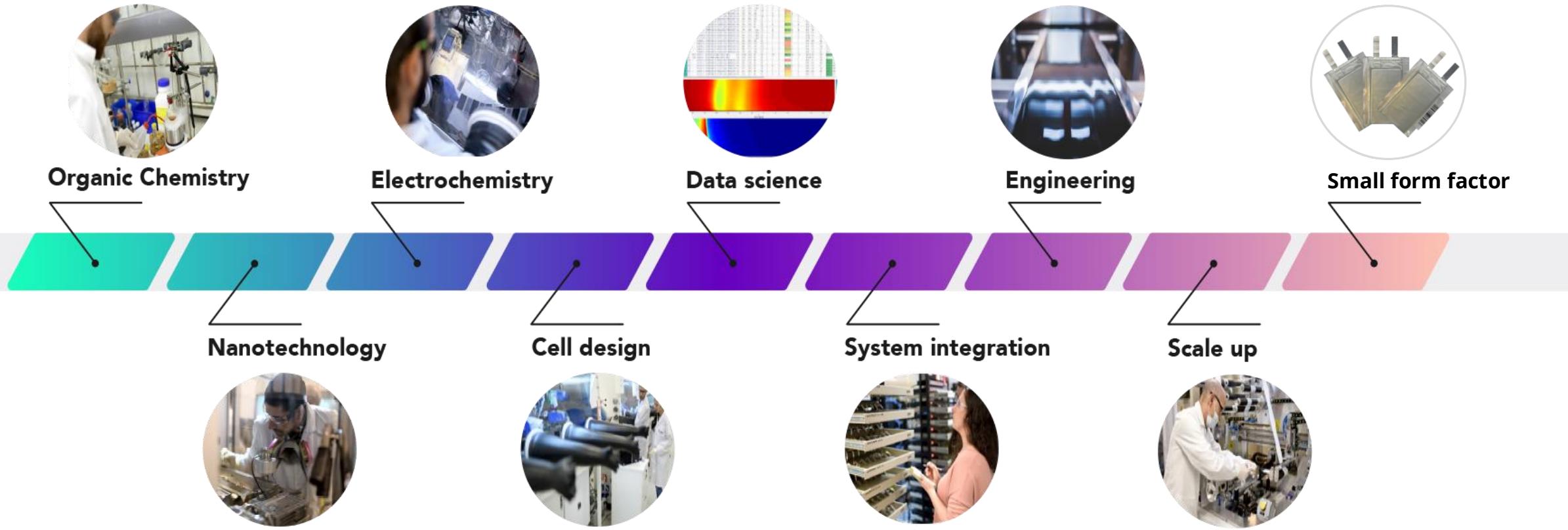
Offering prolonged lifespan to allow EV drivers long battery life, reduce the need for material recycling and support second life usage

# **SCALEUP & MANUFACTURING**

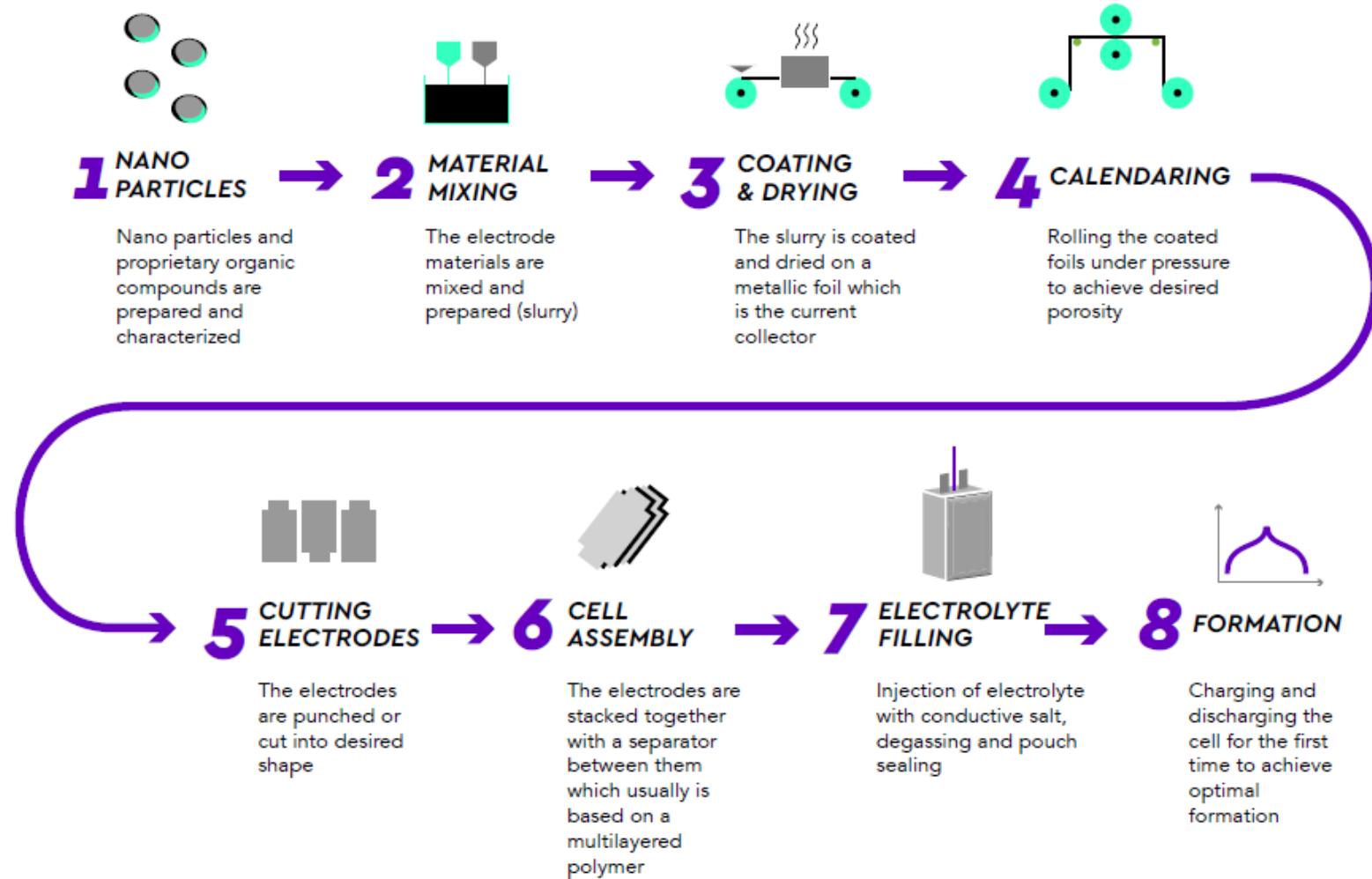


# In-house pilot production and scale up

From molecule design to sample production, under one roof



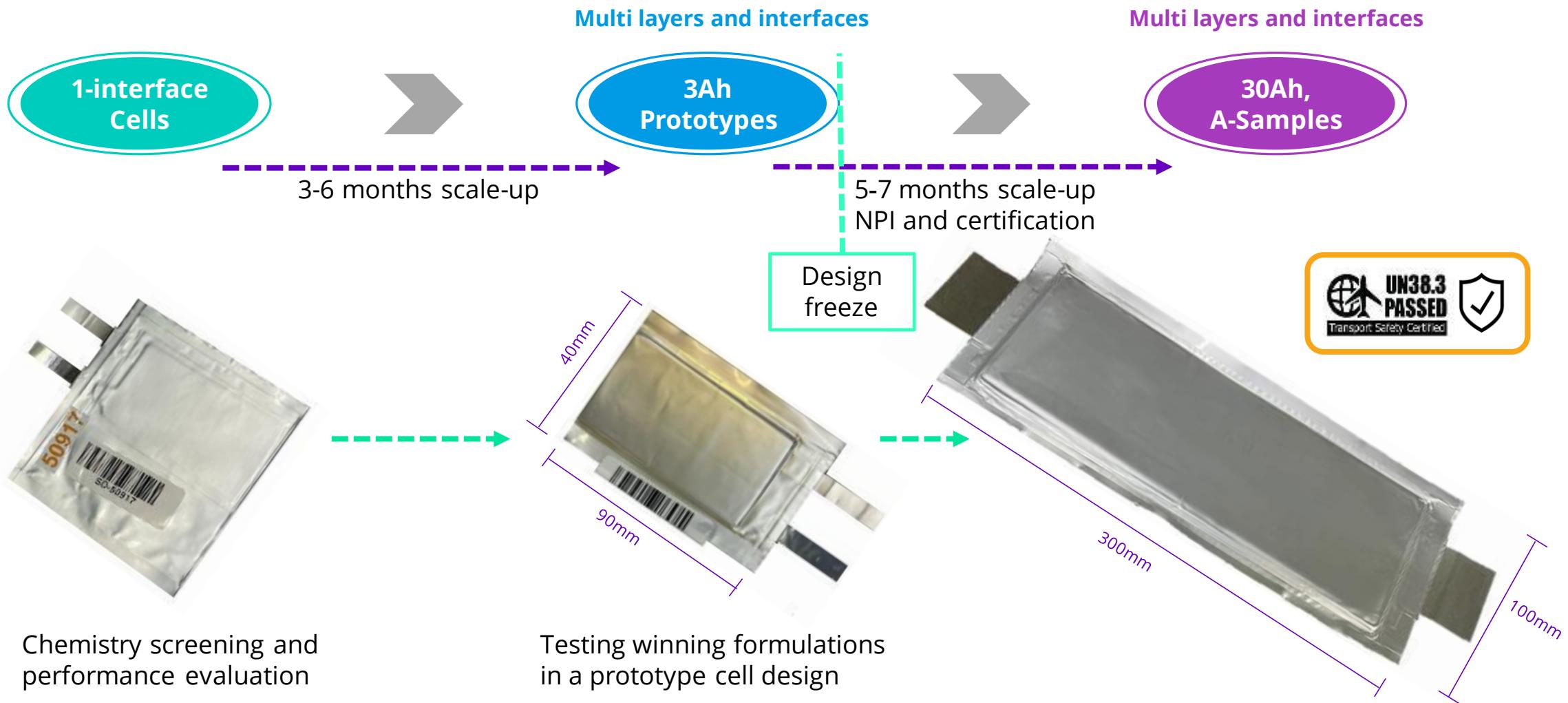
# Standard production process



## No unique production steps

- StoreDot's XFC technology is produced at a standard line.
- We are **fully compatible** with existing giga factories.

# Shortest time from lab prototype to EV form factor

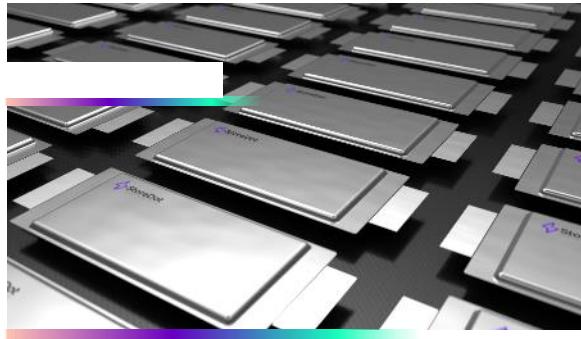


\*Dimensions, typical numbers

# Form factor flexibility

Developing cells for all form factors, allowing OEM design flexibility

Pouch



Prismatic



46XX Cylindrical



21700 Cylindrical



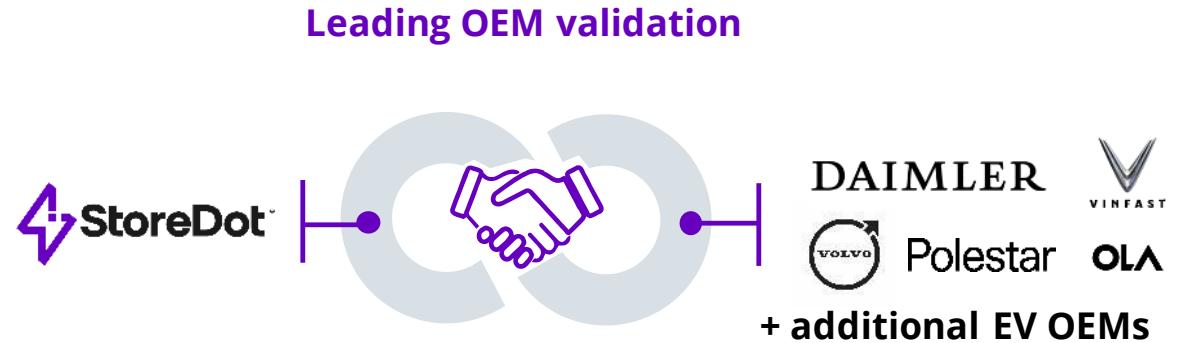
StoreDot's main focus in recent years has been on pouch cells. Our pilot line and EV samples (A & B) are based on a typical form factor of 300X100mm. We offer flexibility in dimensions according to customer requirements.

StoreDot technology is suitable for scaling up production of prismatic cells based on OEM requirements.

We have developed prototypes of 46XX cell based on our innovative chemistry, and are exploring the cooling requirements while scaling up the technology

We have developed prototypes of 21700 cells based on our innovative chemistry, and are exploring scaling up the technology

# XFC solution with established EV battery manufacturing



## StoreDot manufacturing partnership

- Production of EV form-factor A-D sample cells
- Framework to achieve mass-production and captive capacity
- Utilizing existing Li-ion manufacturing lines

## Strategic partnership with leading EV OEMs

- A-Samples supply by StoreDot
- Evaluation of StoreDot technology
- EV OEM collaborative projects

# **MARKET**



# EV market drivers

## BEV demand



Continued exponential growth in North America, Europe and China

## Regulatory restrictions and EV stimulus packages



Number of regulations to improve CO<sub>2</sub>/fuel efficiency and reduce pollutant emission

## End-customer preferences



Improvements in charging speed and infrastructure supporting EV penetration, in addition to cost and range.

## OEM strategy



- Increasing EV offering to meet demand
- Diverse cell format roadmap
- Securing global battery manufacturing capability

# OEMs take action to match growing demand and regulatory requirements

Global OEMs are planning to spend

**\$550BN**  
on EVs and batteries through 2030<sup>2</sup>

OEMs have set ambitious BEV targets...



Mercedes-Benz: **all-electric** car brand by 2030



Volvo: **fully electric car company** by 2030



GM: **all-electric** company by 2035



Ford: have its passenger vehicle range in Europe **all-electric** by 2030



Hyundai: targets 7% of Global BEV Market by 2030



BMW: BEV share of over **50%** by 2030



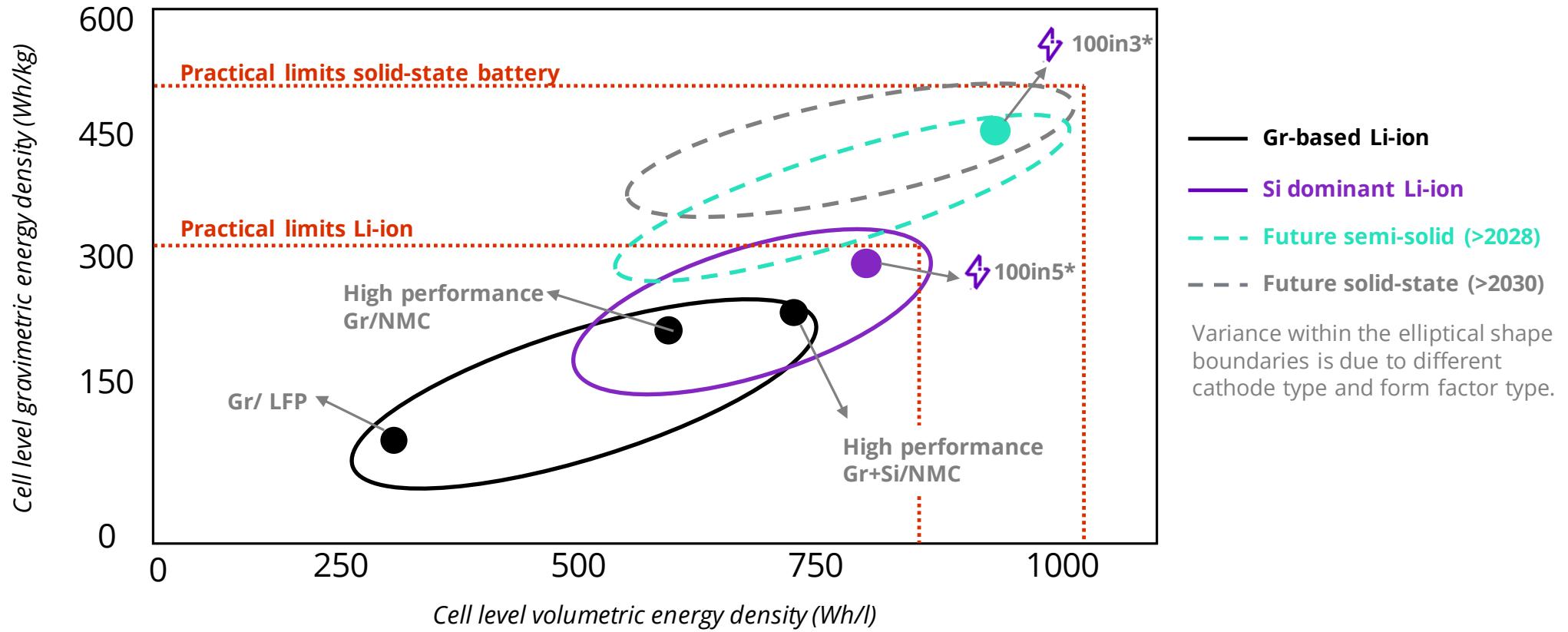
Stellantis: **100%** passenger cars sales in Europe to be BEVs by 2030



Volkswagen: increase BEV share in Europe to **70%** by 2030

# Technology evolution timeline

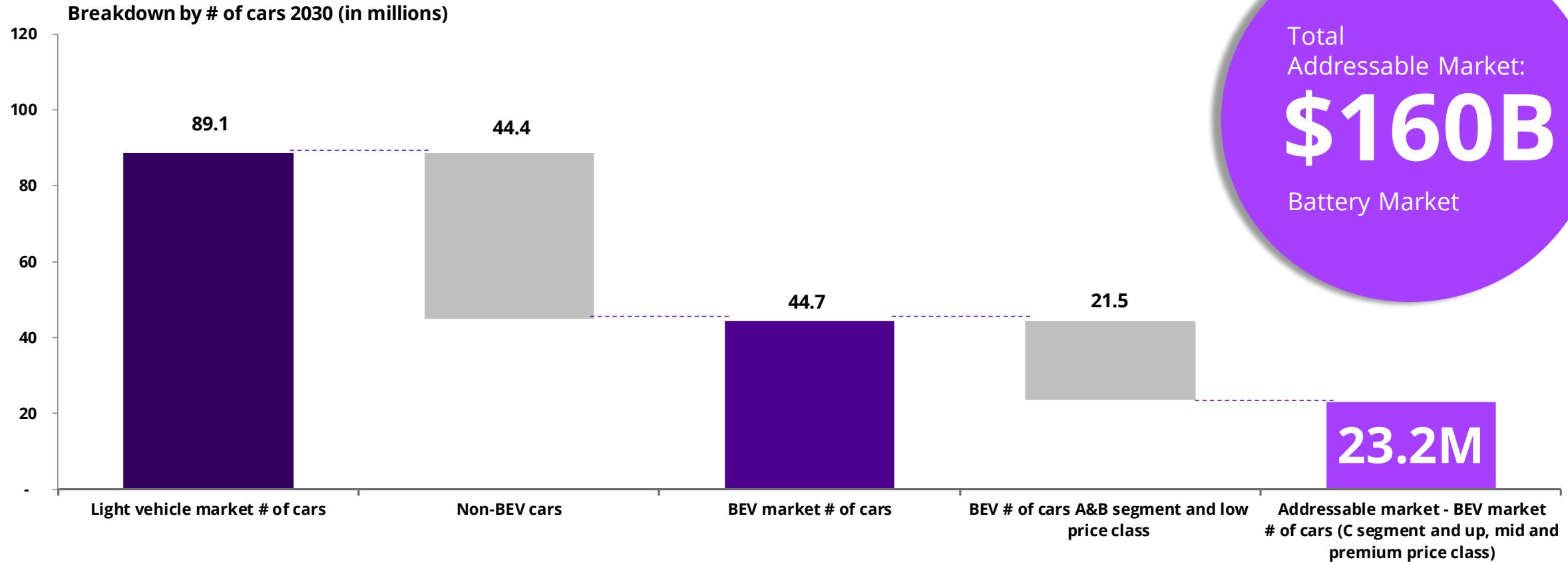
StoreDot's solution is superior to emerging technologies



\*StoreDot technology is optimized for extreme fast charging with minimal compromise in energy density

# StoreDot's addressable market

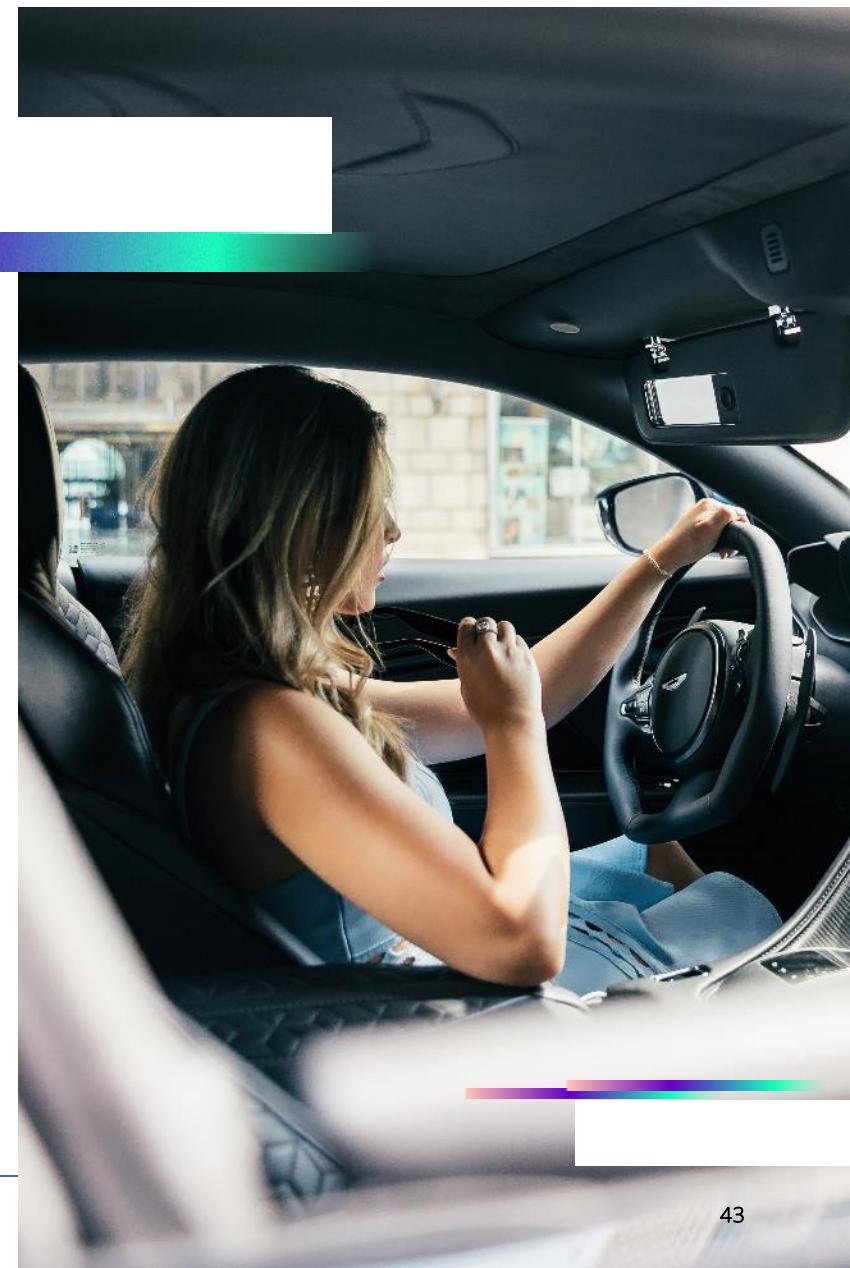
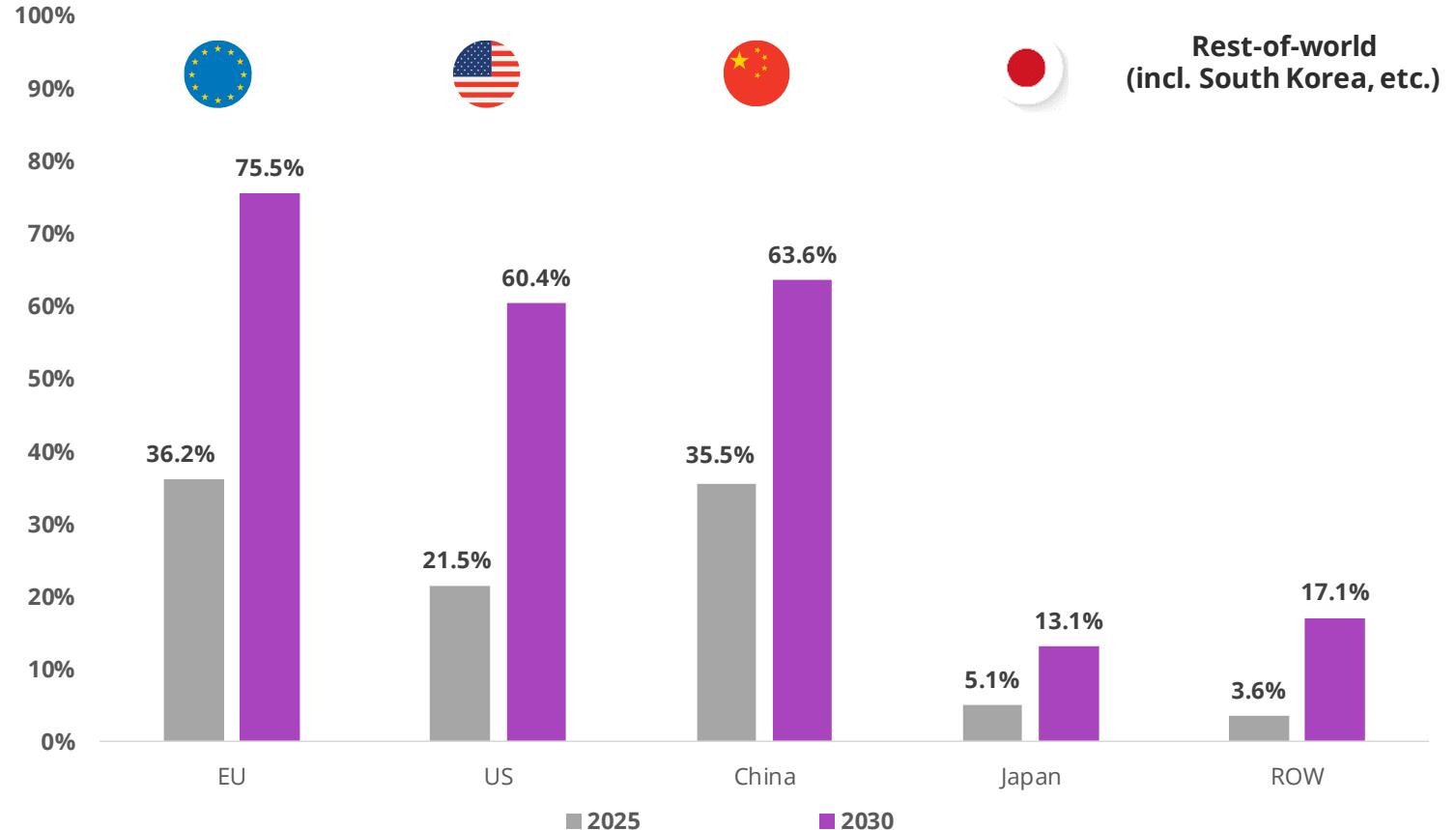
Enormous global market seeking a solution for range anxiety



Source: UBS - Monthly Recharge: IRA developments/Future of city transport, IHS;

# Market drivers accelerate BEV penetration across regions...

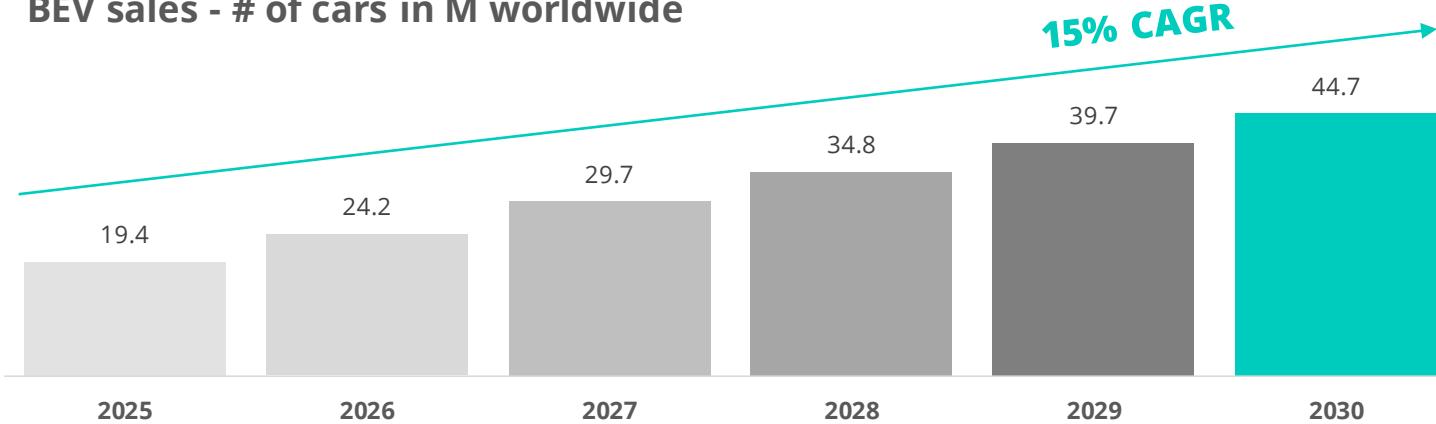
BEV penetration forecast by region (mm units)



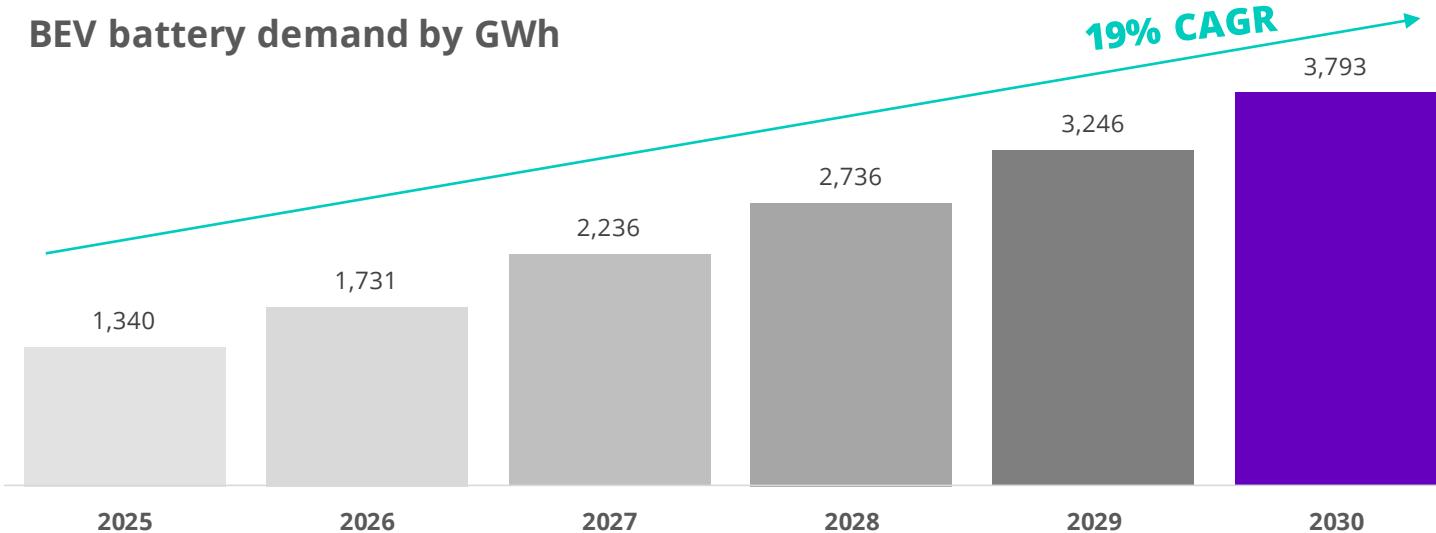
Source: UBS - Monthly Recharge: IRA developments/Future of city transport, IHS;

# ...and result in an immense BEV market

BEV sales - # of cars in M worldwide



BEV battery demand by GWh



Source: UBS - Monthly Recharge: IRA developments/Future of city transport

# **CORPORATE OVERVIEW**



# StoreDot is disrupting the EV battery space

## Key takeaways

- 1** Pioneer in an enormous Addressable market
- 2** Disruptive technology based on proprietary compounds and cell design
- 3** >50% reduction in charging time with same energy density and price trajectory
- 4** Mass-production readiness of **100in5** XFC by 2024
- 5** Roadmap to **100in3** fast charging and extreme energy density in 2028
- 6** Established OEM and manufacturing partnerships
- 7** Five EV-OEM partners and shareholders underpinning our positioning
- 8** Strong management with experienced professional R&D team

**>23m cars per annum in 2030**

**100+ Patents**

**100in5**

**>1,250 cycles at >300 Wh/kg**

**400 Wh/kg**



Polestar

DAIMLER



**40 PhDs, 130 professionals**

# Outstanding Battery R&D team

Focused on innovation across the board

## Agile project management



- Pioneering in practicing Agile Project Methodology in Electrochemistry, method taken from software design and DevOps
- Breaking development process into short 4 weeks iterative cycles ("sprints") with strict goals for each cycle, followed by execution, results review and conclusions
- R&D organization is split to several multidisciplinary agile teams, each responsible for different technology angle

## Data Science for formulation optimization



- First to implement in battery R&D phase
- Enabling major leaps in the discovery phase
- Ability to draw battery performance predictions based on the first 100 cycles

## Unique R&D hub in Orange County, USA



- Strengthen relationships with US OEM partners and customers
- Set to accelerate development of semi solid battery technology
- World-class team of researchers focus on material research

**The team includes 40 PhDs**

**THANK** —————  
————— **YOU** —————

