BlueSolutions

BOLLORÉ

SOLID-STATE BATTERIES FOR EVs

Strategic Roadmap Gen 4 SSB For Electric Vehicles

The Battery Show North America
Novi, MI

September 2022

BOLLORÉ

Revenues
€ 20 Bn

People
73,000

- Transport & Logistics
- Media & Communications
- Energy Storage & Systems

Founded in 1822 as a paper manufacturer, the French company and family story successfully navigated through the 20th and 21st centuries with activities diversification in Transportation, Logistics, Energy distribution and storage as well as Media and Communications.

Celebrating its 200th birthday this year, the group has now become one of the 500 largest companies in the world and ranks amongst the top 200 in Europe.

Publicly listed, the group is majority controlled by the founding family and it is chaired since 2019 by Cyrille Bolloré.

The stability of its shareholder base enables the group to pursue long-term investment and transformative policies.

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Blue Solutions is the world's pioneer on SSB,

with a global footprint and 20+ years of experience in design, development, and industrialization

A unique know-how

20+ years
R&D in SSB

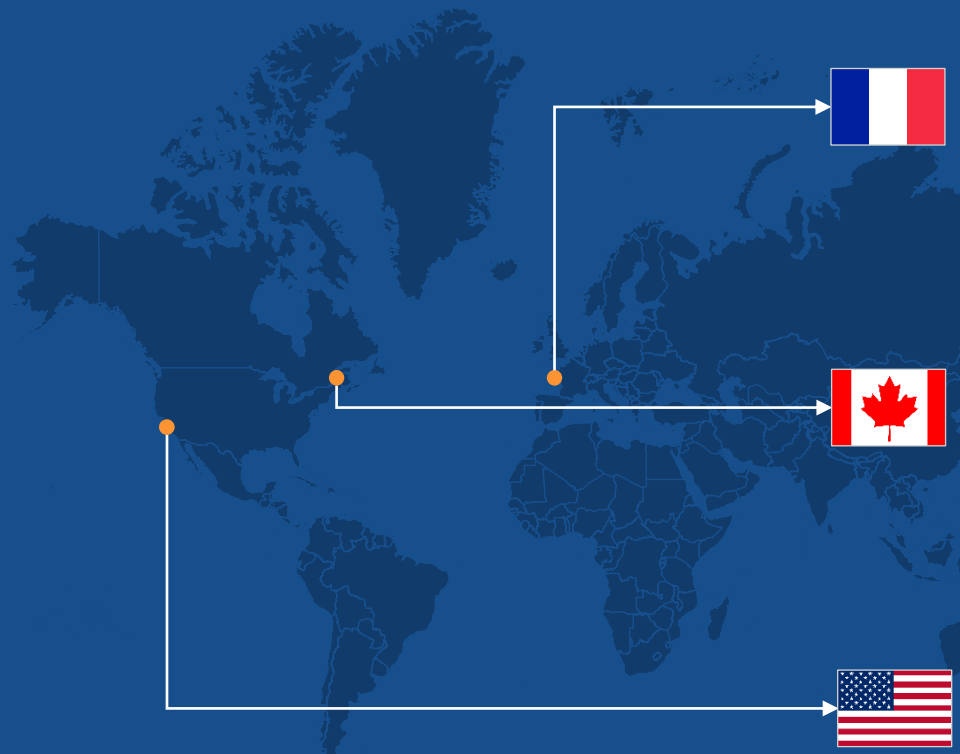
10+ years
Industrial operations

Proprietary
Lithium metal anode production

Expertise
In extrusion & coating processes

Innovative
Electrolyte preventing dendrite creation and growth

600
Patents in the portfolio today



France, HQ, ~300 staff
Production line of Gen3,
Research Center for Gen4

Quimper & Grenoble

Canada, ~200 staff
Production line of Gen3,
Research Center for Gen4

Boucherville, Quebec

United States, ~10 staff
Expertise in polymer synthesis,
access to Stanford lab equipment

Palo Alto, CA

Blue Solutions is leveraging its strong industrial track-record

Building on a decade-long R&D and manufacturing experience to develop the technology of the future

1980s

Collaboration between French (**CEA/CNRS**) & Canadian (**Hydro-Québec/IREQ**) to develop a new polymeric electrolyte with lithium salt

2001

In Canada, creation of **Avestor,** a 50/50 JV between Hydro-Québec and Kerr-McGee

2001

In France, a partnership between CEA, EDF & **Bolloré** leads to the creation of **Batscap**

2007

Bolloré Group acquires Avestor and the merger with Batscap results in **Blue Solutions**

2011

1st electric car, equipped with a 1*30 kWh pack providing a 250-km range

2015

1st electric bus, equipped with 8*30 kWh packs providing a 180-km range

2018

Contract with Daimler to equip their eCitaro electric buses

Cumulated achievement

5.5 Million units

# of cells already produced in cumulative

500 Million km

Distance achieved in cumulative

2022
LMP®

Targets specialized markets such as electric buses, off-highway vehicles, etc.

From 2026
Gen4 Production

Li-metal anode, polymer electrolyte and HV cathode.

Designed for the EV mass market needs.

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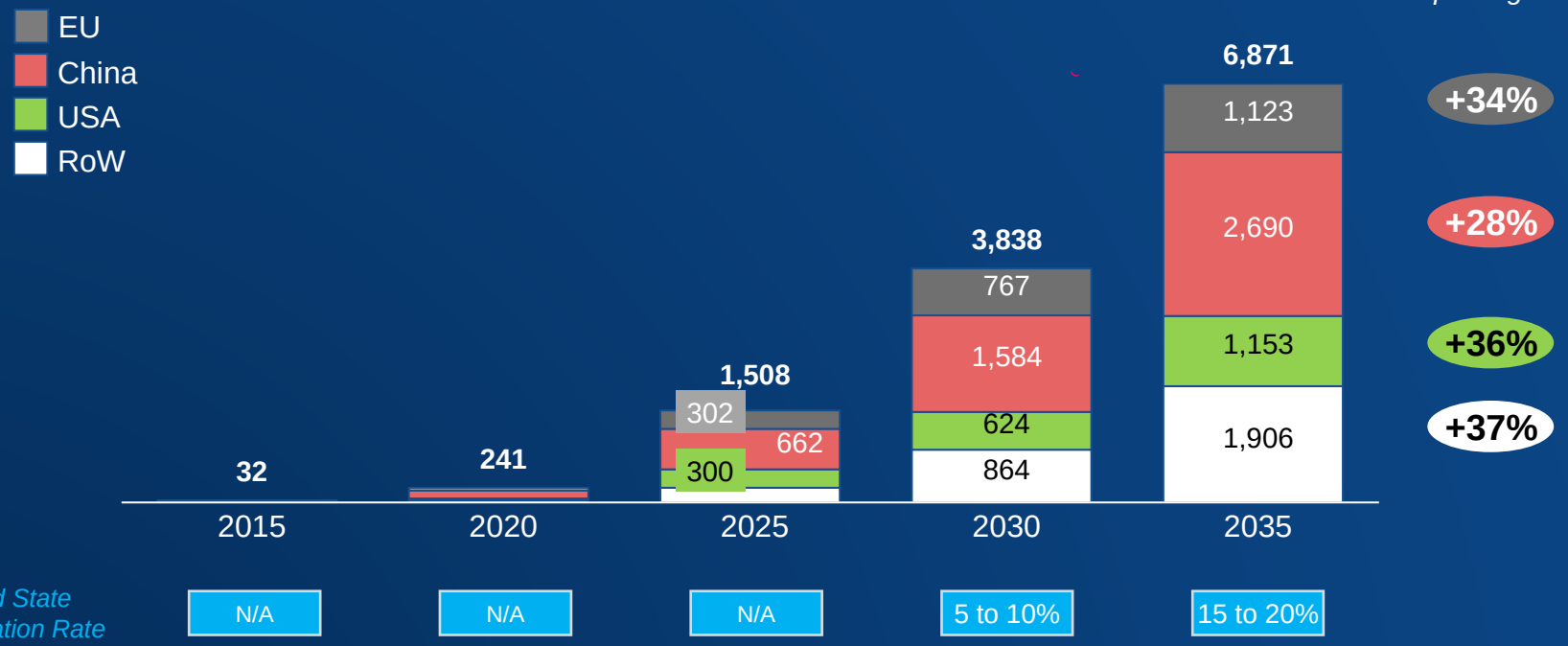
Global batteries market to reach ~3,800 GWh by 2030…

Global battery cell demand by region & SSB Penetration Rate, in GWh



SSB will be introduced from ~2026 to significantly increase its penetration share to represent ~1,000-1,400 GWh by 2035

SSB market size is highly contingent to technology availability at the right performance and price and related to OEM partnerships **to take SSB to the market.**

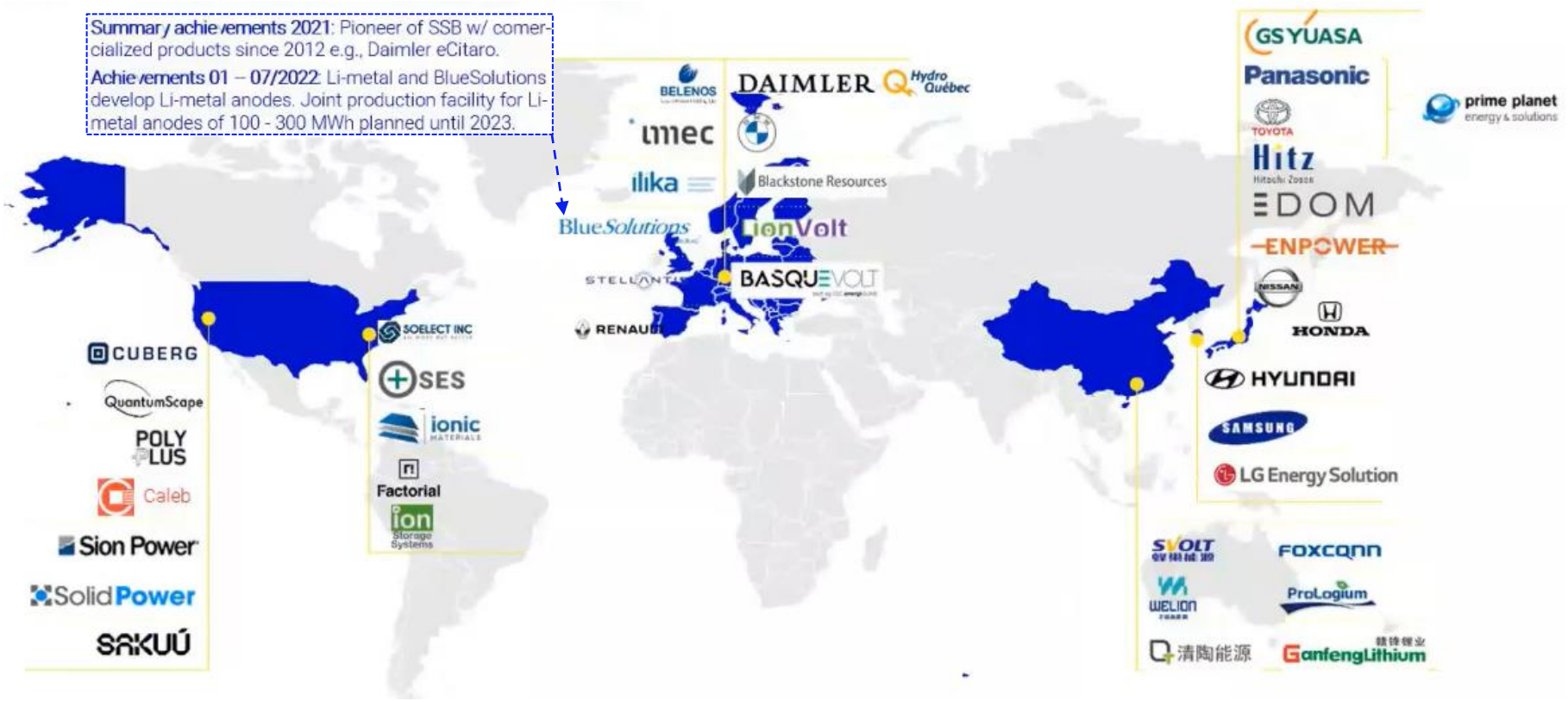
Market share of SSB estimated at 5-10% by 2030 and **15-20% by 2035** of the global battery market driven by safety and strong performance specs

Announcements of SSB peers and li-ion incumbents represents ~2-3x the expected market size in 2028.

Source: Consultant Proprietary Battery Demand Model, Updated 2021H2

Addressable market excl. consumer electronics segment.

Solid-State Battery Players – Worldwide 2021/2022



Blue Solutions is well positioned to capture growth as the only commercial player in SSB market.

In a realistic scenario, Blue Solutions' Gen4 could target ~15 to 20 GWh batteries sales by 2030 and >60 GWh in 2035 equivalent to more than 6% market share.

Source: Extract of P3 Group Presentation, Solid State Battery Summit, August 2-3 2022.

Gen 4: choosing the right path for the technology

	GEL	POLYMER	HYBRID (polymer + ceramics)	OXIDE	SULFIDE
Conductivity	●●●○	●●●○	●●●○	●●○○	●●●●
Thermal stability	●●○○	●●●○	●●●○	●●●●	●●●●
Li metal compatibility	●●○○	●●●●	●●●●	●●●●	●●○○
Moisture stability	●●○○	●●●●	●●○○	●○○○	○○○○
Manufacturability	●●●○	●●●●	●●●○	○○○○	●○○○
Pressure requirement	●●●●	●●●○	●●●○	○○○○	●○○○

- Conductivity of basic polymeric electrolytes is not sufficient at room temperature
- Gel and hydrid can help bring down the temperature requirement

- Li-Ion organic solvent electrolytes unstable from 70-100°C. All solid electrolytes stable up to 250°C and more. Thermal stability will be defined by lithium metal anode (fusion at 180°C).

- Challenges related to foam with gels and to resistive passivation layer for sulfides

- Manufacturing challenge for all technologies
- But especially for ceramics, since process has to be in an inert atmosphere

- Gel, polymer and hybrid easy to manufacture using roll to roll process; harder to roll ceramics (especially oxides)

- One of the biggest challenges for solid state is integration, because of the pressure requirements

Gen 4: asking the right questions

Finding the right **compromise** between thermal stability, conductivity, cycle life, etc.

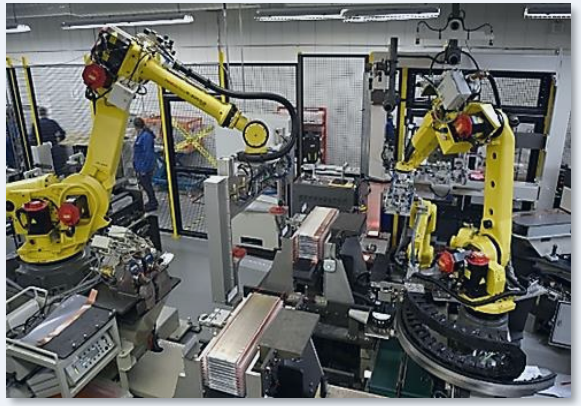
Going **from lab coin cells to production cells with > 20Ah capacity.**

Designing a battery cell technology that can be **manufactured at industrial-scale.**

The ability to **integrate** it into a car **with volumetric & weight constraints.**

There is a challenging journey ahead!
Experienced players, realism, technical know-how will be key to achieve a successful launch.

Gen 4: based on a strong experience and lessons learned



To transition from the first coin cells produced in 1999 to the first commercially available battery modules, Blue Solutions had to overcome many challenges and develop an expertise that goes beyond the chemistry itself:

- Manufacturing and assembly process of **ultrathin films.**
- Specific processes dedicated to the production of **a thin metallic lithium foil:** anode in lithium metal down to 20 µm thickness and 160 mm width.
- Overcoming **interface challenges.**
- Electrolyte **preventing dendrite creation and growth.**
- **Extrusion** process.
- Stacking of **several battery cell layers** (around 100 layers).
- A **dedicated recycling process** (industrial process readiness in late 2021 based on existing recycling pilot line).

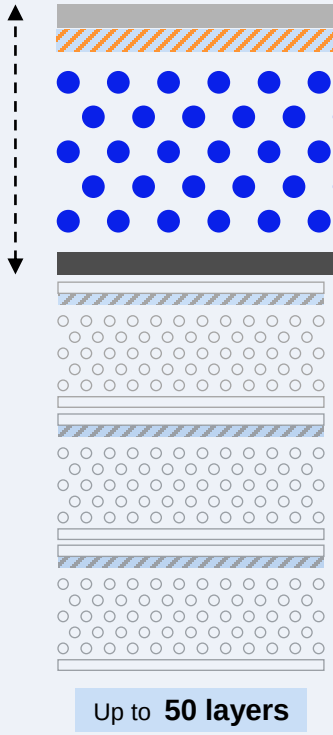
Introducing Gen 4 SSB for the EV Market

Gen 4

Know-How

Manufacturability

Maturity



Ultra thin Lithium metal anode

- Thin & large lithium metal films stacking

Innovative solid electrolyte

- Avoiding dendrites formation in existing industrial processes

High Voltage Cathode

- High voltage material in line with OEM needs & ensuring high density
- Platform design that will allow different Cathode material: NMC, LFP, etc.

Current collector: Aluminium foil

Up to **50 layers**

>900 Wh/L
Volumetric density

>450 Wh/kg
Gravimetric density

<100 $/kWh
Price Target

25-40°C
Operating Temp.

15-20 mins
Charging to 80% SOC

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