European Commission

Lithium-ion batteries for mobility and stationary storage applications

SCENARIOS FOR COSTS AND MARKET GROWTH

Global supply and demand of lithium-ion batteries today and in the future

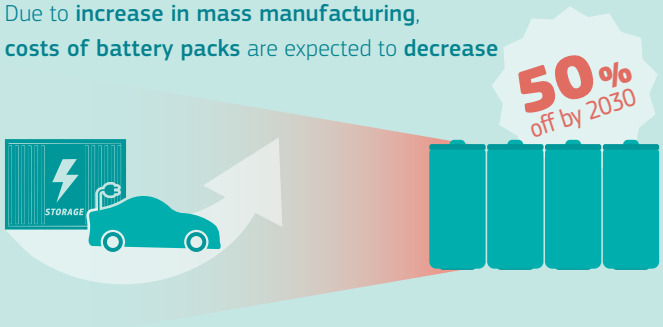
	2018	2028	2040
ELECTRIC VEHICLES ON THE ROAD	>4 million	50 to 200 million	up to 900 million
LITHIUM-ION BATTERY CELL SALES	>77 GWh	250 to 1100 GWh	600 to 4000 GWh
EUROPEAN SHARE OF GLOBAL CELL MANUFACTURING	3 %	7 to 25 %	can we do better?

Growth in sales of **electric vehicles** and **energy storage** increases the demand for **lithium-ion batteries**.
In the near-term, Europe is expected to have **sufficient manufacturing capacity** to meet domestic demand. It will however **largely depend** on (foreign) **investment** and a **few major players**.

LG Chem northvolt TESLA SK innovation CATL

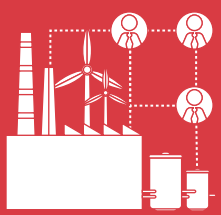
Implications of growth on costs and market size

Due to **increase in mass manufacturing**, **costs of battery packs** are expected to **decrease**



The **global market size will increase** and **Europe** has the **opportunity** to tap into a **market of billions**

WHAT CAN EUROPE DO?



Ensure **long-term engagement** and commitment of all relevant stakeholders (e.g. industry, energy system providers, policy makers and citizens) to establish a **competitive and sustainable European battery value chain**

Stimulate **cost reduction** for battery energy storage solutions by also tackling **non-battery components** (e.g. balance of plant, energy management system)

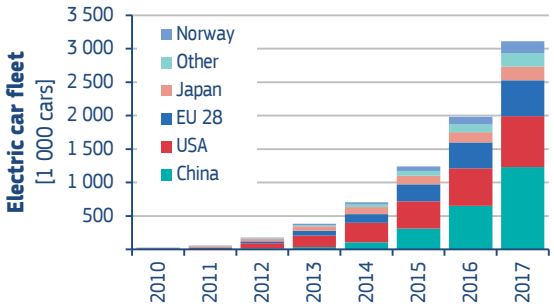
Exploit opportunities in cost reduction from other **synergies** across the **value chain** (e.g. re-use)

Find out more at **https://europa.eu/!FF86WW**

Joint Research Centre

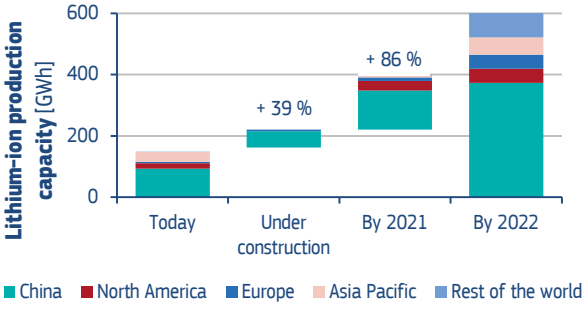
Lithium-ion batteries for mobility and stationary storage applications: Scenarios for costs and market growth*

The global fleet of electric cars and buses recently exceeded four million units (0.3 % of the total car fleet), and **more than one million electric cars were sold last year** as part of the transition towards a clean energy system. Whereas Europe represents a sizeable market (15 % of new electric car sales in 2017), more than half of new units are currently sold in China.



The ever-growing sales of electric cars boosted the global lithium-ion battery production from about 20 GWh (~6.5 bn €) in 2010 to 120 GWh (~24 bn €) in 2017; in a market historically driven by electronics, more than half (70 GWh) of the present sales cover mobility. As for stationary energy storage, market penetration is also increasing but at much lower volume (6.5 GWh in 2017).

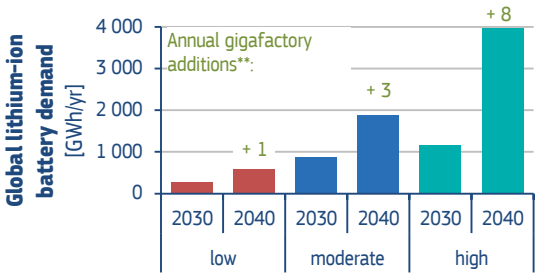
The global manufacturing capacity of lithium-ion cells for electric cars and energy storage is about 150 GWh per year. China holds the lion's share (about two-thirds), while Europe lags behind and hosts only about 3 % of the global production capacity. This situation may change thanks to initiatives such as the European Battery Alliance.



In the **near-term** (2025-2028), projections show that between 50 and 200 million electric cars could be on the road worldwide (3-6 % of the global car fleet). By then, the **annual demand for car batteries and energy storage may be about ten times higher than it is today**.

In this period, based on recent announcements, the global share of European lithium-ion cell manufacturing capacity may range between 7 and 25 %. Such levels could be sufficient to meet the domestic demand for batteries (2-8 million electric car sales), but not for long. Before 2030, a further surge in battery demand is expected. Moreover, China remains the main supplier, Europe largely depends on inward investments from Asian battery producers and the region's production will be concentrated to a handful of suppliers.

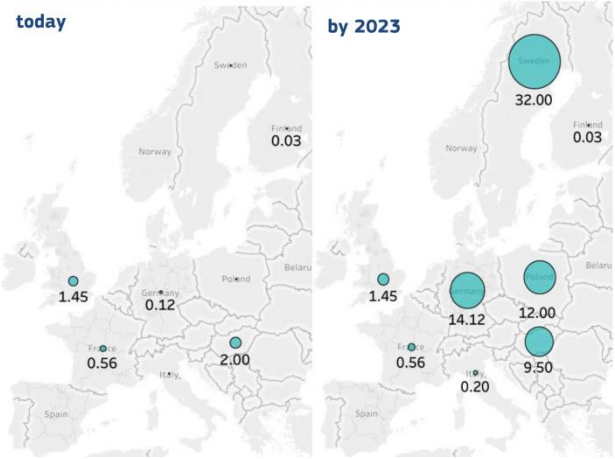
The continuing electrification of the energy system for the clean energy transition may maintain the growth in battery demand. **Long-term** analyses estimate that the number of electric cars on the road in 2040 could be between 150 and 900 million, and more than 1 000 GWh of batteries for energy storage could be installed by then. Based on different growth scenarios, **between one and eight new gigafactories would need to be added every year** from 2030 to 2040.



** based on 35 GWh/gigafactory

Mass manufacturing, through economies of scale and experience in production, **can halve the costs of lithium-ion batteries by 2030**, and **an additional 50 % reduction may be achieved thereafter**; that is, a lithium-ion battery that today costs about 200 €/kWh may ultimately cost 50 €/kWh. This is attainable based on advanced battery chemistries, but does not take into account potential disruptions in material prices (e.g. cobalt). Benefiting from spill-over effects from mobility, the cost of stationary storage may also drop between 50 and 70 %.

Lithium-ion cell manufacturing capacity in Europe [GWh]



By 2025, the global market for lithium-ion batteries for electric cars could reach 40–55 bn €/yr. The European market could grow from about 450 M€/yr (2017) to 3–14 bn €/yr (2025). In the long-term, the **global market may exceed 200 bn €/yr**. In order to tap into it, Europe should further expand its manufacturing base and support its industry's competitiveness with a long-term focus, by:

- ensuring long-term engagement and commitment of all relevant stakeholders (e.g. industry, energy system providers, policy makers and citizens) to establish a competitive and sustainable European battery value chain;
- stimulating cost reduction for battery energy storage solutions, also by tackling non-battery components (e.g. balance of plant, energy management system);
- exploiting cost-reduction opportunities from other synergies across the value chain (e.g. re-use and re-purposing).

* This factsheet is based on the JRC Science for Policy Report: Tsiropoulos I., Tarvydas D., Lebedeva N., *Li-ion batteries for mobility and stationary storage applications – Scenarios for costs and market growth*, EUR 29440 EN, Publications Office of the European Union, Luxembourg, 2018, doi:10.2760/87175.