

USE CASE

Batteries for Electric Vehicles



SECTOR

Transportation

« A [solid-state battery] model has been developed by NASA with a 40% lower weight and tripled energy density compared to a conventional battery. »



Applicable quantum technologies

- Quantum computer⁴
- Hybrid simulations⁵
- Quantum materials

Commercial applications

- Simulation of materials to discover new properties
- Simulation of interactions between different cathodes, anodes, electrolytes and separators
- Batteries that are more energy dense and faster to recharge
- Solid-state battery
- Lighter batteries (for the same capacity)



Opportunity Quantum technologies will make it possible to develop batteries that will be more energy dense and faster to recharge. ^{1,2,3}



Threat Transportation companies and electric vehicle manufacturers that do not use batteries developed using quantum technologies will lose their competitive advantage.

Examples of actors in the innovation chain



DEVELOPPERS



ECOSYSTEM



USERS



USE CASE: Vehicle batteries

SECTOR Transportation

Factors preventing adoption

The simulation capacity is currently limited by the computing power of quantum computers.

Indeed, it will be their power that will accelerate and reduce costs in the discovery of the materials necessary for the manufacture of more efficient batteries.

Ultimately, the unparalleled material simulation capability of quantum computers will be the key advantage that will enable the development of batteries that will be superior in energy density and recharge speed⁶.

Risks of the status quo

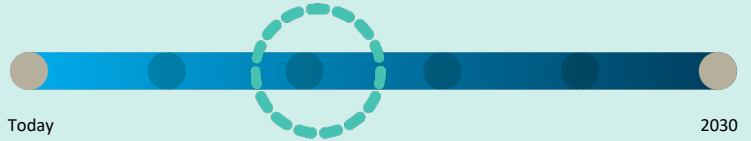
The development of batteries is a major issue considering the electrification of our transport. In fact, global energy demand will increase by 27% by 2040⁷.

Indeed, Canada will end the sale of vehicles using only fossil fuels by 2035⁸, and a similar law has been adopted by the European Union⁸.

Thanks to quantum simulation, it will be possible to develop batteries that are more energy dense, lighter, and which recharge more quickly. These batteries will probably be solid state batteries. In fact, a model was developed by NASA with a 40% lower weight and tripled energy density compared to a conventional battery⁹.

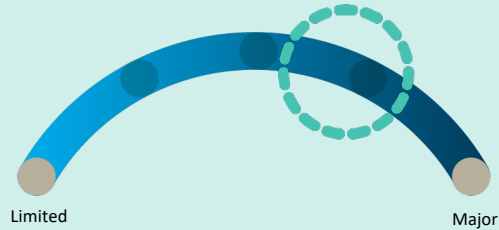
For transport and electric vehicle production companies, the capacity and properties of batteries are major issues for differentiating their products and maintaining a competitive advantage.

OPPORTUNITY window



Considering that the quantum computer capable of performing these simulations is not yet ready, the window of opportunity is more in the medium term. However, since changes in R&D will require new expertise, it is crucial to explore this opportunity now, in order to be ready once computers and quantum materials become available on the market.

POTENTIAL impact for businesses



The impact will be major for companies that manufacture or operate electric vehicles and for consumers. The transition to electric vehicles will be made easier for corporations and consumers; due to the reduction in perceived disadvantages compared to non-electric vehicles.

1. <https://www.independent.co.uk/tech/battery-charge-time-electric-car-quantum-b2042063.html>
2. <https://scitechdaily.com/new-quantum-technology-to-make-charging-electric-cars-as-fast-as-pumping-gas/>
3. <https://futurism.com/the-byte/quantum-charge-electric-cars>
4. <https://www.popsci.com/technology/ford-quantum-ev-battery/>
5. <https://www.popsci.com/technology/ford-quantum-ev-battery/>
6. <https://www.engineering.com/story/eve-on-lithium-for-better-batteries-use-quantum-computers>
7. <https://www.cbc.ca/news/politics/canada-electric-vehicles-2035-1.7063993>
8. <https://www.reuters.com/business/autos-transportation/eu-lawmakers-approve-effective-2035-ban-new-fossil-fuel-cars-2023-02-14/>
9. <https://www.newscientist.com/article/2398896-what-are-solid-state-batteries-and-why-do-we-need-them/>



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Québec Quantique aims to promote the adoption of quantum technologies by Québec businesses and organizations.

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