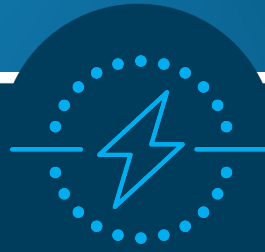




# QUÉBEC QUANTIQUE

## Enabling the Quebec Quantum Ecosystem

quebec-quantique.ca



USE CASE

# Battery of the future

SECTOR

# Energy

*Quantum simulation will speed up and reduce R&D costs and risks for new batteries*



### Applicable Quantum Technologies

- Quantum computers<sup>4</sup>
- Hybrid simulations<sup>5</sup>
- Quantum materials

### Commercial Applications

- Simulation of materials to discover new properties
- Simulation of interactions between different cathodes, anodes, electrolytes and separators
- Simulation of different recharging technologies
- Ultimately, development of batteries with higher energy density and faster recharging times



**Opportunity** Quantum technologies will enable the development of batteries that are denser in energy and faster to recharge <sup>1,2,3</sup>.



**Threat** Companies developing batteries will eventually lose any competitive edge if they continue to produce batteries using conventional technologies.

Examples of actors  
in the innovation  
chain

DEVELOPERS

ECOSYSTEM

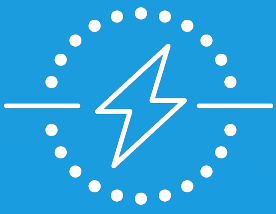
USERS

Created in collaboration with



Public partner





## USE CASE: BATTERY OF THE FUTURE

# SECTOR Energy

### Factors preventing adoption

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

Indeed, it will be their power that will accelerate and reduce the cost of discovering the materials needed to manufacture higher-performance batteries.

Ultimately, the unrivalled materials simulation capability of quantum computers will be the key advantage enabling the development of batteries with superior energy density and recharging speed<sup>6</sup>.

### Risks of Status Quo

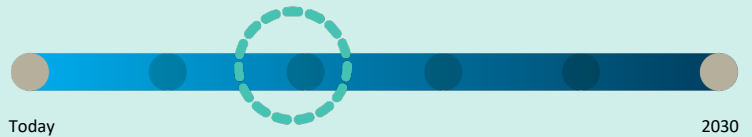
Battery development is a major challenge for the electrification of our societies. Global energy demand is set to rise by 27% between now and 2040<sup>7</sup>.

With the advent of certain green technologies (solar, wind, etc.), it will also be necessary to increase the overall storage capacity of this energy, which can be produced during periods of low demand, so that it can be consumed at another time<sup>8</sup>.

For companies developing or using batteries with high storage capacity, quantum simulation will speed up and reduce the costs and risks associated with the research and development (R&D) of new batteries. It will also be possible to develop batteries with otherwise impossible properties by exploiting quantum phenomena in battery cells.

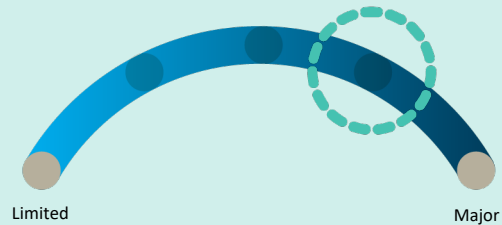
Eventually, a company that does not use these technologies will see its competitive advantage disappear.

### 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 the changes in R&D will require new expertise, it is vital to explore this opportunity now, so as to be ready once the computer and quantum materials are available on the market.

### POTENTIAL impact for businesses



This will have a major impact on the companies that control power grids and on consumers. Energy generation and storage will be easier and will run more smoothly. All this will enable better energy management, both for networks and for 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.popsi.com/technology/ford-quantum-ev-battery/>
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6. <https://www.engineering.com/story/eye-on-lithium-for-better-batteries-use-quantum-computers>
7. <http://capp.ca/energy/world-energy-needs/-:~:text=Energy Consumption by the Numbers&text=5 billion%3B from 8 billion.is forecast to increase 27%25>
8. <https://www.newyorker.com/magazine/2022/04/25/the-renewable-energy-revolution-will-need-renewable-storage>



# QUÉBEC QUANTIQUE

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

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