Pasqal

Energy

Powering the future with quantum

> Industry **power demand** is expected to **double** by 2050[1]

> The energy sector faces **unprecedented challenges** linked to **Grid stability** & **Energy storage**

Diversification of power sources
Expected share of renewables in electricity generation: 68 % by 2030[2]

Fluctuating supply & **demand**
In the EU power system, flexibility needs to almost double by 2030[3]

[1] https://www.mckinsey.com/industries/oil-and-gas/our-insights/global-energy-perspective-2023-power-outlook
[2] https://www.irena.org/Digital-Report/World-Energy-Transitions-Outlook-2023
[3] https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_MMR_2023_Barriers_to_demand_response.pdf

> How can the **network be kept stable day & night?**

> How to optimise the **supply chain?**

> How can **variability in energy production and consumption be accommodated?**

The energy industry needs to step up **efficiency** to keep pace with change

Quantum computing offers **tremendous opportunities** for the **future of energy**

Towards **market-leading solutions** with the help of **quantum algorithms**

Across the entire **energy value chain:** From **power generation** to **demand management**

Smart grid optimisation

> Improving balance between energy sources & meeting changing needs in real time

Use case: Smarter, more reliable grids

The challenge

Growing electricity demand
Diversification of the energy mix with highly localised production (e.g. houses producing their own energy)

> **Less predictable supply**
> Increasingly **complex grid management**

The solution

Quantum graph kernel method

Modelling electricity grids using our **quantum** graph kernel **method** for enhanced efficiency and reliability

Result:
Aggregating grid information to help improve balance **between reliability, availability, efficiency and cost**

More efficient batteries

> Enabling higher battery density and charging speeds

Next-gen batteries for electric cars

The challenge

Limited battery density and charging speeds are major bottlenecks for mass adoption of electric cars

The solution

Differentiable Quantum Circuit

Simulating battery design at the atomistic level for precision and performance (intractable with classical computers)

Result: Solution design that could deliver batteries that outperform today's lithium-ion batteries:

> **Smaller**
> **Faster-charging**
> More **powerful**
> **Longer-lasting**
> **Cheaper**

Better network design

> Improving **infrastructure** & **finding the solution faster through better resource allocation**

EDF *Smart charging for shared electric cars:*

The challenge

Scheduling optimal resource allocation to find solutions faster based on

> **expected** availability
> **real-time** availability
> charging **constraints**

The solution

Optimisation Methods

Mapping vehicles on charging stations
Using **quantum optimisation** techniques
Implemented on Pasqal's **neutral atoms quantum processor**

Result:
Overcoming the limitations of large supercomputers
Finding the optimal grouping of vehicles to

> reduce congestion at charging stations
> shorten overall charging times as a result
→ Bringing down production costs

Quantum can also provide a significant advantage in these areas

More efficient hydrogen fuel cells delivering sustainable solutions

Our **fuel cell models in 3D at full complexity** enable numerical simulation to improve **fuel cell performance, lifespan, and costs**

> **Reduced CO2 emissions** for heavy-duty vehicles

Using modelling to take nuclear fusion to the next level

Quantum-driven **numerical simulation** using an **analog-digital approach** could drive **fusion technology** forward

> Making the most of an **abundant source of clean energy**

More efficient wind farms

Graphs techniques can map correlations to find the layout that **maximises windmill exposure**

> Optimising **windmill positioning** to **generate more energy**

Quantum will boost energy **savings & efficiency**

A double driver of net zero:

Technology for sustainable energy

Quantum vs leading supercomputer: less power consumption
Pasqal's neutral atoms vs other quantum technologies: **lowest consumption**

Solutions for the industry

Pasqal's low-power quantum solutions should contribute positively to energy sector. Quantum can enhance energy supply and consumption by optimizing generation, distribution, and demand.

We are taking quantum technology out of the labs

Define quantum reality with us >

Pasqal