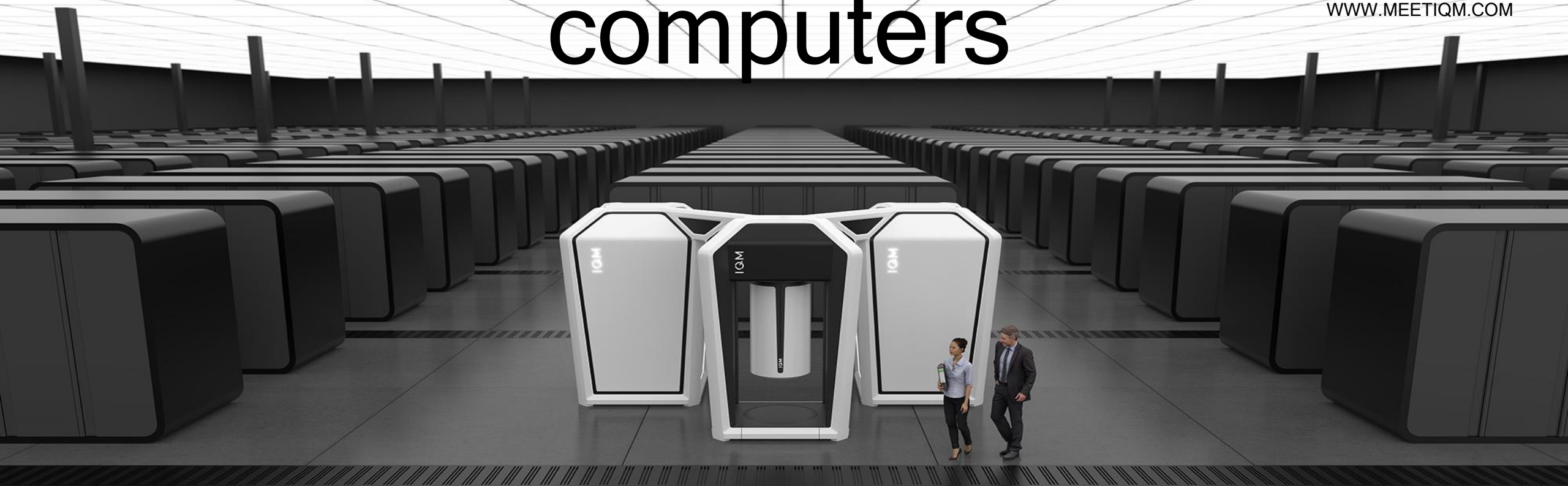# We build quantum computers

Company presentation

Dr. Jan Goetz, CEO

jan@meetiqm.com

Mission:
We build world leading quantum computers for the well-being of humankind, now and for the future.

IQM in a nutshell

- 225+ experts
- ~50% PhDs
- 7 Professor-level tech leaders
- 40+ nationalities

- ~180 M€ investment
- On-premises & full access
- 2 systems sold, 1 delivered

EIB President Werner Hoyer & EIB Vice-President Thomas Östros handing over funding documents

Global presences:

Espoo - Finland
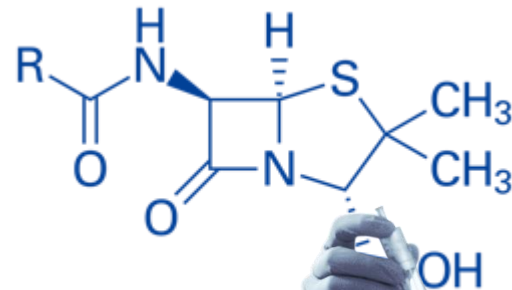
Munich - Germany

Madrid - Spain

Paris - France

Singapore

Some problems "we" are facing

PANDEMICS

INDIVIDUALIZED MEDICINE

200 bn USD R&D spend yearly (+6% p.a.)

Decline in R&D effectiveness over past **25 years**

"the ecological footprint of the pharmaceutical industry is … generating more CO_2 than the automobile industry. This is not only an issue in large-scale syntheses, but also in the labour intensive and time consuming search for new small molecules in the drug discovery phase."

https://www.sciencedirect.com/science/article/pii/S2590098621000282

Some problems "we" are facing
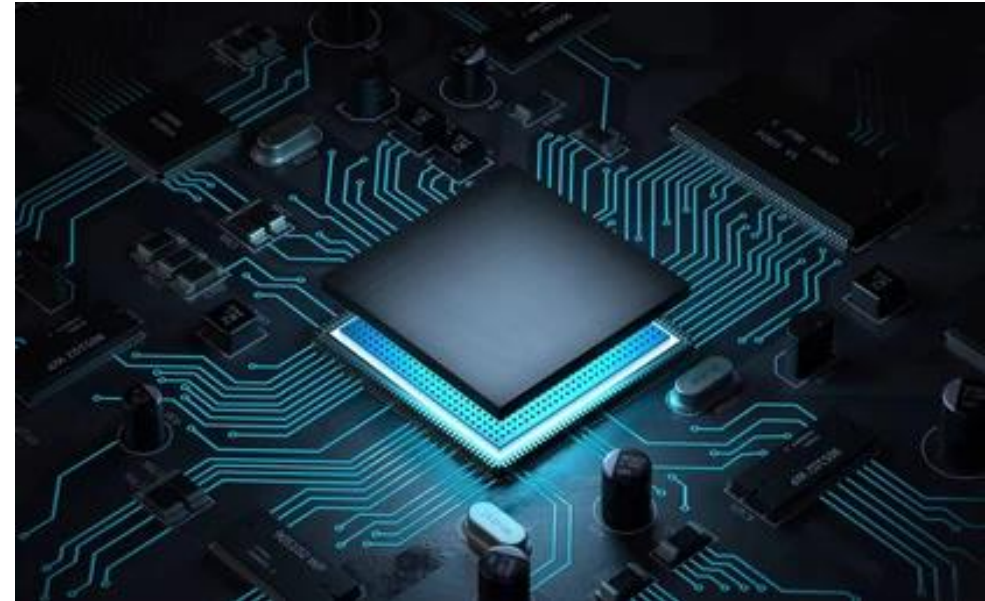
GLOBAL FOOD PRODUCTION

We will need to grow more food in the next 40 years than we did in the past 8000 years (source WWF)

"the synthetic N fertiliser supply chain was responsible for estimated emissions of 1.13 $GtCO_2e$ in 2018"

https://www.nature.com/articles/s41598-022-18773-w

Some problems "we" are facing

Since Apollo 11, processing power increased 1 trillion times
(1,000,000,000x)

NEED FOR MORE COMPUTING
POWER

"latest findings suggest global computing is more likely responsible for between 2.1% and 3.9% of greenhouse gas emissions."

Our infrastructure is collapsing

Data center electricity demands could curtail London housing development

Paul Sawers @psawers / 2:00 PM GMT+2 • July 28, 2022   💬 Comment

Image Credits: KTSDESIGN/SCIENCE PHOTO LIBRARY / Getty Images

Irish government could restrict data center building

New Climate Action Plan says the data center policy will be "reviewed"

November 05, 2021   By: Peter Judge   💬 Comment

The Irish Government is considering placing restrictions on data center building, in order to meet targets for emissions and renewable energy.

In a new Climate Action Plan, the government, says it will "review" its current positive policy on data center building, because the rapid growth of facilities is a "challenge" to the legally-binding targets the Government has set itself.

Who's using all the renewables?

Data centers' energy use is forecast to grow by 9TWh by 2030, and forecasts for their energy use range from 23 percent to 31 percent of Irelands grid supply by 2030, according to the state-owned utility Eirgrid. This comes at a time when the government wants to reduce emissions by 60 to 80 percent, by increasing the proportion of renewables. At the same time, the Government wants to decarbonize heating and transport by moving them to electricity, increasing the demand on the grid further.

– Government of Ireland

There is no way we are going to make it using conventional computers
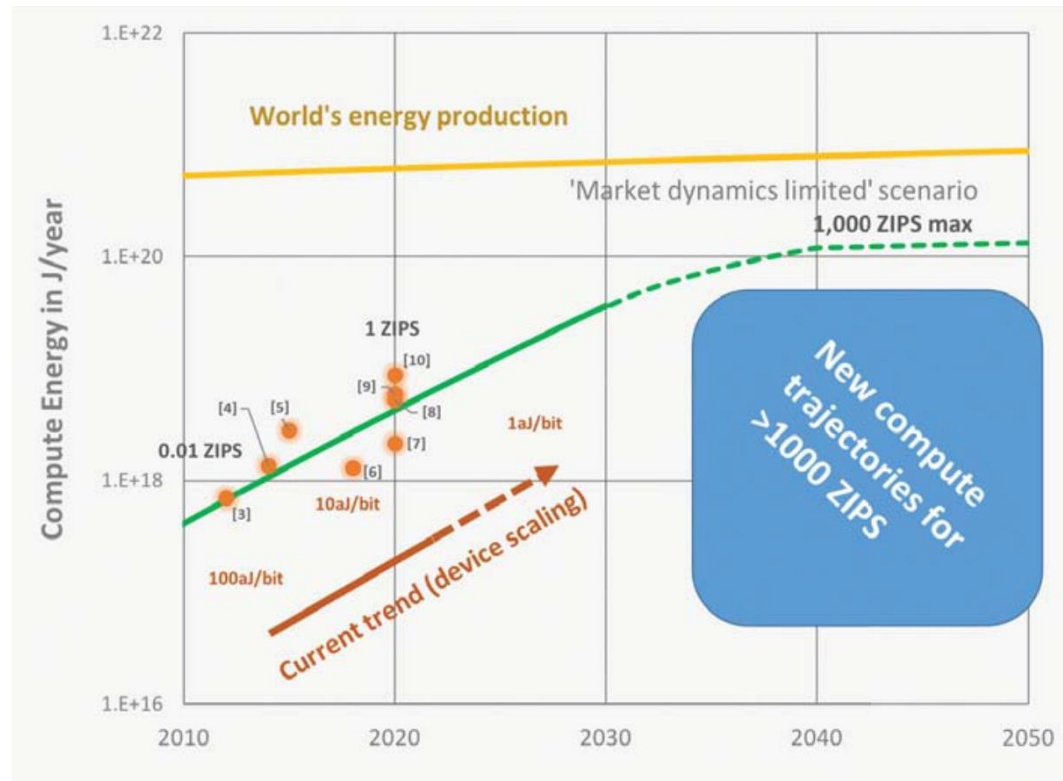
IQM is part of the quantum energy initiative to explore the energy effectiveness of quantum computing.

There are signs for a so called "Quantum Energy Advantage"

But who is providing the hardware for all the compute needs?

The EuroHPC JU has selected six sites across the European Union to host and operate the first EuroHPC quantum computers in:

- Czechia
- France
- Germany
- Italy
- Poland
- Spain

Quantum computing stack

Applications

| Drug development | Financial modelling | Battery design | Traffic optimization | Machine learning |

...

SW-App Interface

| Chemistry library | AI/ML library | Optimization library | other libraries |

| Quantum algorithms | | Classical algorithms |

Quantum HW-SW Interface

Hardware-agnostic

QPU-specific technology

HW system
- Computation Execution
- Transpilation & routing
- Control & calibration SW
- Control instruments

QPU
- QPU

Integration of classical & quantum computing

- HW abstraction
- Classical computing HW

Timeline of availability

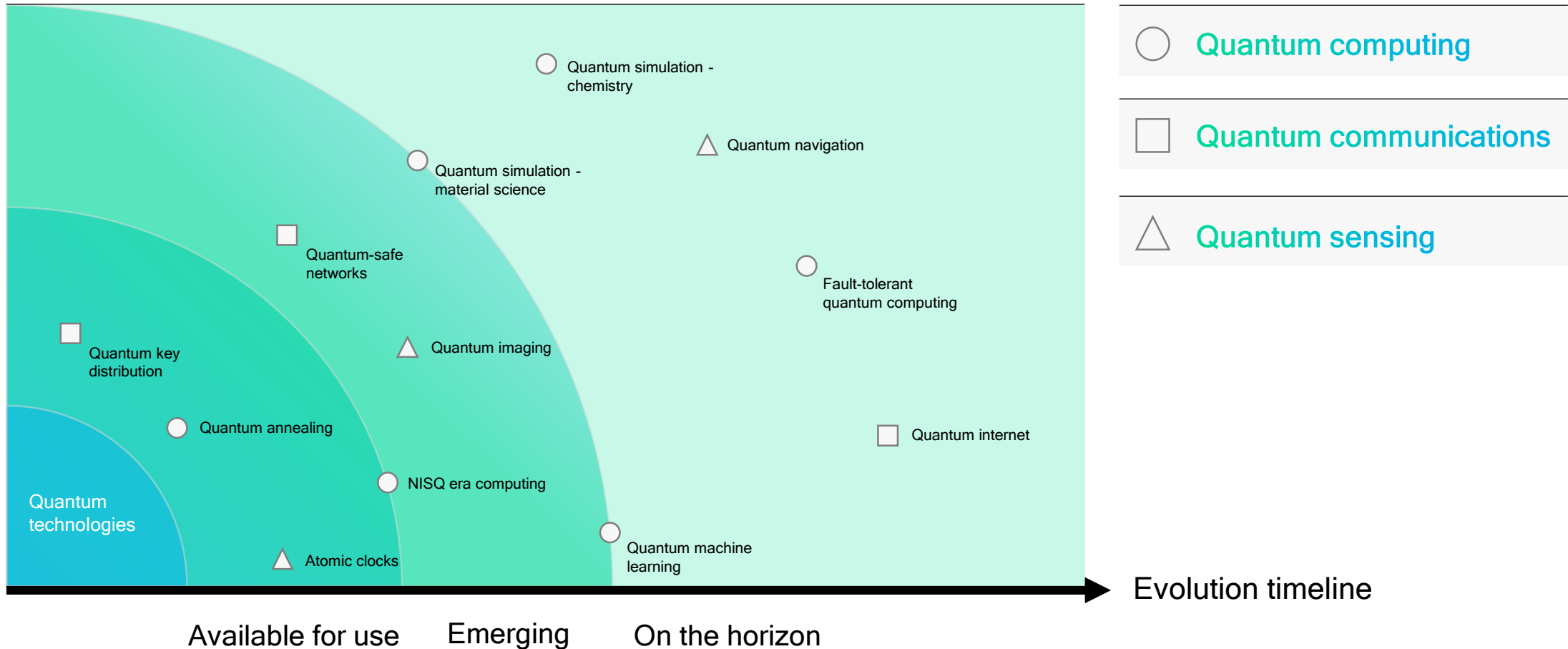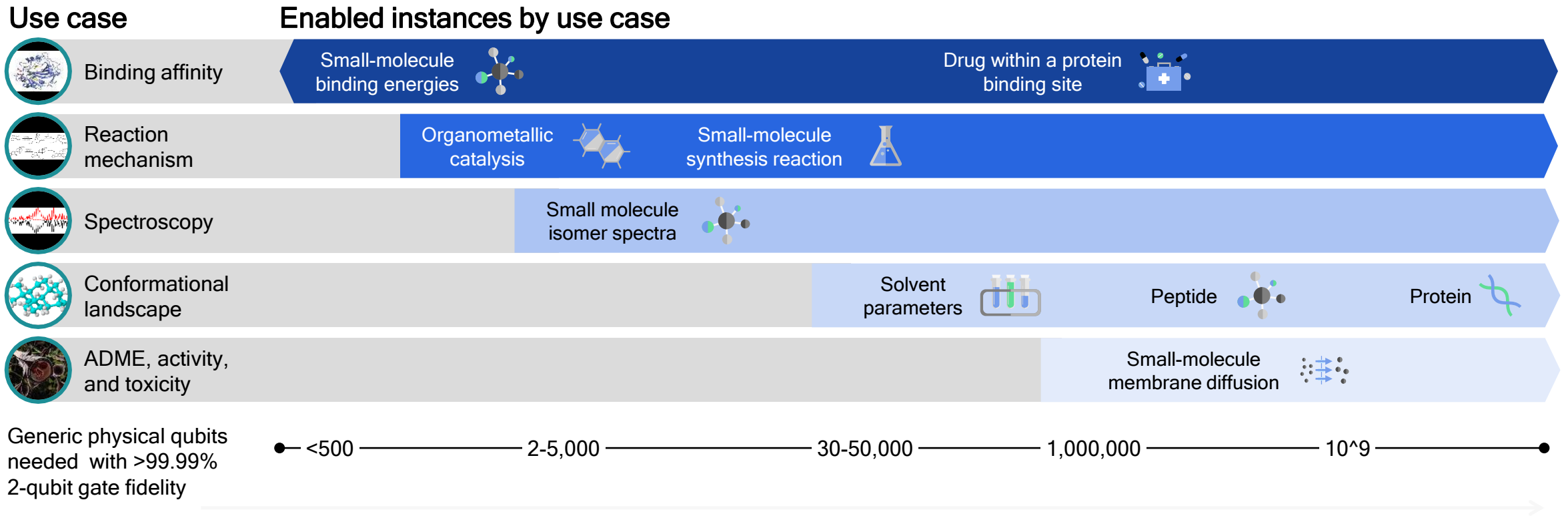Source: Capgemini, 2022

Example:
Life Science use cases unlocked early by IQM's unique co-design approach

Use case   **Enabled instances by use case**

Use case	Enabled instances by use case			
Binding affinity	Small-molecule binding energies			Drug within a protein binding site
Reaction mechanism		Organometallic catalysis	Small-molecule synthesis reaction	
Spectroscopy		Small molecule isomer spectra		
Conformational landscape			Solvent parameters	Peptide / Protein
ADME, activity, and toxicity				Small-molecule membrane diffusion

Generic physical qubits needed with >99.99% 2-qubit gate fidelity

<500 —— 2-5,000 —— 30-50,000 —— 1,000,000 —— 10^9
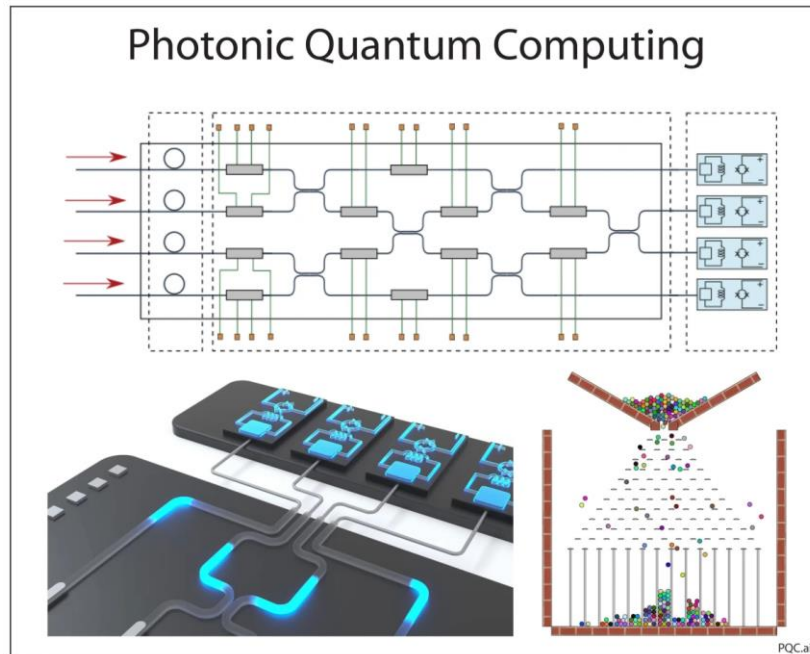
IQM

Technology maturity

Source: Arthur D. Little, Olivier Ezratty

The role of photonics in quantum computing

Many of the most promising HW platforms use photonics

Integral part of the supply chain

Photonic Quantum Computing

https://galileo-unbound.blog/2021/12/20/twenty-years-at-light-speed-the-future-of-photonic-quantum-computing/

.: Quantum Technology: The Next Little Thing in Photonics

Quantum research has prompted high expectations and more than a dozen Nobel Prizes. Photonics is a key to the market's future success, and it is particularly attractive when it comes to the miniaturization and integration of components.

ANDREAS THOSS, CONTRIBUTING EDITOR

Thank you!

IQM
WWW.MEETIQM.COM