

The Electronics business of Merck operates as EMD Electronics in the U.S. and in Canada.

Sustainable Innovation Needs Collaboration

Future disruptions as an accelerator of collaboration & innovation

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MERCK

Today's disruptions are manifold



Europe sets benchmark for rest of the world with landmark AI laws

The Economist

The end of Moore's law will not slow the pace of change



OpenAI CEO Altman says at Davos future AI depends on energy breakthrough

The Chemical Engineer

EU introduces new chemicals strategy



U.S. rolls out new chip-related export controls as China makes industry advances

FINANCIAL TIMES

Inside the miracle of modern chip manufacturing

Forbes

The Geopolitics Of AI Chips Will Define The Future Of AI

FORTUNE

The green revolution runs on chips—but there is no good way to make the fragile semiconductors ecosystem sustainable in the short term

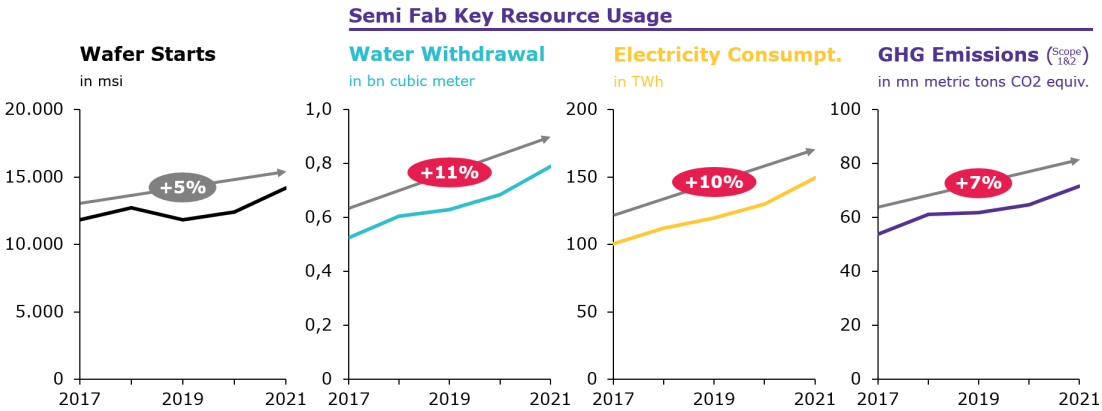
Bloomberg

Ban on PFAS Use and Production Proposed in European Union (1)

The Guardian

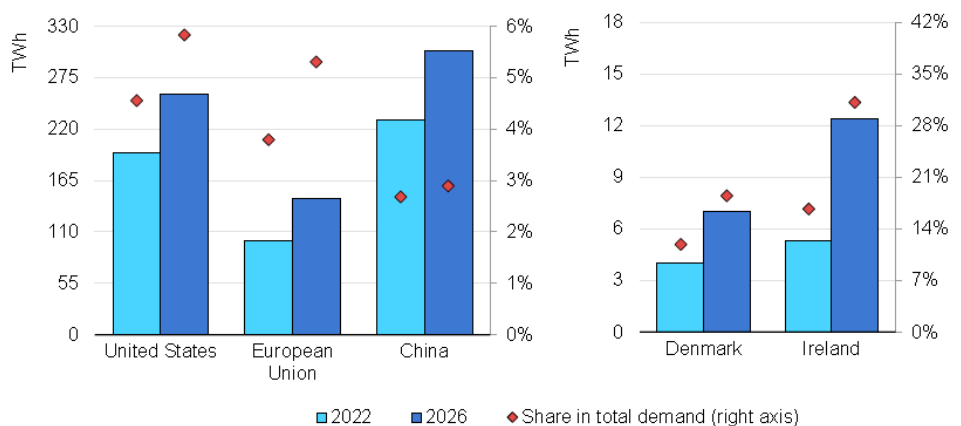
We're approaching the limits of computer power - we need new programmers now

A closer look at disruptions impacting sustainability



Source: Environmental data and facts in the semiconductor manufacturing industry, Elsevier - Water Cycle, 4 (2023) 47–54; based on data published by the 28 main semi manufacturing corporations

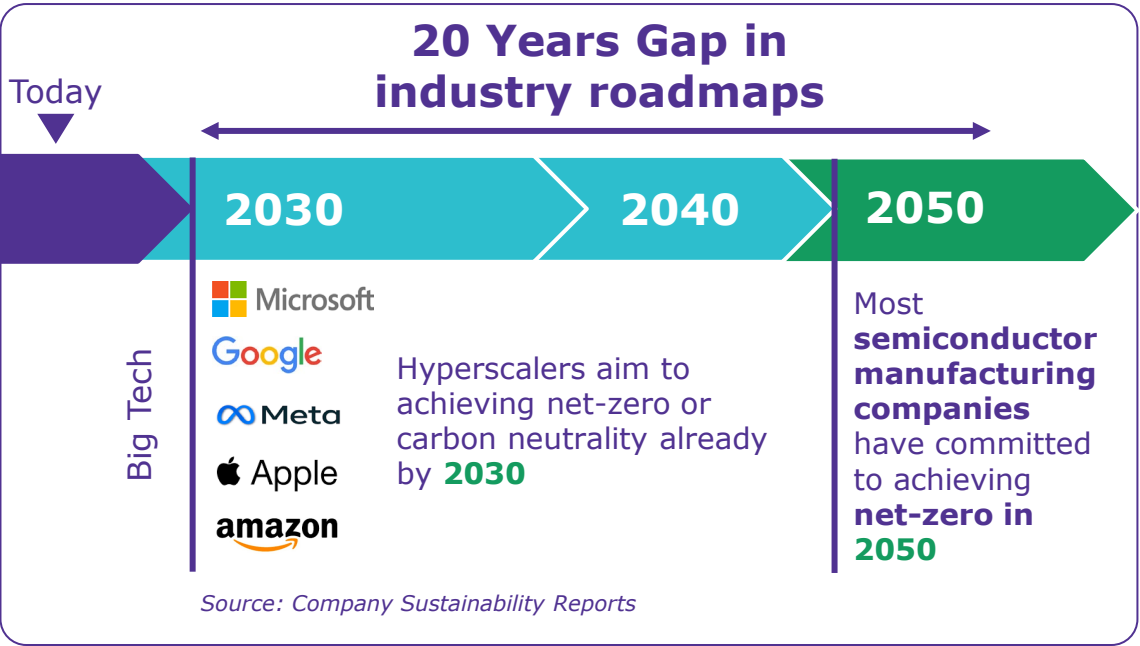
Estimated data centre electricity consumption and its share in total electricity demand in 2022 and 2026



Source: International Energy Agency (IEA): Electricity 2024 - Analysis and forecast to 2026



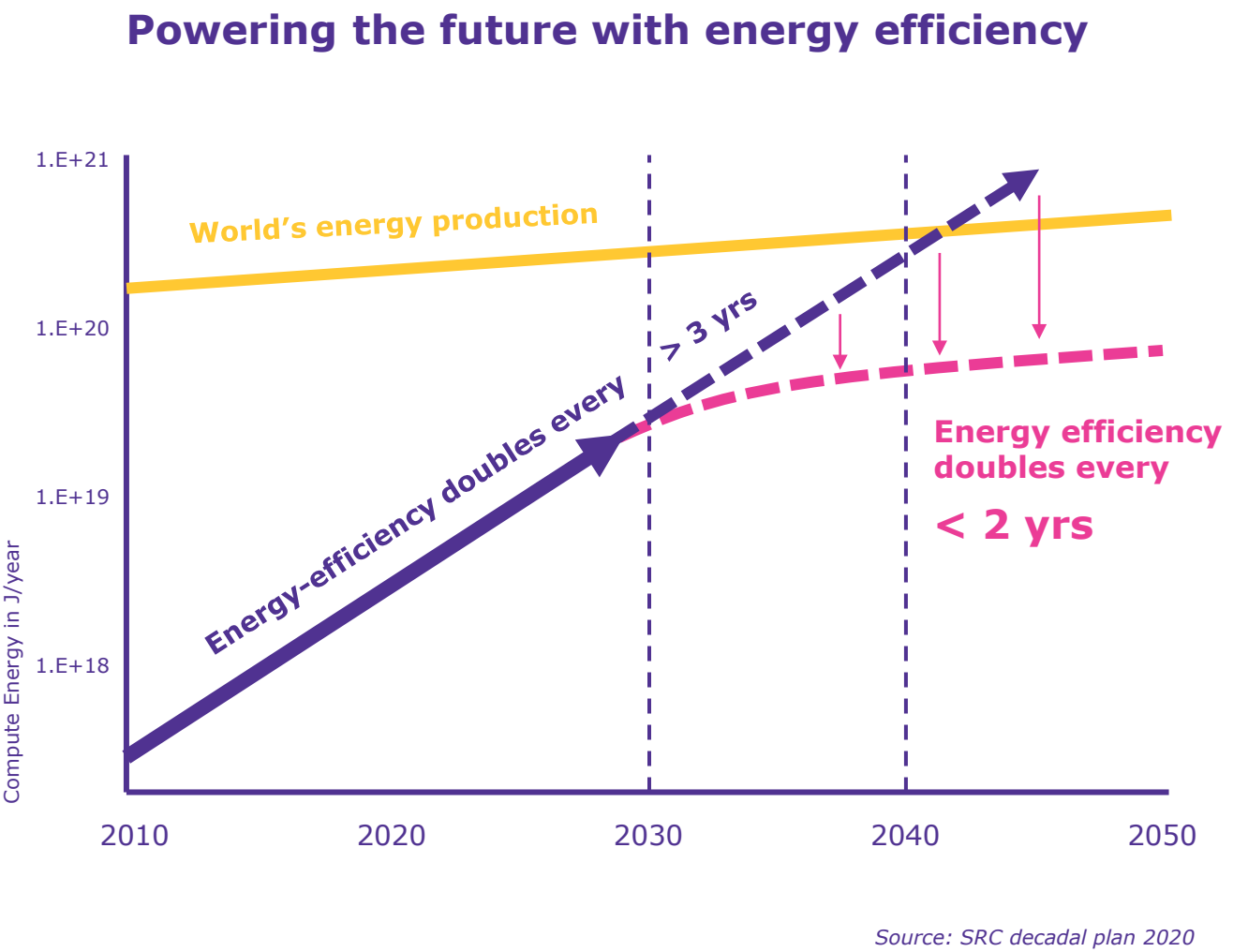
2030 expected to mark a crossroad for sustainable solutions





SUSTAINABLE DEVELOPMENT GOALS

**Transforming our world:
the 2030 Agenda for
Sustainable Development**

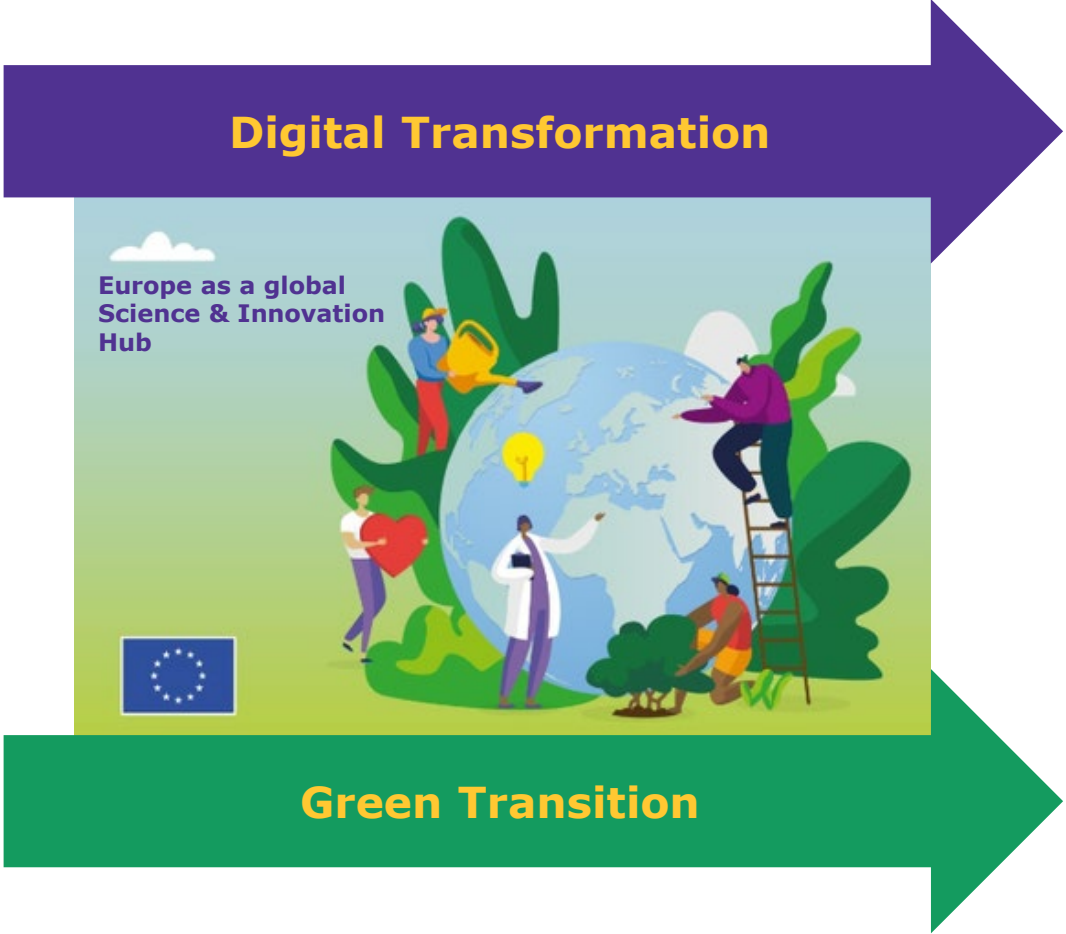


Leveraging Europe's strength for a more sustainable industry

Europe is a **GREEN POWERHOUSE** striving to be the first climate-neutral continent



With great potential to **LEAD THE TWIN TRANSITION**



Advancing Sustainable Digital Living



Collaboration

Partnering with the value chain and the broader ecosystem to collectively introduce **more sustainable solutions**.

Leveraging data, AI, and digital tools to create transparency around **challenges and opportunities**.

Our Focus Area

PROCESS GASES



Innovation

Sustainability as a core aspect of **technology roadmaps**.

Enabling progress in more sustainable materials by accelerating the development of new solutions with data and digital tools.

Our Focus Area

**ENERGY EFFICIENT
CHIPS AND DEVICES**



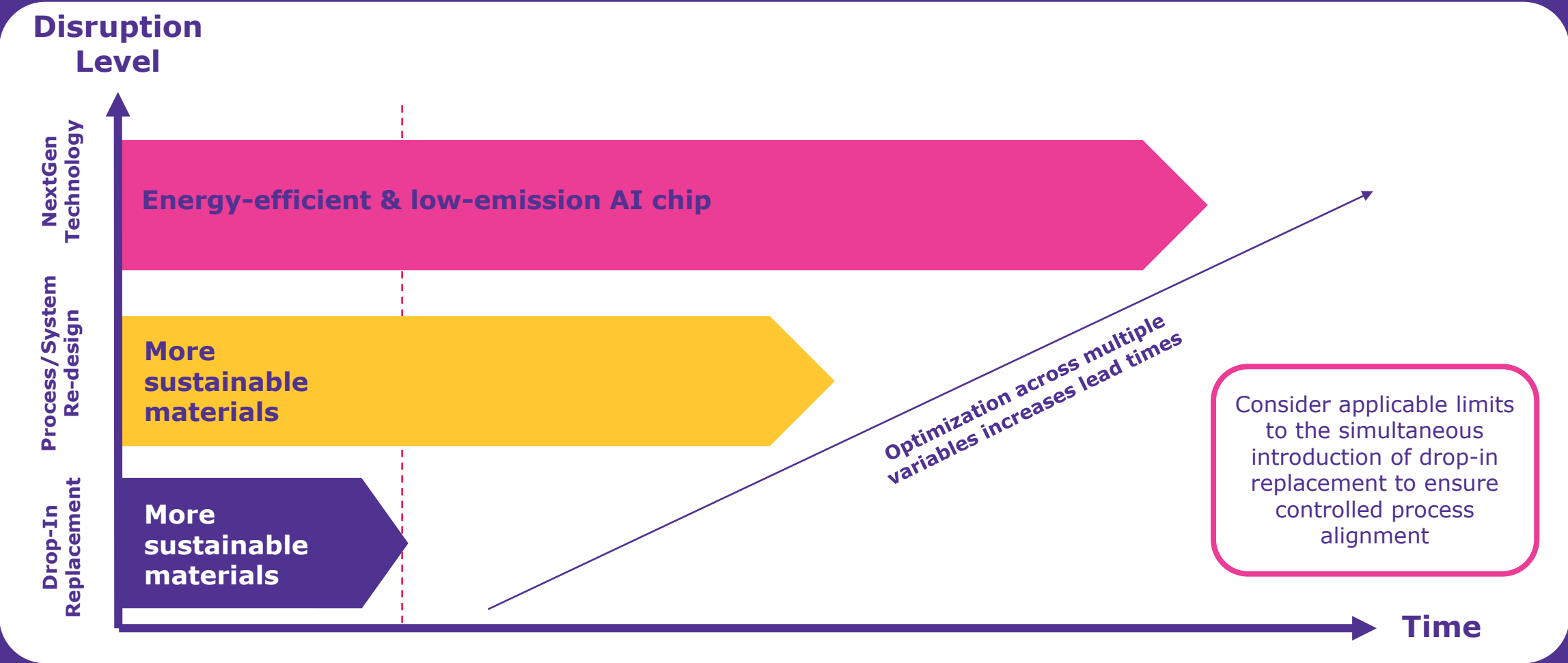
Operation

Reducing **environmental impact** and **footprint** in the value chain.

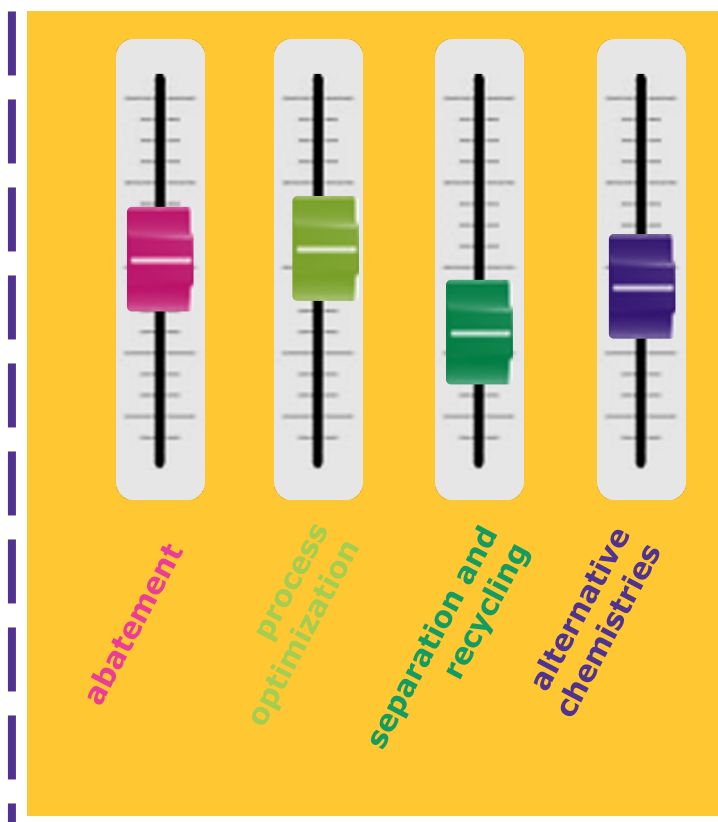
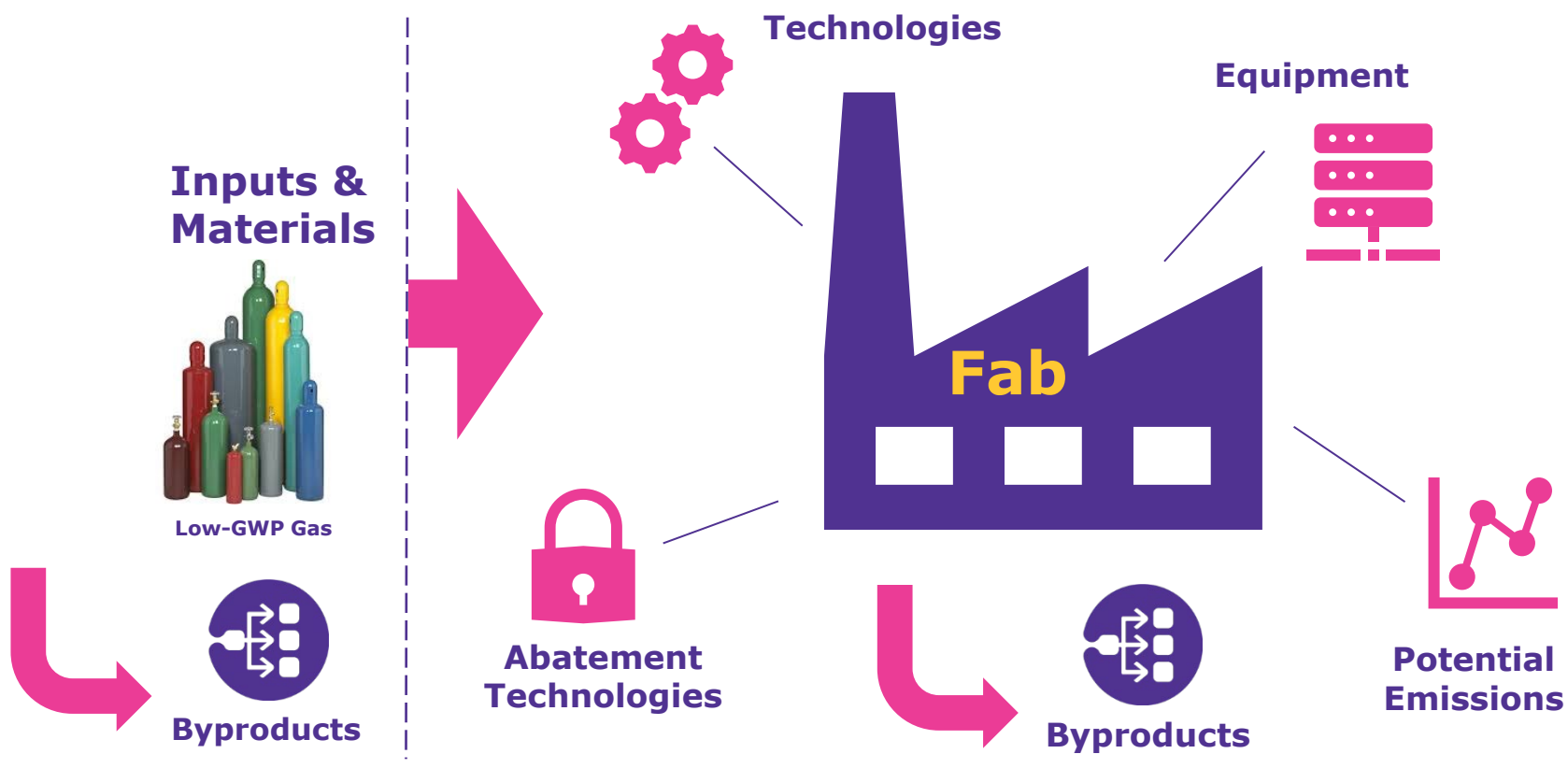
Our Focus Area

**GHG EMISSIONS,
WATER, ENERGY
& WASTE**

Sustainable solutions often don't come as drop-in replacements



Deep dive: Low-GWP etching gases



Multiple variables can cause a variety of effects

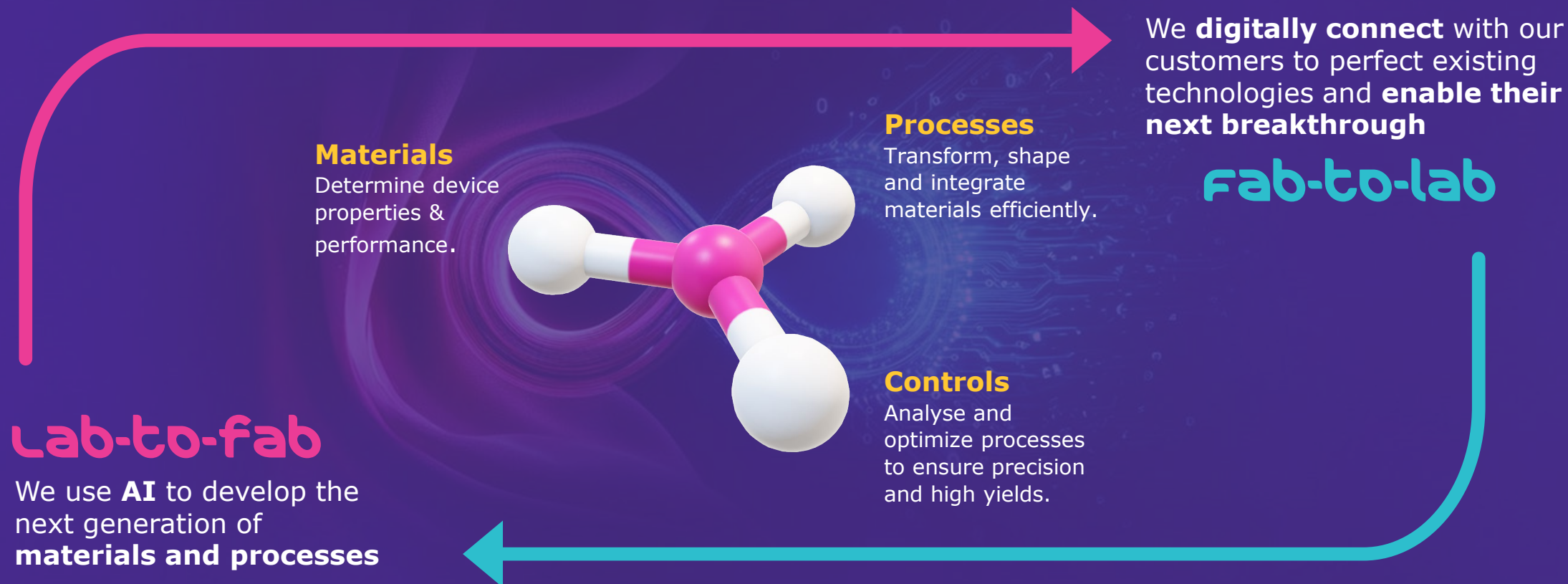
Variety absorbs variety

Ashby's Law of Requisite Variety

In order to deal properly with the diversity of problems, you need to have a repertoire of responses as nuanced as the problems you face.

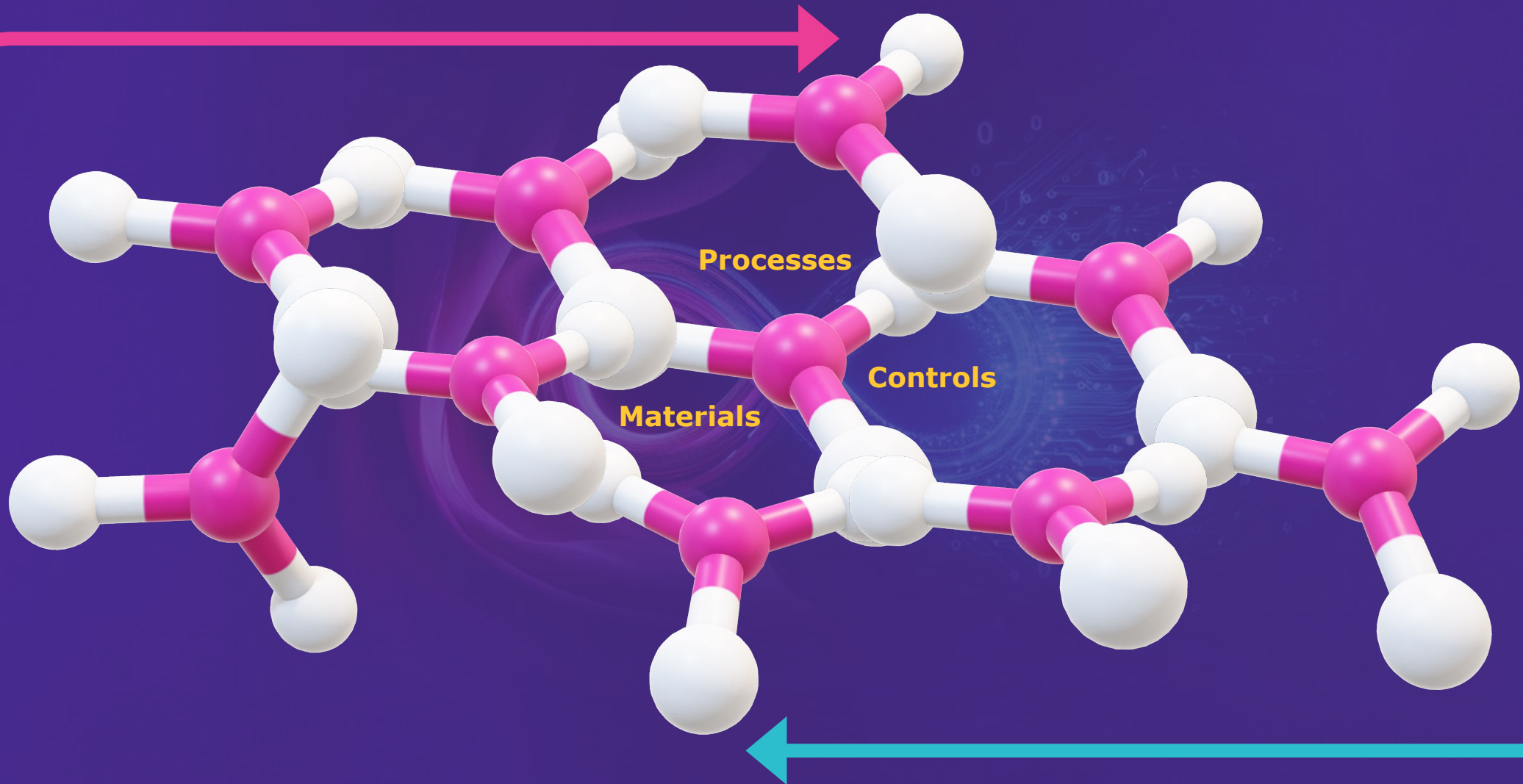
Based on W. Ross Ashby (1956)

Converging AI and material science enable insights to better understand interdependencies and develop targeted solutions

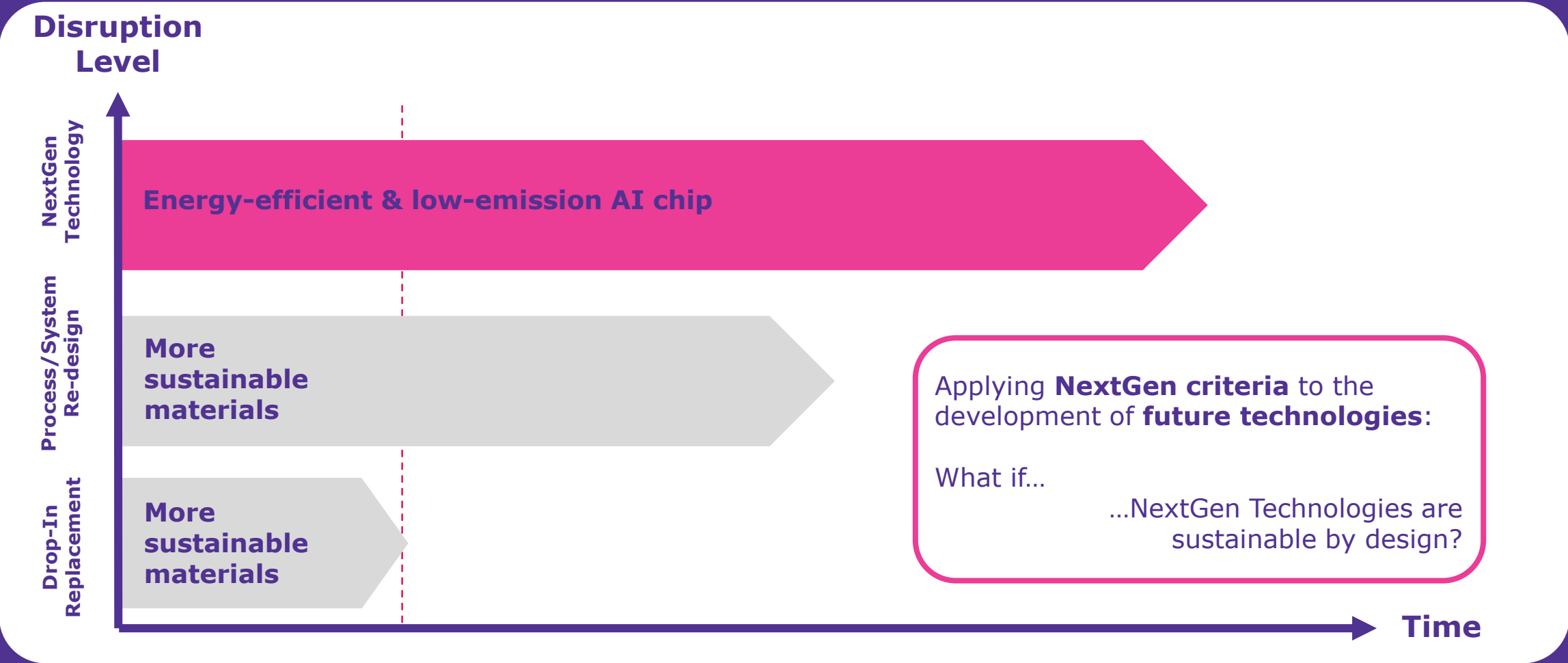


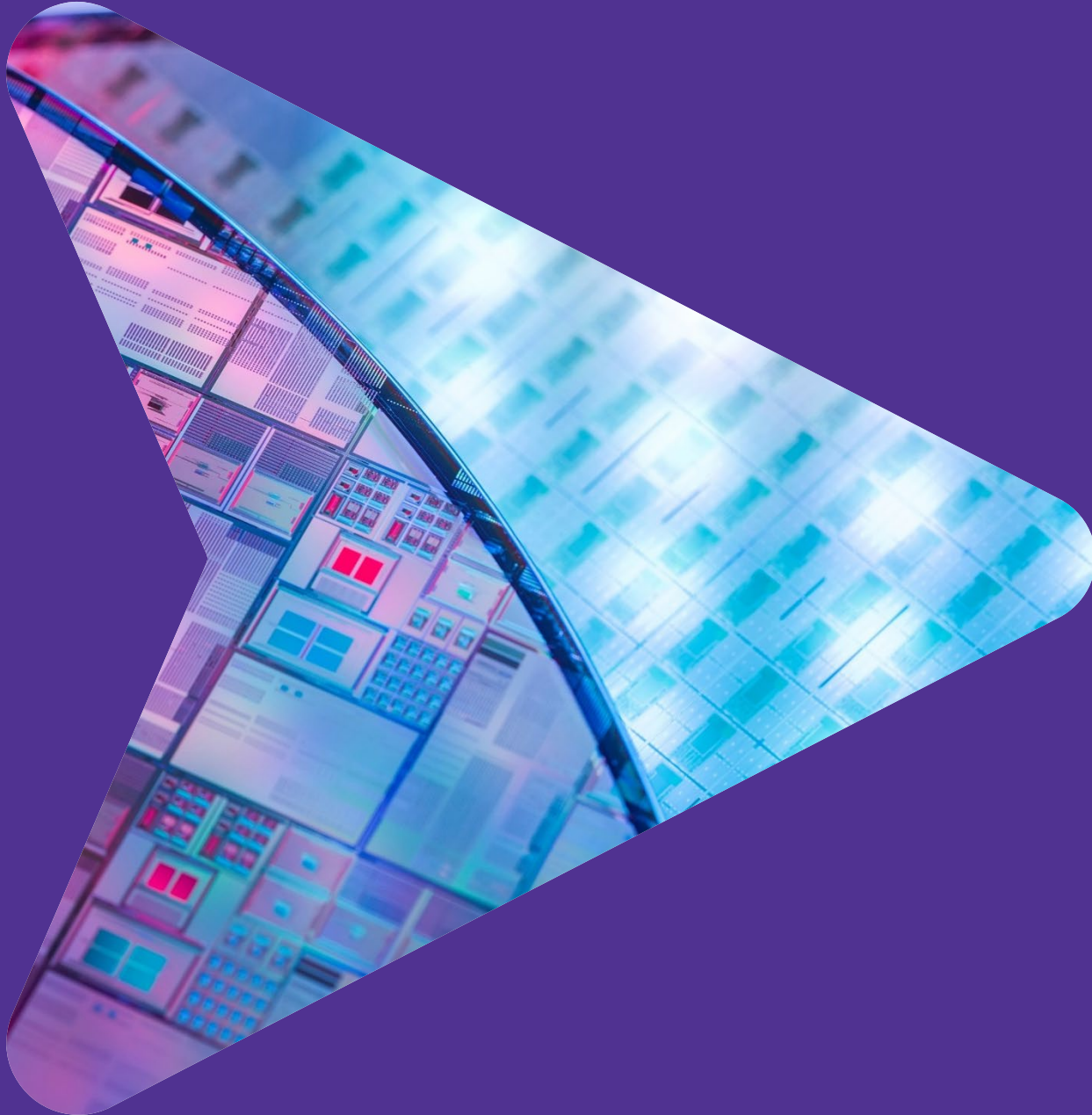
Faster, better, more adaptive

Leveraging AI and digital solutions as an ecosystem will enable effective sustainable technology disruptions



NextGen Technologies as sustainable technologies by design?





Key take-aways

- 1 AI and data sharing**
enhance breakthroughs in sustainable solutions
- 2 An ecosystem approach**
accelerates identification and implementation of solutions
- 3 NextGen Technologies**
can be sustainable technology disruptions by design

THANK YOU

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