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Smart sensors: paving the way for a sustainable future

Lisa Trollo

Artificial Intelligence Strategy

STMicroelectronics

Laptop
Windmill
Car

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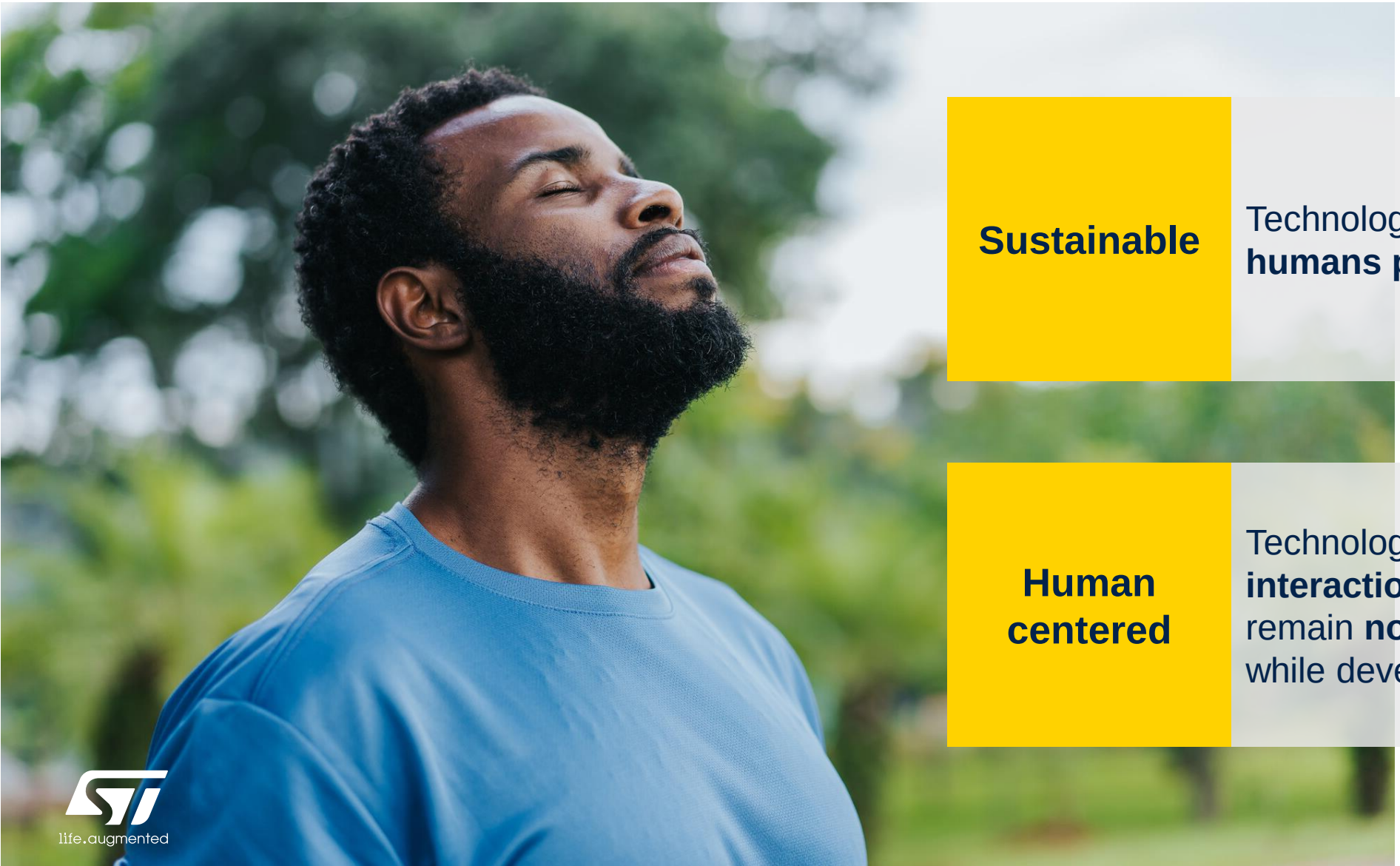
What do we expect from technology today?



Sustainable

Technologies that **protect** and **help humans protect** the planet

Human centered

Technologies that improve the **interaction** with the world around us, remain **non-invasive** and **secure** while developing our **creativity**

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Sensors at the heart of our interactions with the digital world

Human centered

Sensors are the key components to **bridge** the **physical** and the **digital worlds**

Sustainable

Sensors becoming **smart** answer **human expectations** while ensuring a **sustainable future**

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MEMS sensors attributes for a sustainable future

Smart

Sensors able to **process data**

Open

Sensors configured to **your needs**

Accurate

Sensors providing a **correct set of data**

Meaningful data provided in an optimal way

Human centered	Sustainable

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Smart

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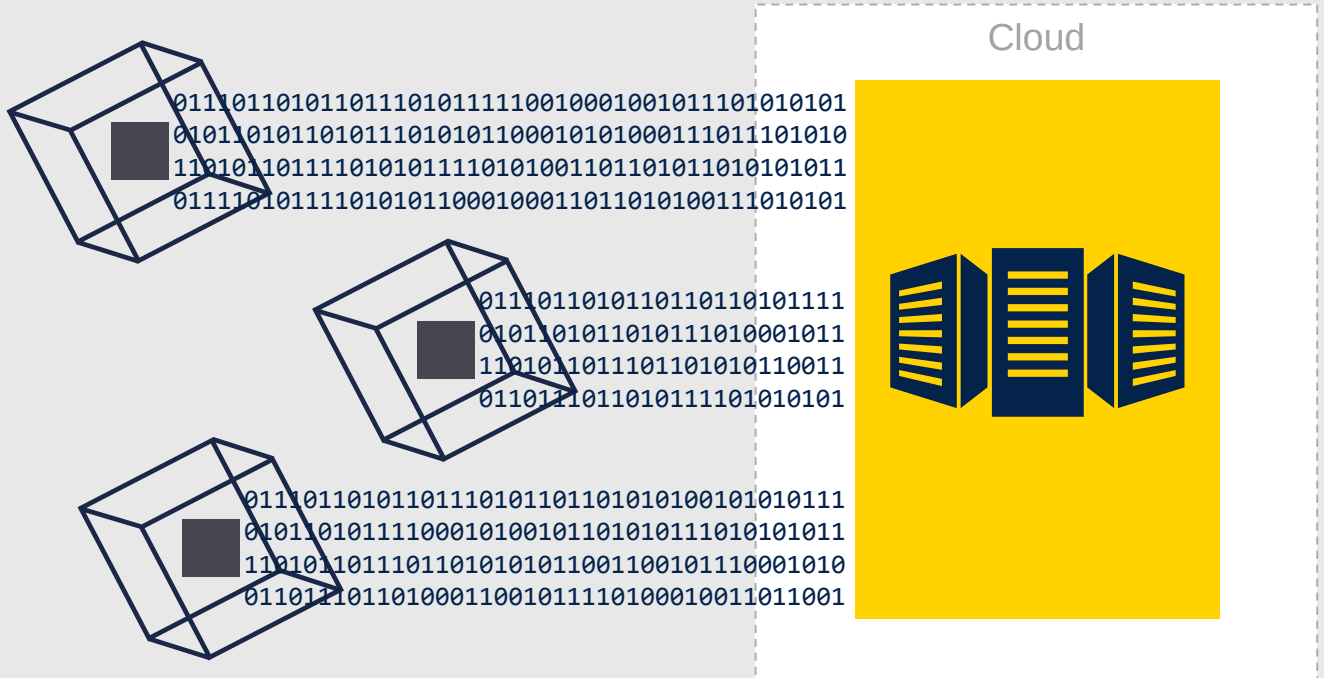
More data = more power



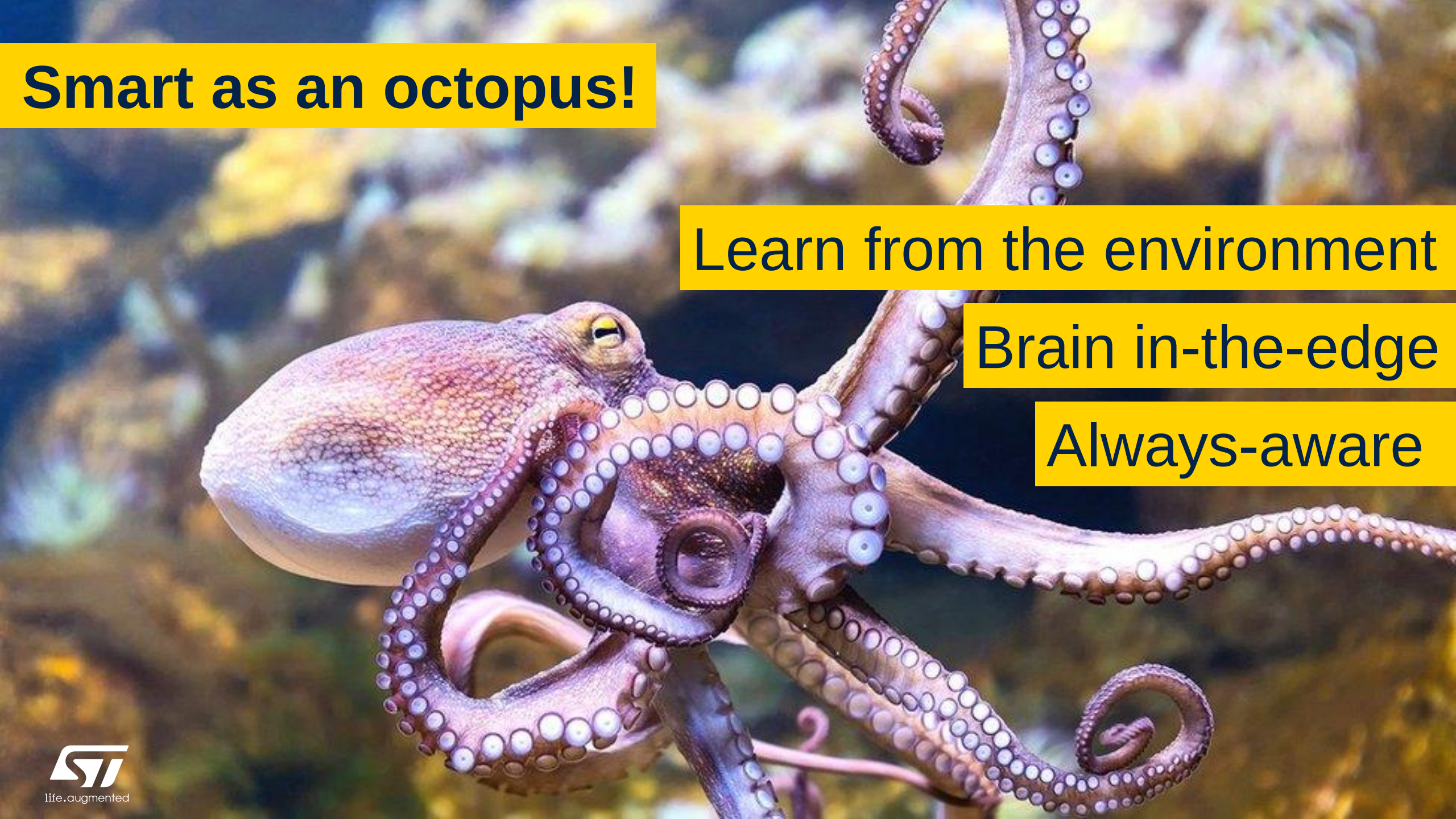
IoT nodes with MCUs and standard sensors

Sensors and MCUs embedded in more and more IoT nodes

The amount of data to process is increasing exponentially

With a centralized processing approach, the required cloud infrastructure is huge

Associated power consumption is not sustainable


Smart as an octopus!
Learn from the environment
Brain in-the-edge
Always-aware
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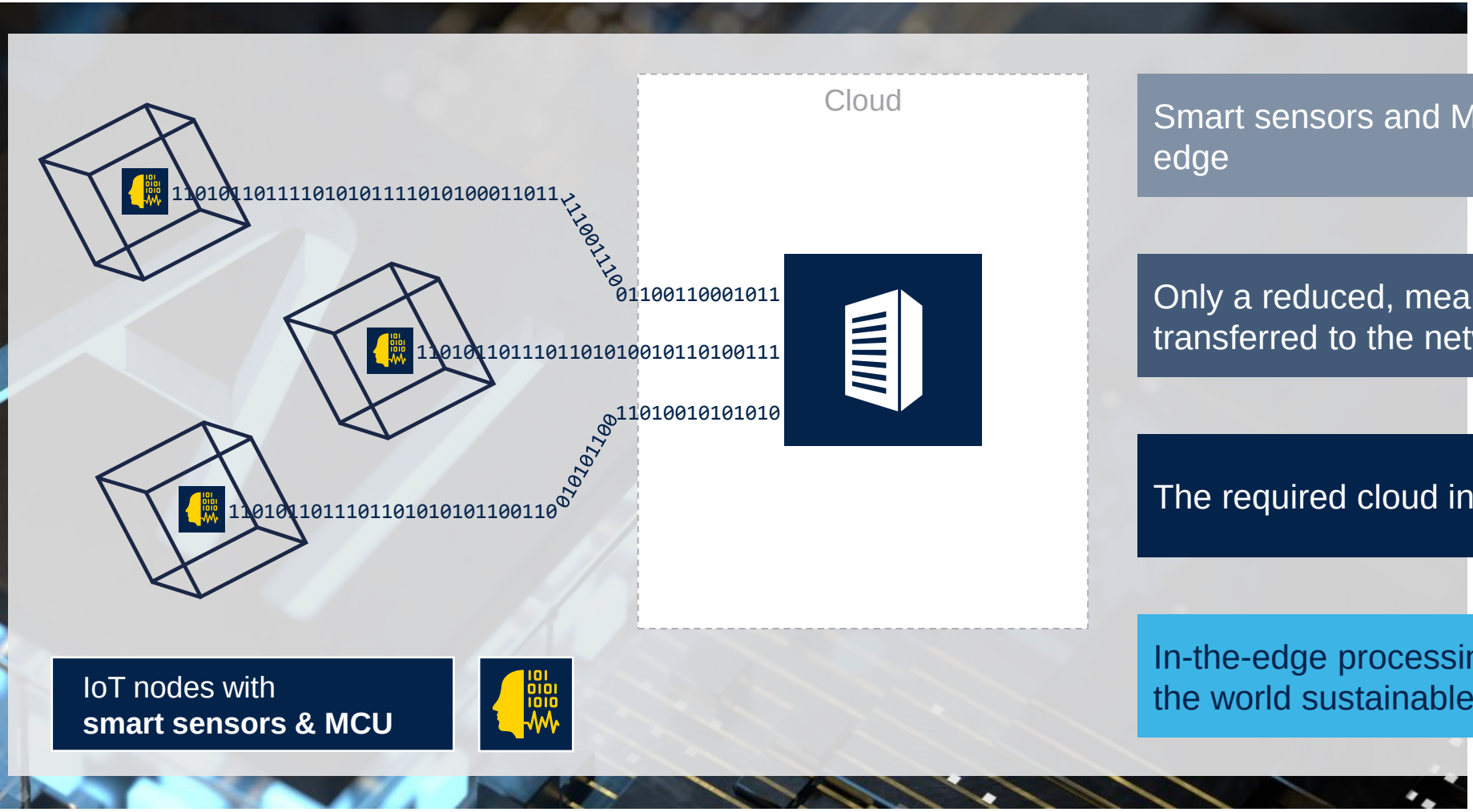
Adding intelligence to make sensorization sustainable



Smart sensors and MCUs process the data in the edge

Only a reduced, meaningful set of data is transferred to the network

The required cloud infrastructure is limited

In-the-edge processing makes the sensorization of the world sustainable

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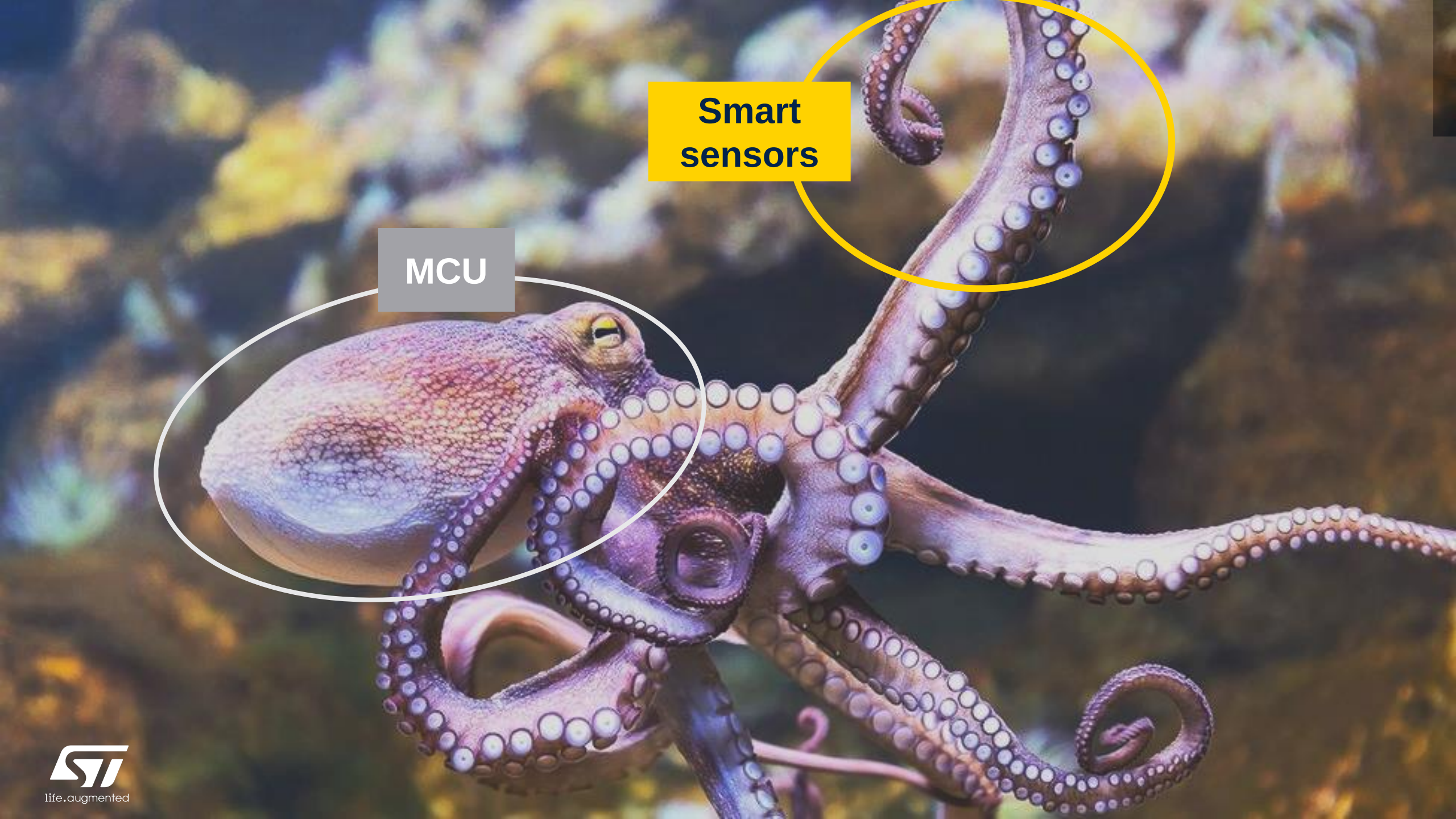

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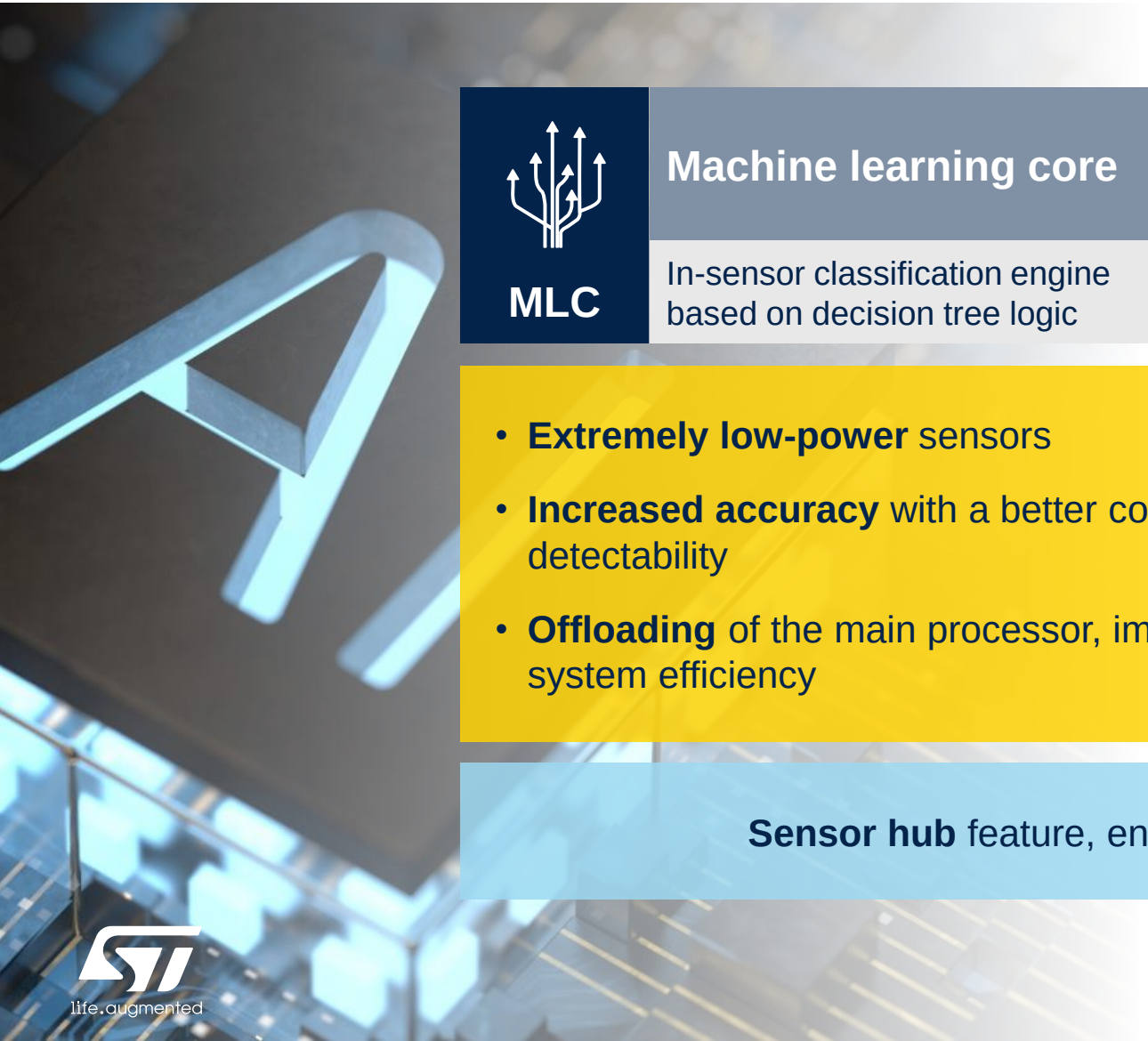
Smart sensors for sustainable future



MLC

Machine learning core

In-sensor classification engine
based on decision tree logic

- **Extremely low-power** sensors
- **Increased accuracy** with a better context detectability
- **Offloading** of the main processor, improving system efficiency

ISPU

Intelligent sensor processing unit

Highly specialized DSP
for machine learning and processing

- **Ultralow power** consumption at **system level**, thanks to **optimized data transfer**
- High-processing capability with **AI-enabled programmable core**
- Comprehensive **ecosystem**

Sensor hub feature, enabling connection of external standard sensors

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Open

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Open the sensor ecosystem till (in) the edge

Sensor hub

Sensors **host** other sensors data making them **intelligent and processed** in the edge.

Sensor ecosystem

An **open ecosystem** to accelerate innovations with **partners** and **customers,** gaining a sustainable competitive advantage.

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ST MEMS sensor hub

Enabling connection of external standard sensors

Helps to **integrate data from other sensors** (up to 4) by connecting them directly to our sensors

Data from all sensors are **processed in ST MEMS sensor**

Allows keeping the **intelligent in-the-edge**, further improving energy efficiency

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ST MEMS sensor ecosystem

OPEN

Jointly create value for customers

- Leveraging **on partners**
- **Sharing** state-of-the-art, high-quality components
- Ability to host partners' IP in our solutions
- Shortening customer's **time-to-market**
- New strategic set-up**: flexibility and sustainability**

Accurate

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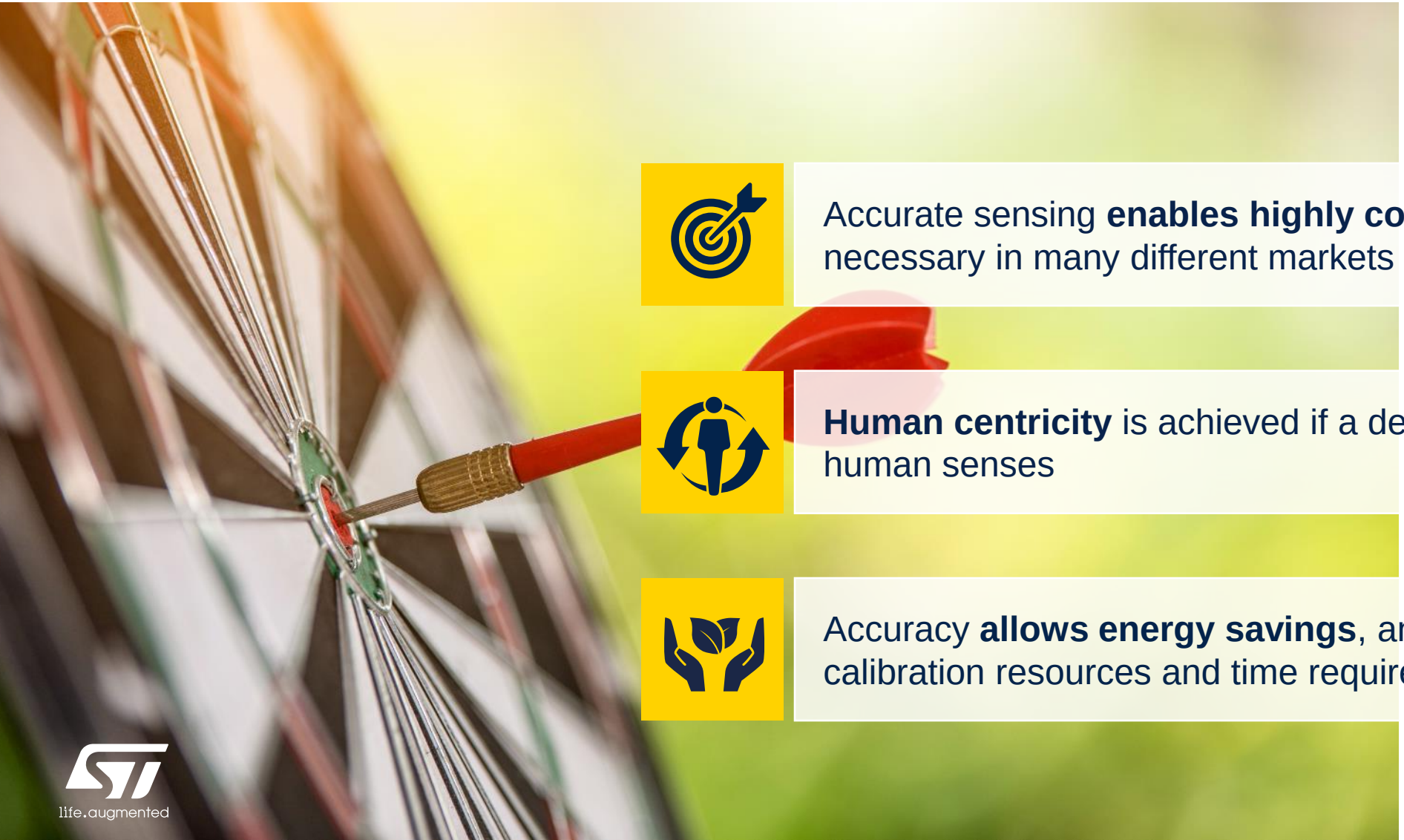
Accurate



Accurate sensing **enables highly complex algorithms**, necessary in many different markets

Human centricity is achieved if a device is capable of imitating human senses

Accuracy **allows energy savings**, and reduces the factory calibration resources and time required

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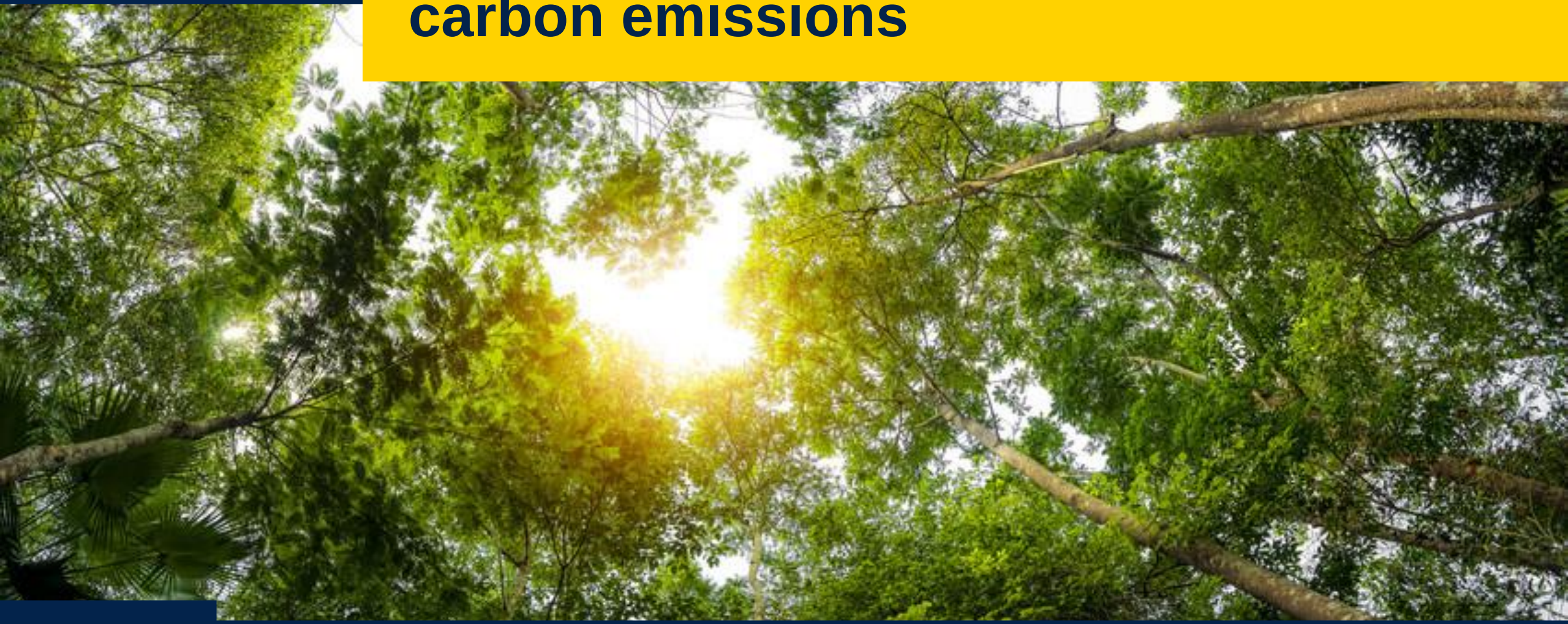
Smart sensors contributing to reducing carbon emissions



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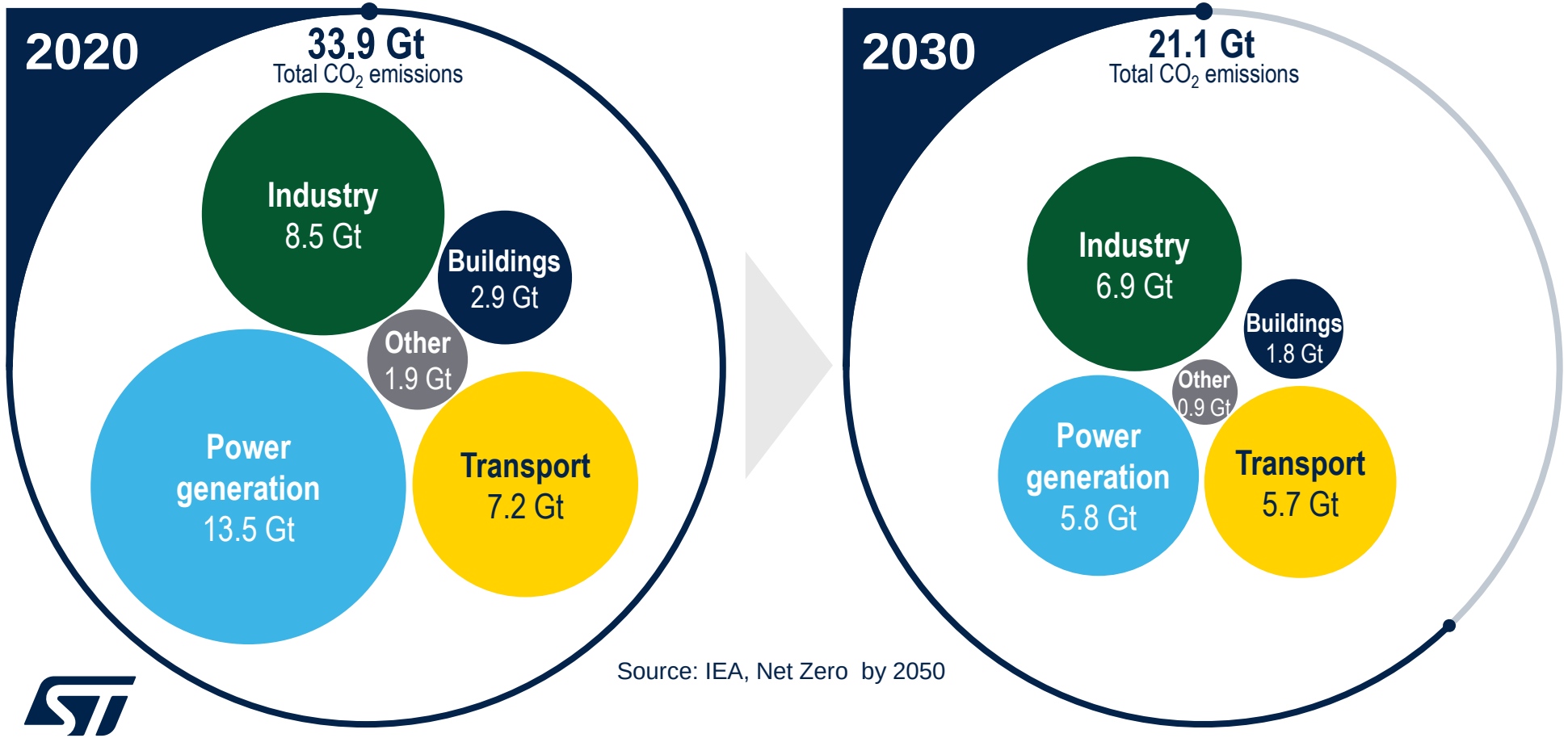
Main focus on CO_2 emissions

Carbon dioxide emissions reached ~34 Gtons in 2020.
Power sector represents 40% of the total.



Source: IEA, Net Zero by 2050

- Clean technology in industry
- 1,020 GW annual wind and solar additions
- Phase-out of unabated coal in advanced economies
- 150 Mt low-carbon hydrogen 850 GW electrolysers
- 60% of global car sales are electric
- All new buildings are zero-carbon ready
- Universal energy access

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The path to carbon neutrality

Energy generation

From fossil to renewable energy sources

Industry

Use of highly efficient equipment

Transportation

Migration to electric vehicle

Building

Low emission energy source and efficient systems

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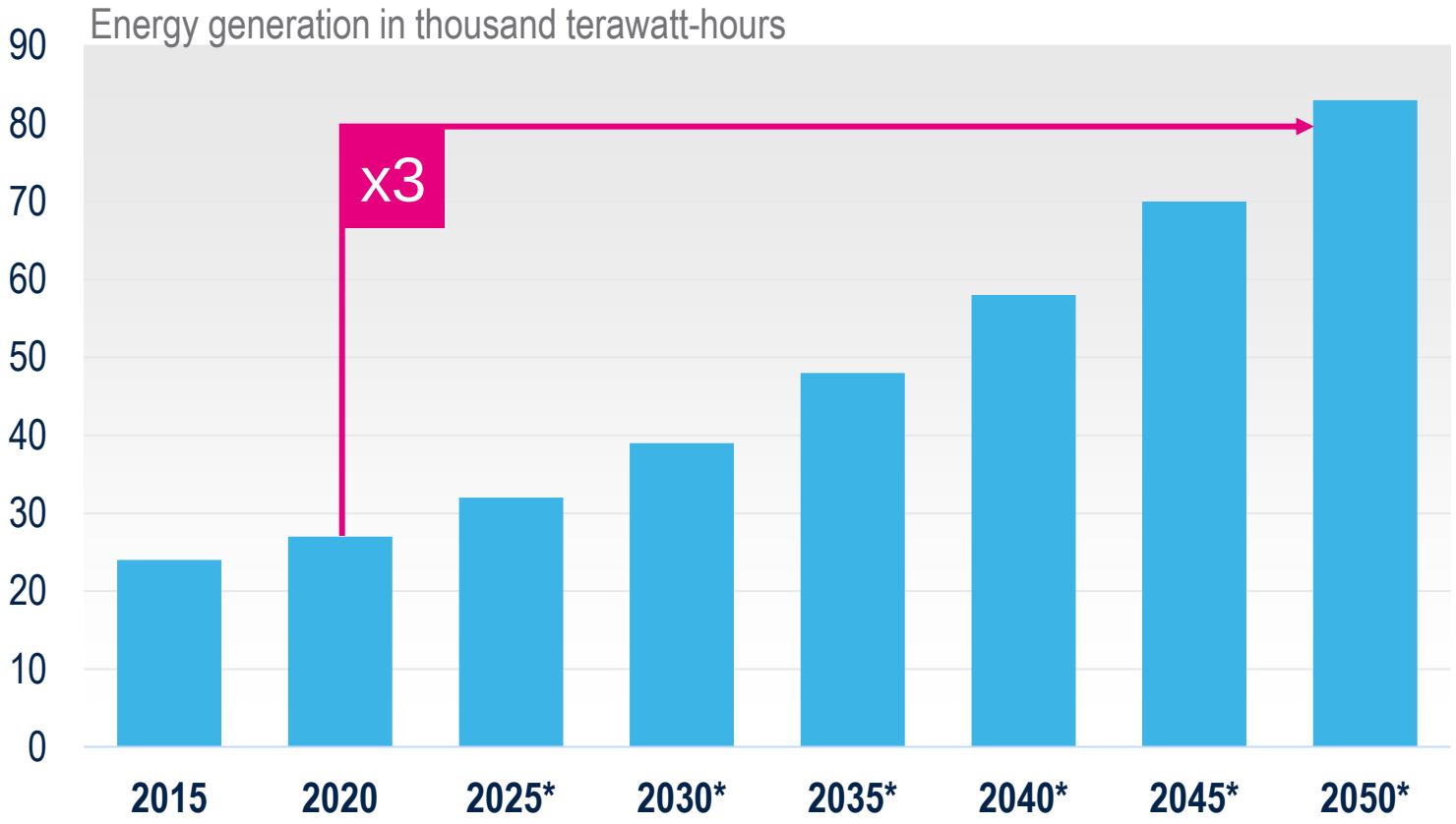
Electricity generation worldwide trend

Electricity generation worldwide is forecast to triple in the next three decades, reaching **83,000 terawatt-hours by 2050**



3x power generation largely **driven by decarbonization efforts** and **electrification** of the transportation and building sectors

Source: Statista, Worldwide; McKinsey & Company

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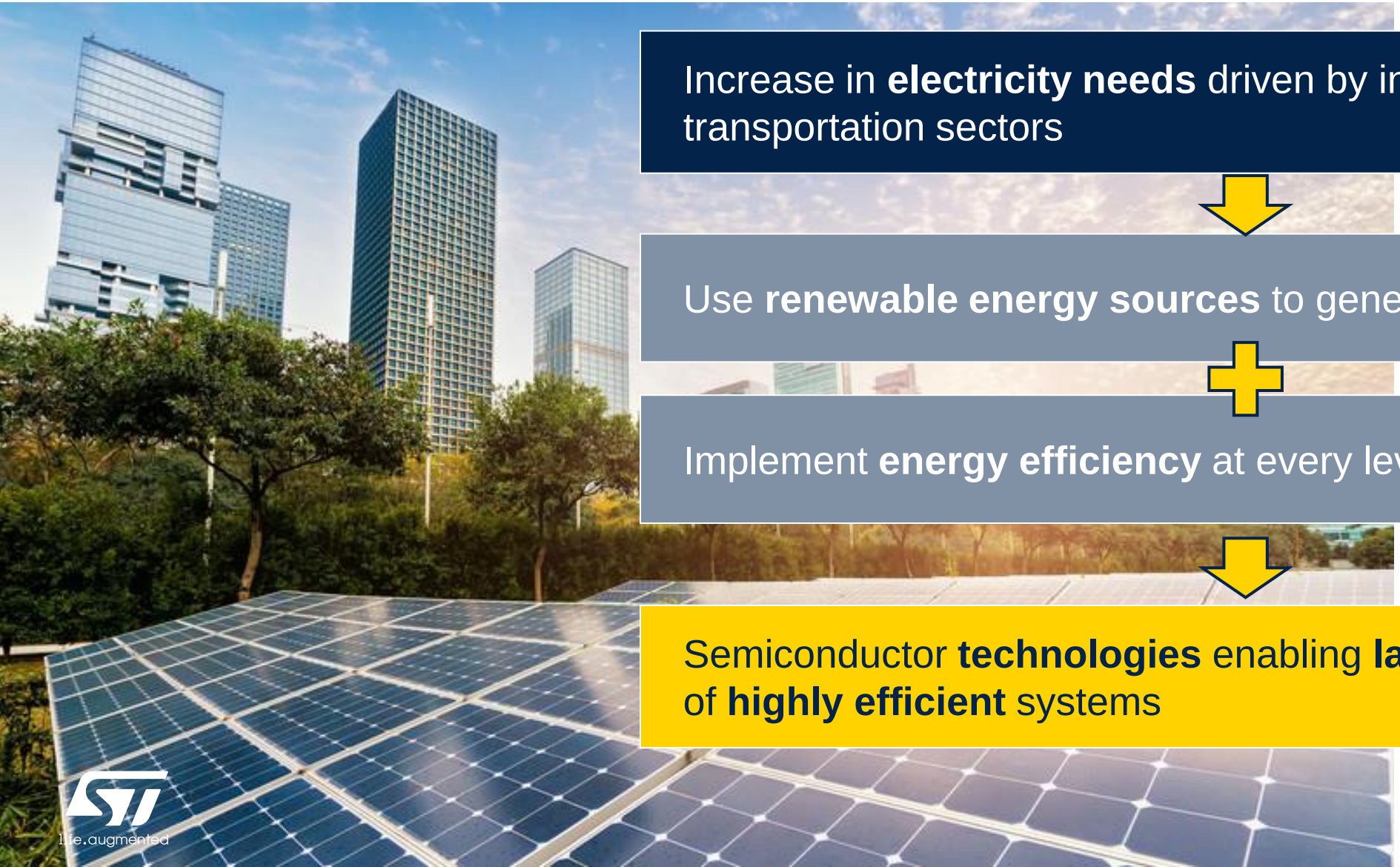
A complex equation



Increase in **electricity needs** driven by industry, buildings and transportation sectors

Use **renewable energy sources** to generate electricity

Implement **energy efficiency** at every level

Semiconductor **technologies** enabling **large-scale** deployment of **highly efficient** systems

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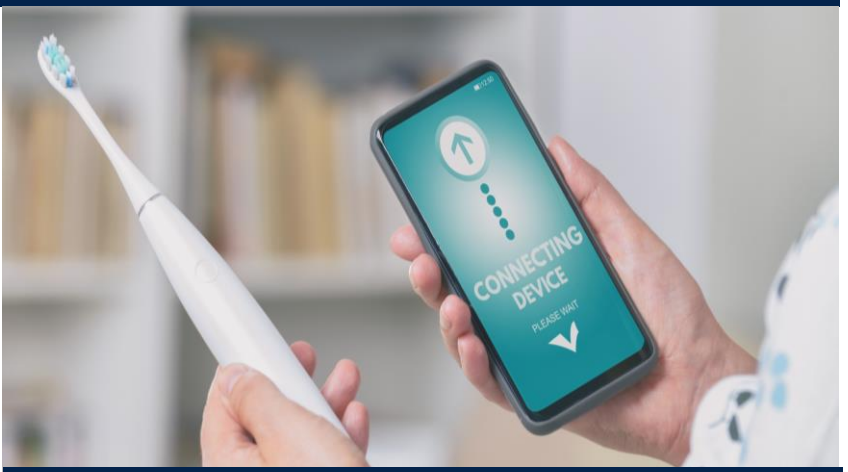
The right path is by no means obvious

Smart sensors contributing to energy savings

In-bag detection prevents battery drain for laptops

smart sensor monitoring your car in low power mode

Low-power monitoring of nacelle attitude or wind blade speed



Local processing of information from your electric toothbrush

Low-power sensor in your drill with anti kickback

Monitoring presence in buildings in low power mode

It takes a village to raise a child

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Our technology starts with You

Find out more at www.st.com/MEMS

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