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ST Technologies for SMART CITY

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Smart City, Home and Building Automation

We are creators and makers of technology

One of the world's largest semiconductor companies

Over **50,000** employees
of which **9,000+** in R&D

$16.1 billion revenues
in 2022

Over **80** sales & marketing
offices serving over **200,000**
customers across the globe

14 main manufacturing
sites

Signatory of the United Nations Global Compact (UNGC)
Member of the Responsible Business Alliance (RBA)

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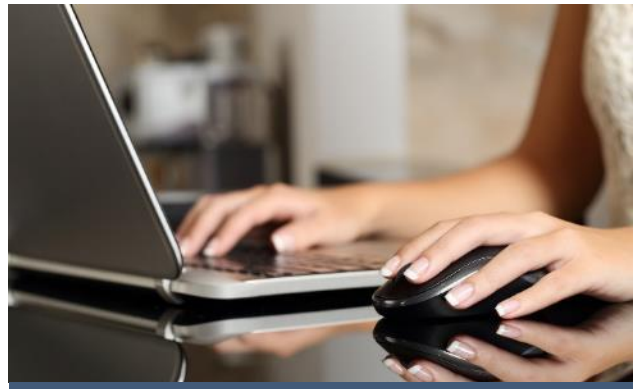
As of December 31, 2022

We address four end markets

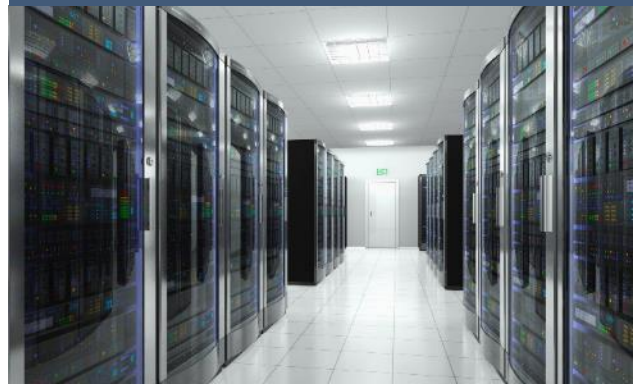
Automotive

Industrial

Personal electronics



Communications equipment, computers & peripherals



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Smart city trends

Power & Energy

Smarter and more efficient energy use

Digitalization

Sensoring and connecting the world around

More efficient

Higher efficiency at all points in power generation and distribution

More efficient power consumption

More connected

Smart city and home devices connect to one another and to the cloud

All communications are secured

More intelligent

Using all available data to adapt infrastructure and services for the benefit of the citizens

More aware

Sensors are collecting information about every node in the city

Homes are adapting living conditions to optimize comfort and energy saving

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Smart city
Microelectronics enables smart cities applications

Smart Grid and Smart meters
gas, electricity and water meters

Smart lighting

Smart building and **smart home**

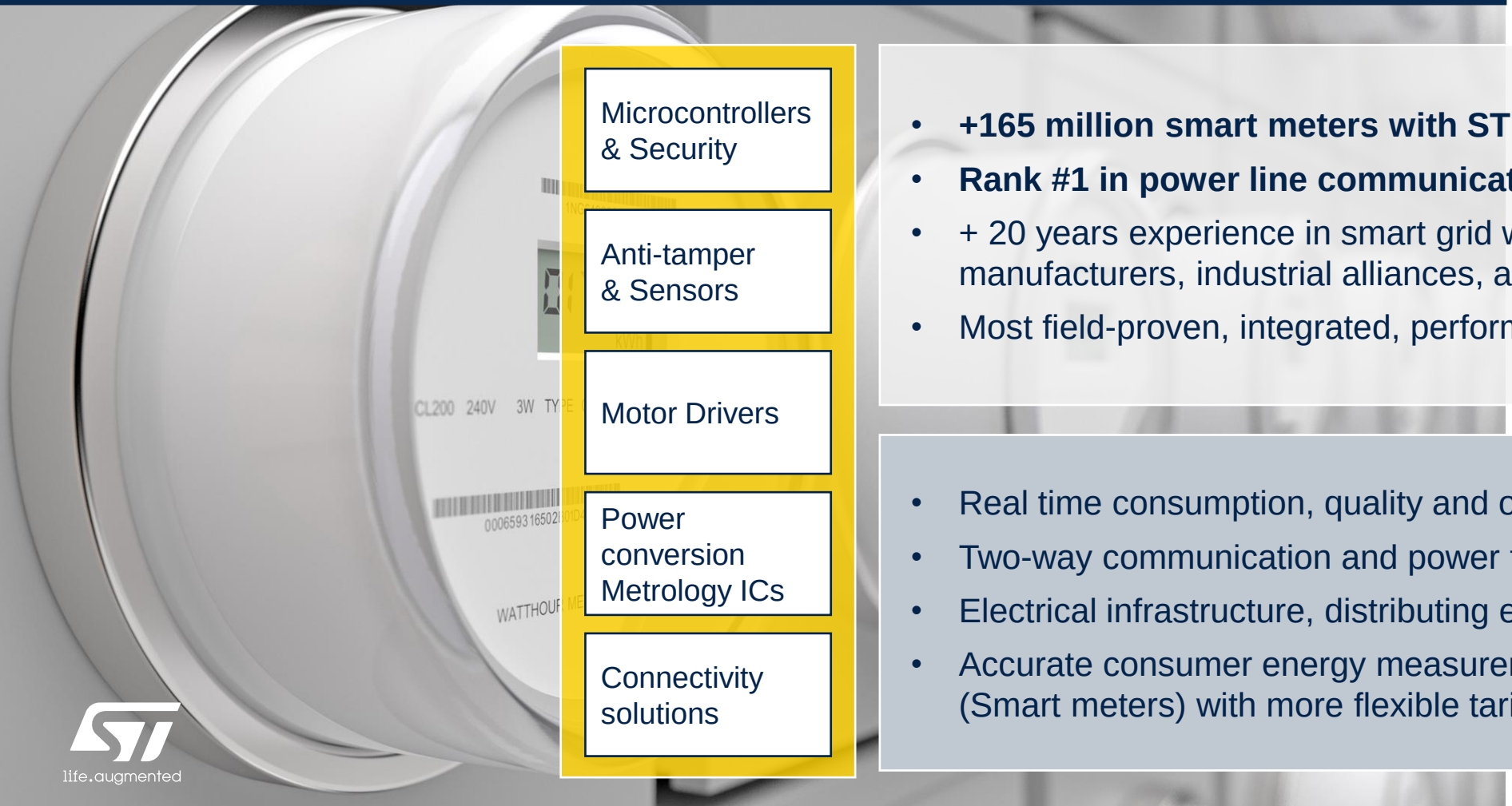
Smart city services
e.g. waste, parking

Intelligent transportation
e.g. station networks

Smart agriculture
e.g. LED growth lights for horticulture

Smart meter
e-meter, gas and water

STMicroelectronics is a leader in smart meter with technology solutions covering all smart grid building blocks



- Microcontrollers & Security
- Anti-tamper & Sensors
- Motor Drivers
- Power conversion Metrology ICs
- Connectivity solutions

- **+165 million smart meters with ST inside**
- **Rank #1 in power line communication**
- + 20 years experience in smart grid with key utilities, manufacturers, industrial alliances, and standardization bodies
- Most field-proven, integrated, performing flexible, and future-proof

- Real time consumption, quality and outage info for providers
- Two-way communication and power flow
- Electrical infrastructure, distributing electricity efficiently
- Accurate consumer energy measurement and regulation (Smart meters) with more flexible tariff schemes and billing

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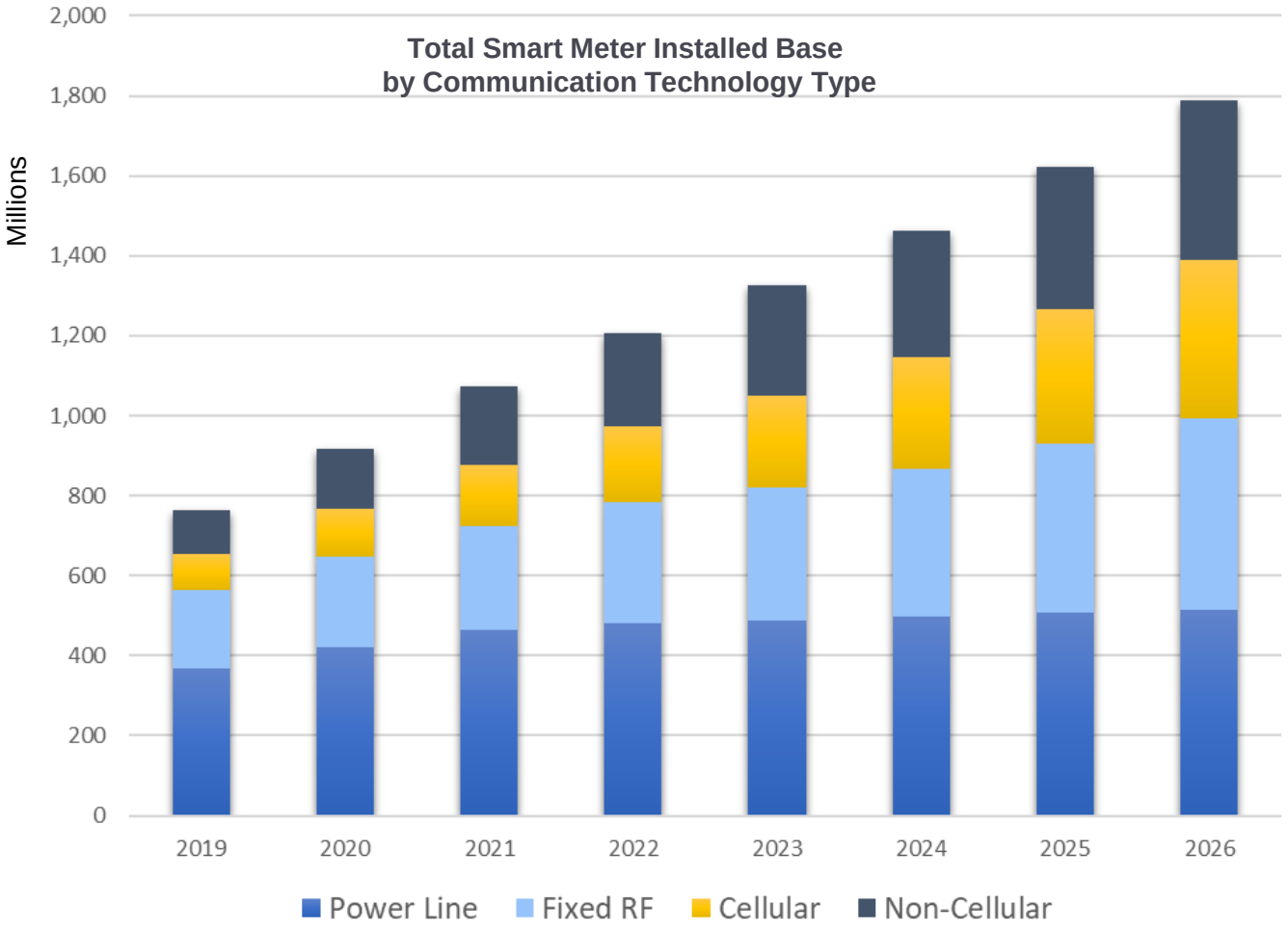
Smart metering Connectivity trends



- PLC connectivity still widely adopted in Smart e-meters
- PLC and RF complementing in Hybrid networks
- **Hybrid and NB-IoT as next major trend for smart metering**

Others (DSL, fiber, co-axial,…)

2G 3G · LTE-M · NB-IoT · M-Bus wireless · sigfox · LoRa · zigbee · Wi SUN Alliance · G3-PLC RFHybrid · meters and more Open Technologies · PRIME Alliance · G3-PLC Alliance

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ABIresearch for visionaries

Smart street lighting

Multifunction intelligent system to aggregate “smart city” services

- Remote lighting control and dimming
- Predictive maintenance of lights
- Air quality and environmental monitoring
- Power consumption reduction
- Predictive and pervasive security
- Traffic monitoring and control

ST solutions

MCU, AI & Security	Motion, pressure, temperature & CO_2 sensors	Microphone array	LED drivers Power management	Connectivity solutions

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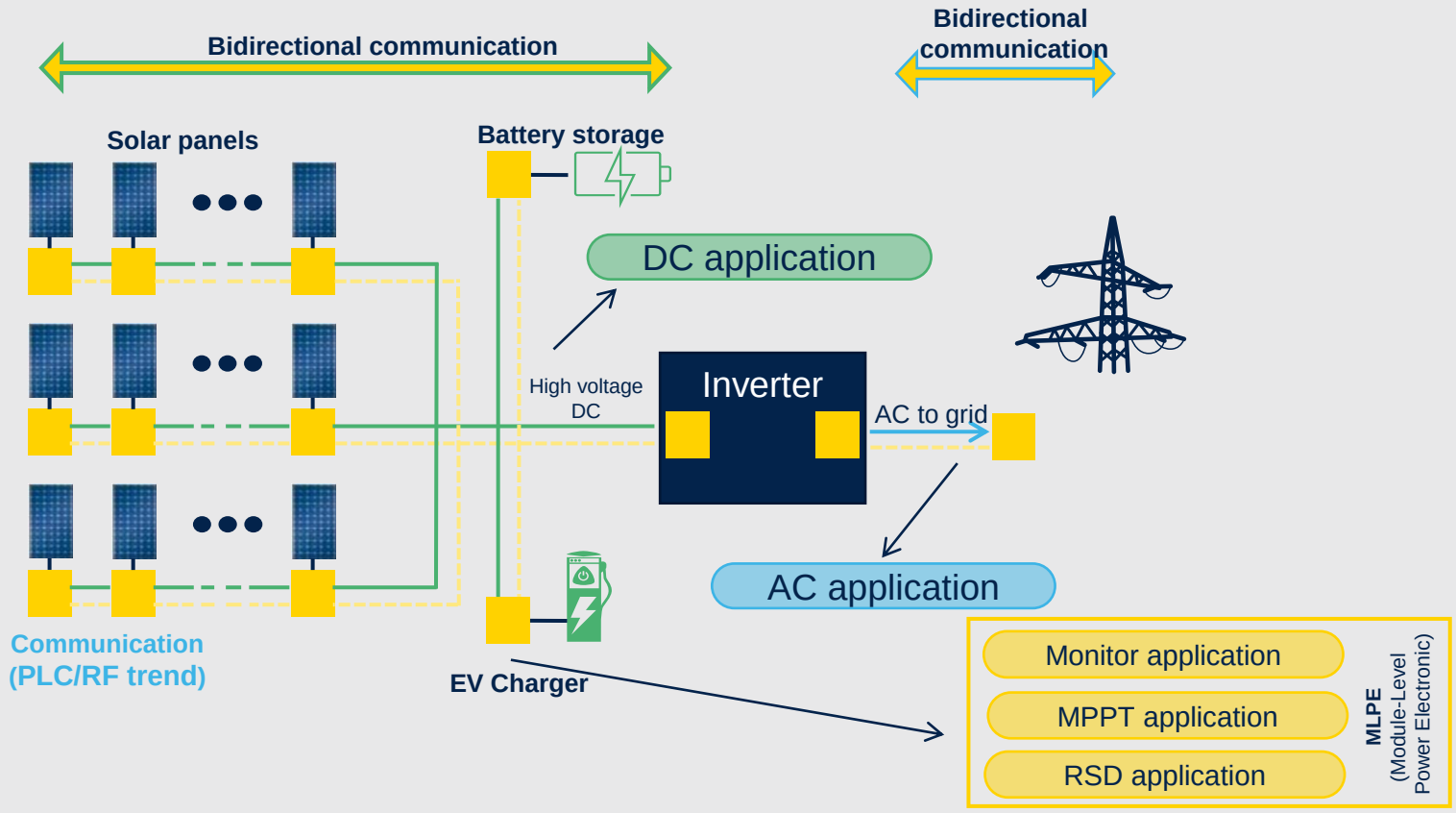
Solar power generation a key contributor to sustainable energy

Solar panels can generate, store, & share electricity thanks to semiconductors



Key components

Inverter
WBG* & Silicon Power MOSFETs, IGBT
Power Modules
Rectifiers, fast diodes
Galvanic isolated drivers

Power management
WBG & Silicon Power MOSFETs
Power Modules
Rectifiers
PWM controllers
Galvanic isolated drivers

Battery management
Battery management ICs
Microcontrollers
Regulators

Connectivity
PLC and RF 2 ways communication of DC and AC for **remote monitoring** (V, I, T) and **rapid shut-down for safety**, in case of fires, (according to NEC 2017 in the US) or maintenance PV theft detection, and more…

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*WBG = Wide Bandgap Semiconductors such as Silicon Carbide and Gallium Nitride

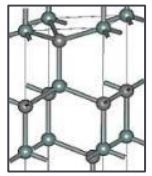
Why silicon carbide?

SiC power devices for performance beyond silicon

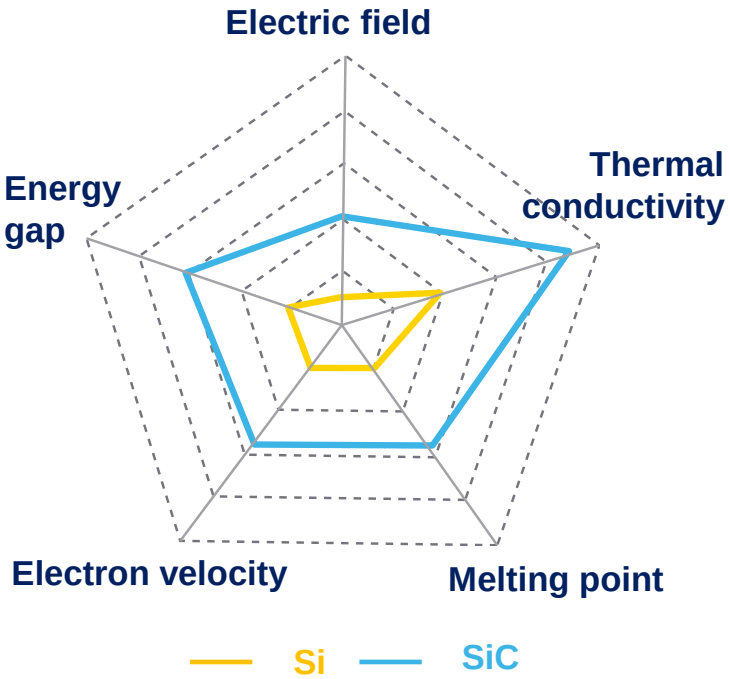
Higher breakdown voltage: x10
Lower ON resistance & losses

Higher temperature
(operation & endurance)
Reduced cooling requirements

Higher switching frequency
Lower switching losses



Silicon Carbide



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Home & building

Monitor, protect and save energy

- **Presence detection**, people counting, indoor tracking. Improve room and **asset use**, **save energy**. Improve **personnel safety** and **security**
- **Smart appliances** and efficient power supplies
- Energy-efficient **smart lighting**. **Security** and **surveillance**
- **Electric Vehicle** charger and **smart meter**
- Customer User Manager (**CEM**)
- Sensors to Cloud, for building **structure monitoring**
- Real-time **monitoring of the environment** (temp., CO2)

ST solutions

MCU, AI & Security	Vibration, chemical & environmental sensors	Imaging, proximity, IR sensors	Advanced power management systems	Connectivity solutions

NFC · Bluetooth · zigbee · LTE-M · NB-IoT · sigfox · LoRa · meters and more · UWB · THREAD · matter

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Home & building energy savings

Residential & commercial lighting, HVAC and appliances use >50% of total electricity consumption

>40% Energy Saving	**Washing machine** From Class D to Class A++
>30% Energy Saving	**Air conditioning** From analog to digital From AC to BLDC control
>70% Energy Saving	**Digital consumer power supply** Efficiency > 98% in run mode Stand-by power < 1mW
>80% Energy Saving	**Electronic lighting** From incandescent bulbs to LED lighting

Source: IEA,EPA

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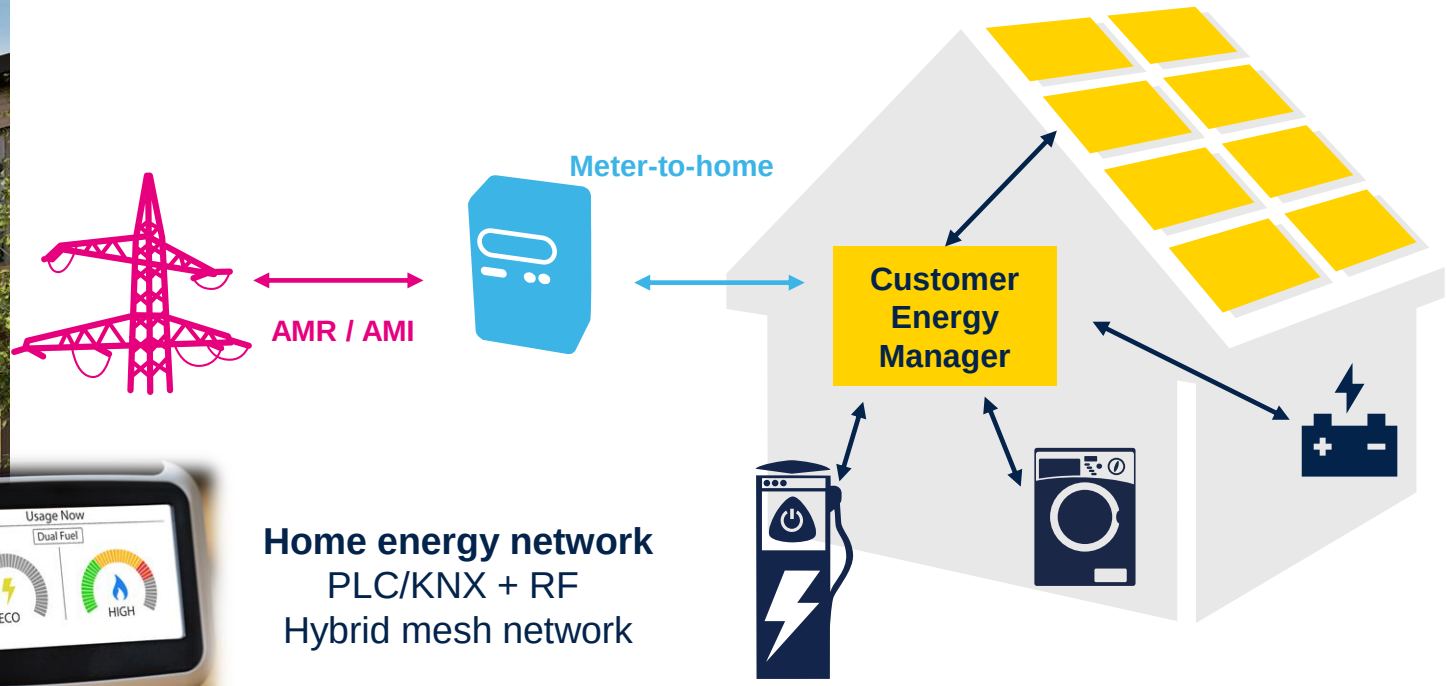
Smart home
Energy management

Customer Energy Manager (CEM) at the heart of a fully integrated energy-aware management of electric loads and DERs



Home energy network
PLC/KNX + RF
Hybrid mesh network

PLC/KNX and Wireless to create a hybrid network for a home energy ecosystem

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Home & building
Presence and occupancy detection

Global occupancy sensor market **2022 $2.1B** with **CAGR of 12%**, with North America region expected to be most opportunistic market with accumulating 38% revenue in 2022[1]

Presence detection & localization

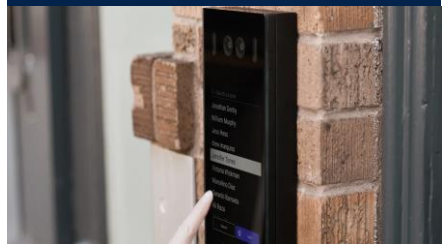
Alarms and PIR replacement

User interface

Lighting control

Heat control

Intercom & access



USD 6.6 Billion by 2032

1. Source: Future Market Insights: https://www.futuremarketinsights.com/reports/occupancy-sensor-market

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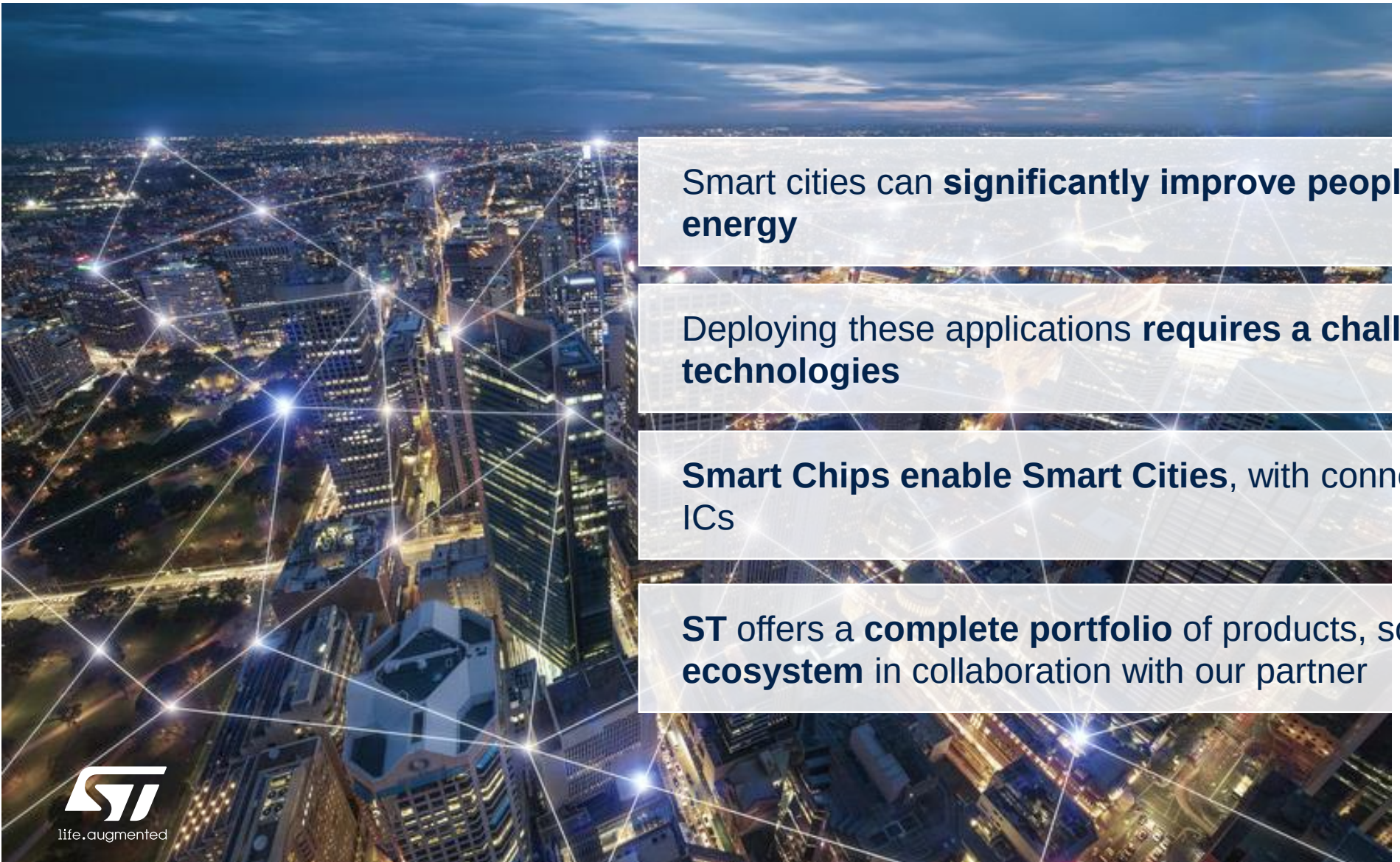
Takeaways



Smart cities can **significantly improve people's lives** while **saving energy**

Deploying these applications **requires a challenging mix of technologies**

Smart Chips enable Smart Cities, with connected, secure & low-power ICs

ST offers a **complete portfolio** of products, solutions & **ready-to-go ecosystem** in collaboration with our partner

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Our technology starts with You

For any doubt or request of information, please contact filippo.colaianni@st.com

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