

SMART CITIES ASSESSMENT

September 2020





Objectives

Detailed objectives for the study include:

- Identify & quantify the growth of smart cities implementation
 - By category/ component
- Identify & highlight both drivers and challenges to smart cities' adoption
- Forecast current & projected future growth of copper in smart cities (in metric tonnes)
- Provide conclusions & recommendation regarding future position of copper in the future evolution of smart cities

Defining the “Smart City”

A smart city is an urban area that **utilizes IoT sensors, actuators**, and different types of electronic Internet of Things technology to **connect components across the city**. It impacts every layer of a city, from underneath the streets, to the air that citizens are breathing. Data from all segments is collected and analyzed, then insights and patterns are detected to **better manage assets, resources and services** efficiently.

“Smart cities are those that use new information and communication technologies to solve pressing problems - such as housing, transportation, and energy - in urban planning and governance.”

Krishna Jayakar,
professor of
telecommunications,
Penn State

Driving Forces

Why are cities trying to become 'smart'?



Safety

Cities strive to maintain/ improve the safety of everyone in and around a city: pedestrians, drivers, business owners, citizens, and visitors. Increasing rates of urbanization are shedding light on the urgency of this.



Environmental Impact

Smart cities aim to reduce their carbon footprint and become as sustainable as possible. Many are under strict government regulations that they must meet to avoid fines.



Social Welfare

One way to sum up the main goal is to improve people's lives: better jobs, better healthcare, better waste management, electricity around the clock, etc.



Reduce Costs

Smart cities know that investing in new technologies will lead to lowered costs in the longer term – lower energy bills, maintenance costs, repair/replacement costs for city infrastructure, etc.



Local Business

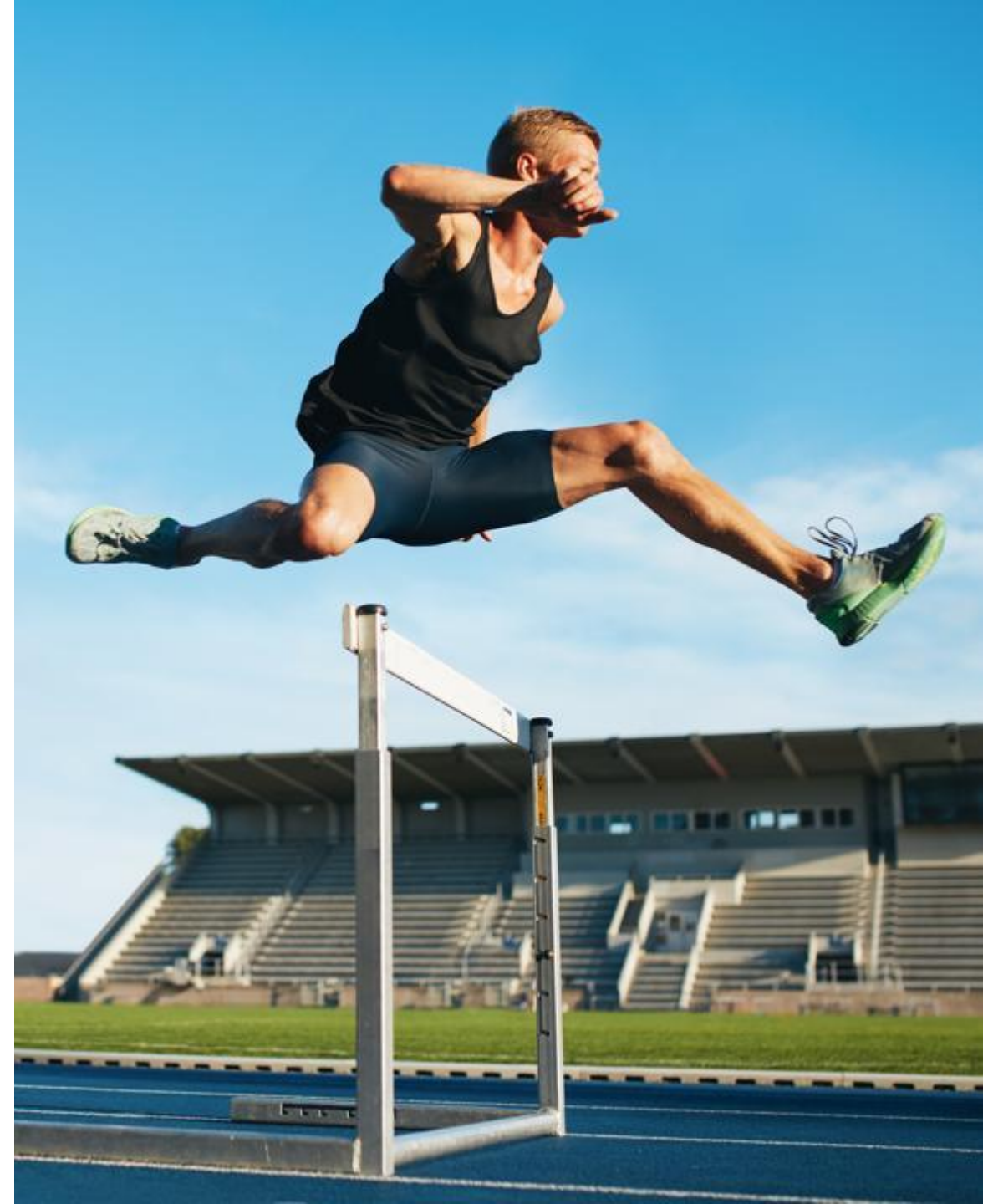
A major perk of the smart city is attracting, welcoming, and keeping local businesses. These businesses bring jobs and are extremely beneficial to the local economy.

Challenges

It's not easy being smart

However, cities have many challenges implementing technologies to make them 'smart':

- **ROI** – the nature of technology investments can prove murky ROI for a budget-conscious city
- **Data** – lack of availability, transparency, concerns over privacy of citizens – who owns the data?
- **Turnover** – hard to make long-term investments, plans, or changes when city terms can be limiting
- **Equitable distribution** – upgrades and technology should serve all citizens, not just the wealthy/powerful
- **Lack of funding** – need to deploy limited resources intelligently and efficiently
- **Accountability** – very few 'smart city' leaders or teams at the city level



Types of Smart Cities

Essential Services

- Use mobile networks in emergency management programs and digital healthcare services; focus on communication infrastructure (and 5G)
- Examples include Tokyo and Copenhagen

Smart Transportation

- Emphasize initiatives to control urban congestion through smart public transportation, car sharing, smart parking, and self-driving cars
- Examples include Singapore and Dubai



Broad Spectrum

- Emphasize urban services such as water, sewage, waste, and pollution control; high civic participation
- Examples include Barcelona, Beijing, and Vancouver

Business Ecosystem

- Use information & communication technologies to jumpstart economic activity
- Examples include Amsterdam, Edinburgh, and Cape Town

Smart City Categories

Category	Goals	Technology Types (not an exhaustive list)	Example	Copper Usage?
Mobility/ Transportation	Solve lack of parking, monitor traffic, reduce congestion, reduce vehicle-related deaths, reduce pollution	Smart traffic lights, smart parking spaces, app-connected buses	Smart traffic lights that monitor traffic can use predictive analytics to help improve traffic flow	Yes
Energy	Higher efficiency, use less energy	Smart grids, smart meters	Installing LED bulbs in streetlights – pays itself back in a few years	Yes
Infrastructure	5G/ Wi-Fi connectivity for all	5G towers, sensors, ISP networks	Internet connectivity for all citizens	Yes
Smart Buildings	Save energy, improve sustainability, extend capital life, improve safety/security, provide access to information	IoT sensors, WiFi, building automation,	Improved access control to only allow specific people in specific areas of a building	Yes

MOBILITY & TRANSPORTATION



City Fit: Bigger cities with limited streets/ parking, and high population or visitor/ tourism activity

Challenges looking to solve:

- Traffic flow
- Congestion
- Limited parking

OVERVIEW

Mobility and transportation solutions are being developed to help pedestrians, drivers, and riders move around cities efficiently and safely.

Key Technologies

Tech	Wire	Copper Weight (kg)
Smart streetlights	Required	1.5 – 2.9
Smart parking meters	Required	0.2 – 0.5
EV Charging Station	Required	3.4 – 6.8
Micro-mobility Charging Station	Required	1.1 – 2.3
Sensors (mass transit)	N/A	0.1 – 0.2

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ENERGY



City Fit: Cities looking to improve electricity distribution and efficiency; cities with residential renewable energy sources

Challenges looking to solve:

- Higher efficiency
- Reduction in energy usage/ consumption

OVERVIEW

Cities, major energy consumers, need to prioritize reducing environmental impact while increasing renewable energy resources utilizing existing infrastructure.

Key Technologies

Tech	Wire	Copper Weight (kg)
Smart grids	Yes	1,000 – 1,500
Smart streetlights	Yes	1.5 – 2.9
Smart meters	Yes	0.2 – 0.5
Solar grids	Yes	2,495– 5,000
Wind turbine wiring (wire only)	Yes	2,225 – 4,500

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INFRASTRUCTURE

OVERVIEW

The goal of smart infrastructure is to optimize city infrastructure and assets for efficiency, sustainability, and safety.

Relevant Technologies

Tech	Wire	Copper weight (kg)
5G	Yes	31 – 62
ISP Networks	Yes	12 – 23



City Fit: Cities who prioritize connectivity and Wi-Fi for all; primarily driven by 5G implementation

Challenges looking to solve:

- Implement and roll out 5G
- Provide Wi-Fi for public use if possible

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BUILDINGS



City Fit: Cities with forward-thinking companies; cities that house many large buildings looking to reduce carbon footprint or improve security

Challenges looking to solve:

- Higher efficiency, reduced energy consumption
- Improved safety and business/operational efficiency

OVERVIEW

Smart buildings use automated processes to automatically control the building's operations including heating, ventilation, air conditioning, lighting, security, and other systems.

Smart building technology is expected to grow at ~15-30%* per year, depending on the tech.

Relevant Technologies

Tech	Wire	Copper Weight (kg)
DAS	Yes	21 – 31
BAS/HVAC	Yes	23.5 – 35.3
ISP	Yes	48 – 72
Wi-Fi	Yes	11 – 16.5
Smart Access Control	Yes	37 – 55.5
IoT Networks	Yes	4.5 – 6.8
IP Video Surveillance	Yes	19.5 – 29.3
LED & UVC Lighting	Yes	186 – 279

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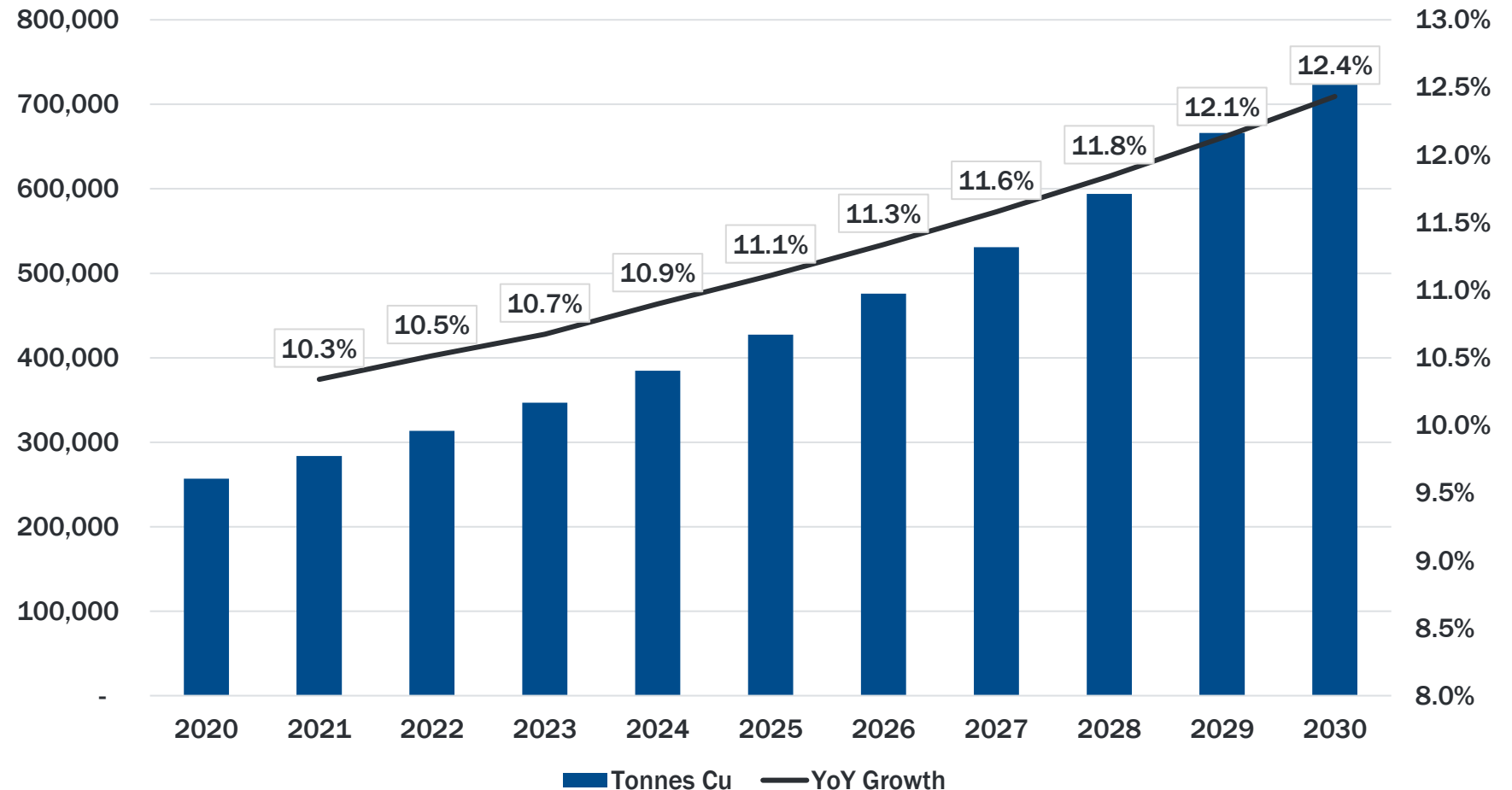
Annual Copper Demand From Smart Cities

Annual Copper Demand from Smart City Technologies (tonnes) 2020 – 2030

Source: The Martec Group

Martec conservatively expects copper demand to grow from 250k tonnes in 2020 to 750k tonnes in 2030.

- Figures are on an annual basis, not a cumulative sum
- Annual growth stretches from ~10% to ~12% in the next 10 years

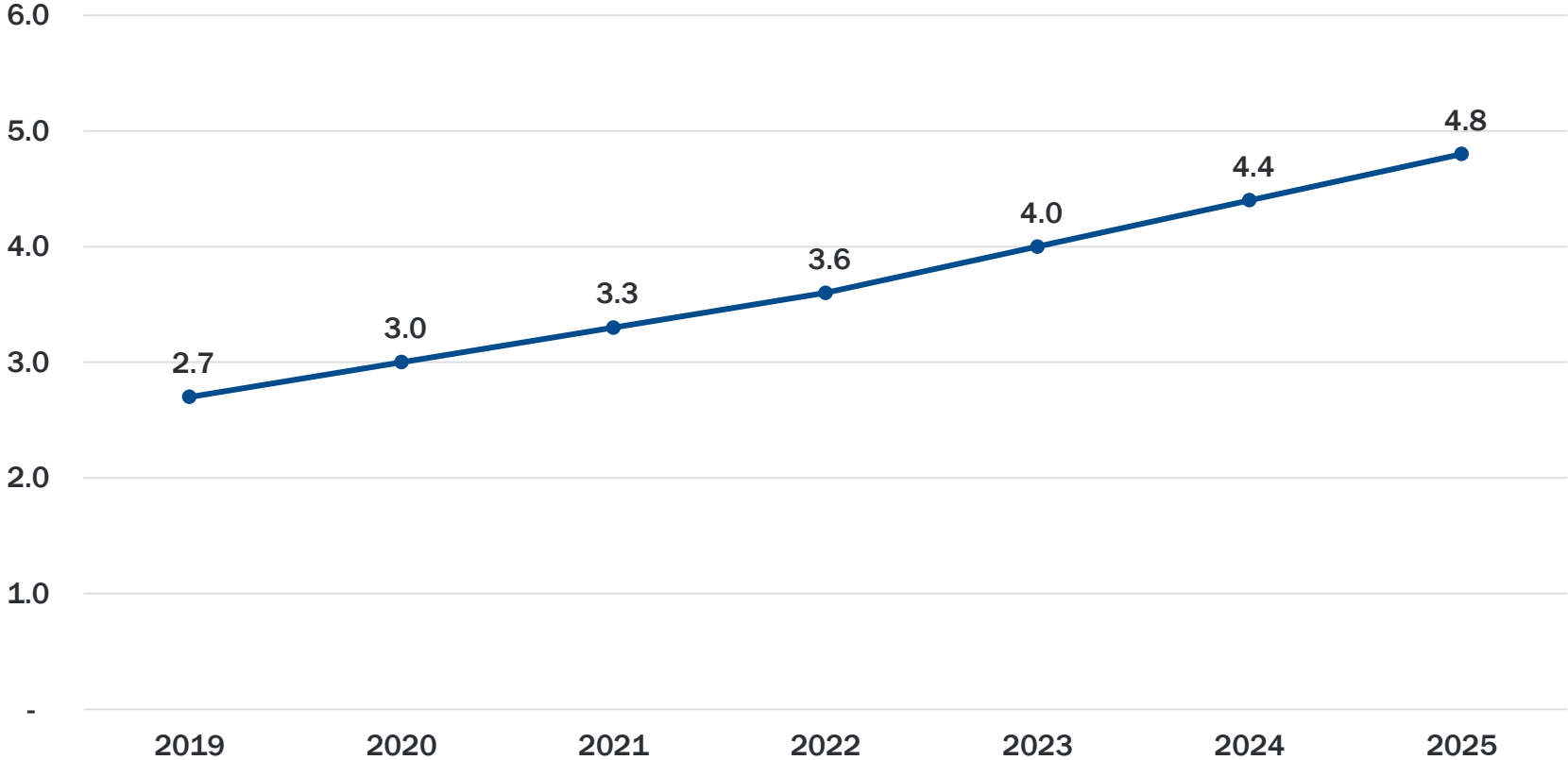


Total Cumulative Copper Demand from Smart Cities

Cumulative Copper Demand from Smart City Technologies
(in millions of tonnes)
2020 – 2025
Source: The Martec Group

Martec expects copper demand from smart city technologies to grow from 2.7M tonnes in 2019 to 4.8M tonnes in 2025.

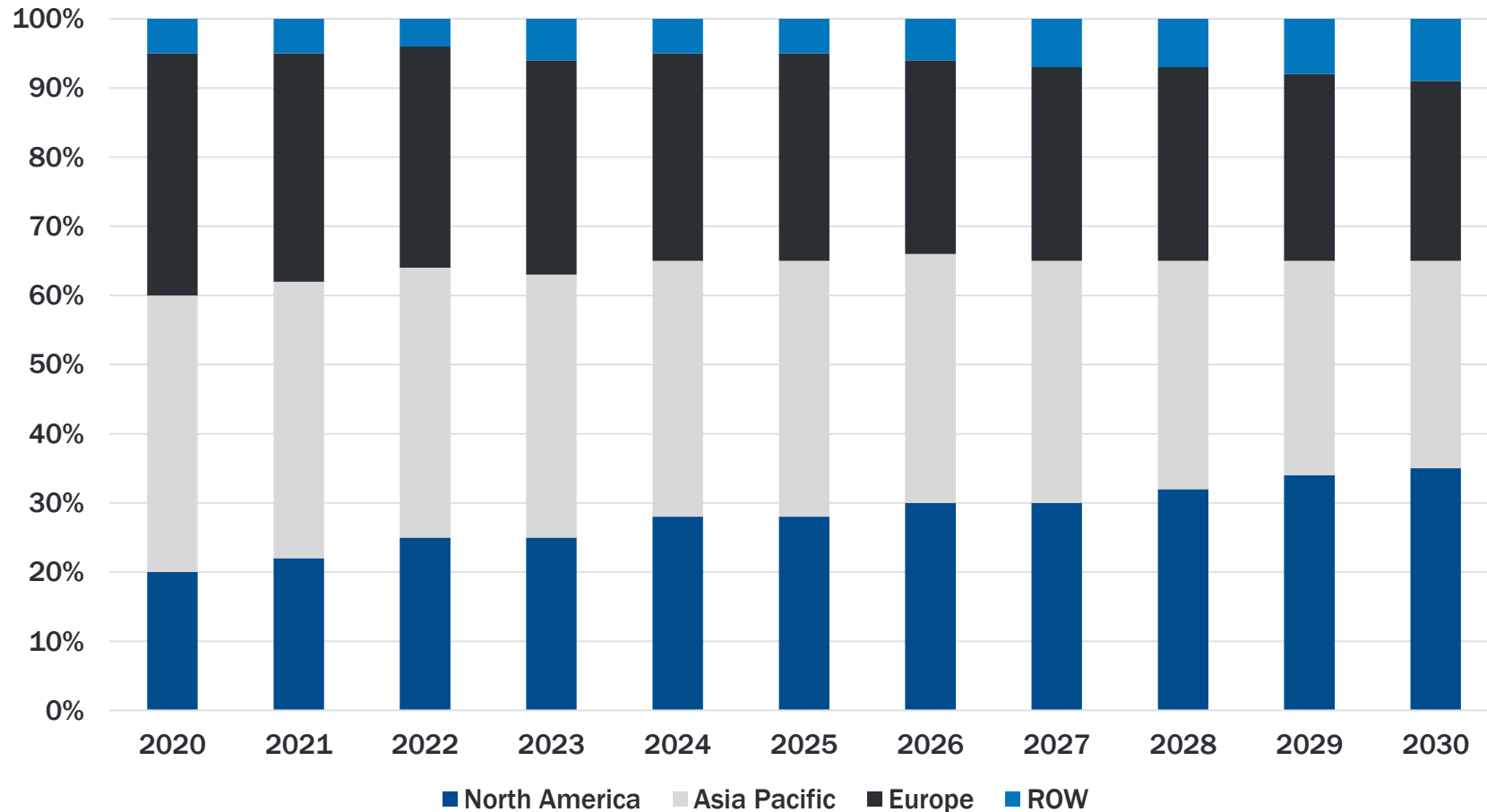
Estimates out to 2030 have lower confidence levels, primarily due to the unknown impact of COVID.



Estimated Regional Breakdown

Smart City Copper Demand by Region 2020 – 2030

Source: The Martec Group



As of now, Asia and Europe lead in smart city development, and thus, copper demand from smart cities.

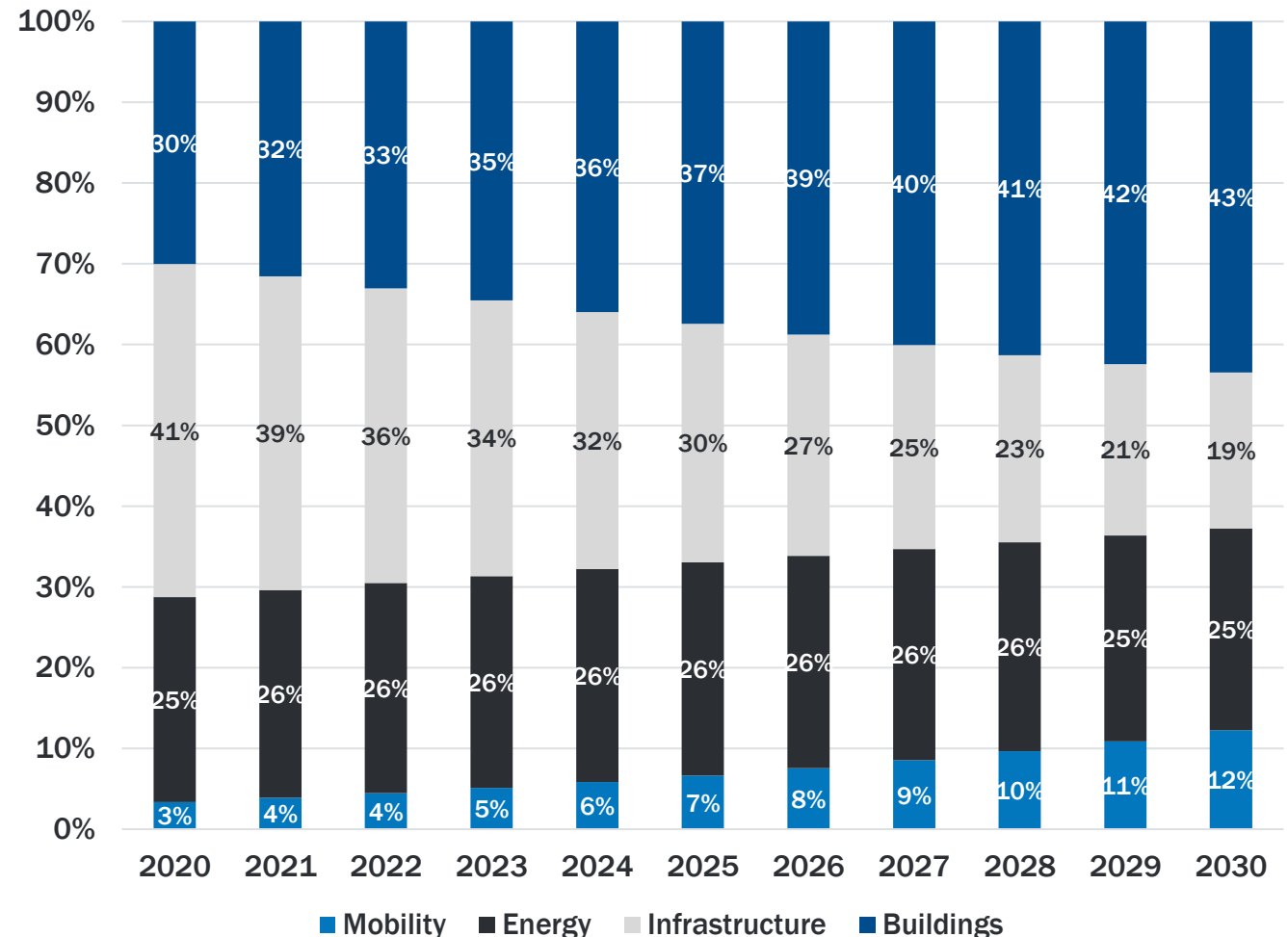
Over the coming 10 years, experts believe that North America will likely steal share from the other regions and become the leader in smart city technology implementation, and thus copper demand for smart city applications.

Copper Demand by Smart City Category

- Buildings and mobility are the two categories gaining share over the coming 5 years – primarily due to continued growth of further evolving technology
 - Experts indicate that technologies in these categories are only scratching the surface and will continue to develop
- Infrastructure loses share, as this is mostly driven by the implementation of 5G towers; growth is strong over the next few years but quickly drops off as we approach 2030
- Energy remains stable – continued implementation of renewable energy and slower, sustainable growth of smart grids and microgrids contribute to these figures

Copper Demand by Smart City Category
2020 – 2030

Source: The Martec Group



Key Takeaways

So what does it all mean?

1. You can't define a smart city – each is unique and focuses on solving the problems of its constituents
2. Cities are slowly changing to incorporate smart city leaders, but this process takes time
3. 5G, and with it, better access to faster Wi-Fi, will be a key enabler to smart cities
4. The impact of COVID is still being determined
5. Copper demand is expected to grow from 2.7M tonnes in 2019 to 4.8M tonnes in 2025 due to its performance and reliability



Thank you!

Emily Bielak
The Martec Group

