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Expo 2020 Dubai: A Sustainable Site

Under the theme 'Connecting Minds, Creating the Future,' Expo 2020 Dubai will bring together millions from around the world — stimulating conversation, exchanging ideas and creating global awareness of its Opportunity, Mobility and Sustainability subthemes.

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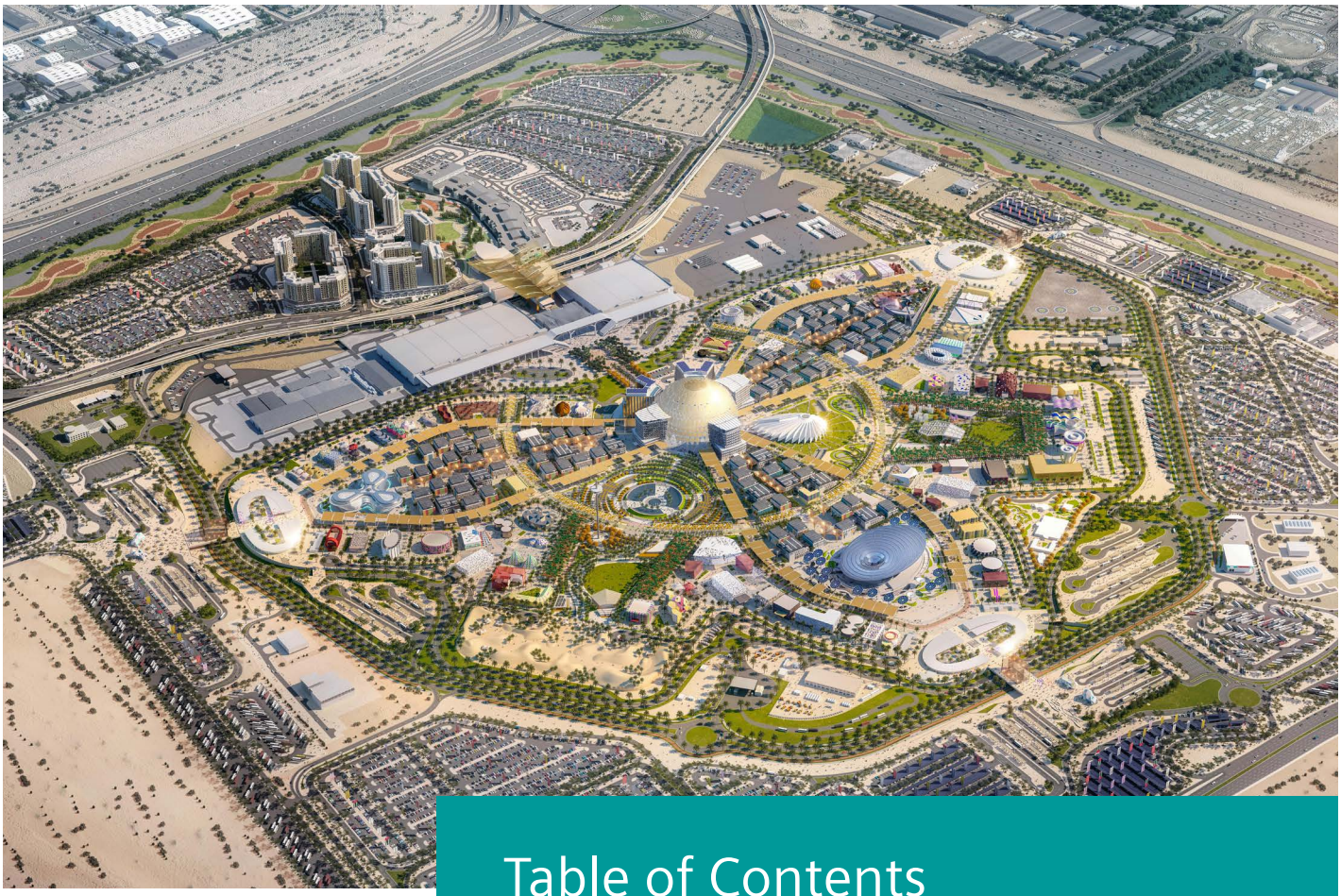


Table of Contents

Introduction 3

Expo 2020 Dubai: Leading the Way to Sustainability 4

Water Management is a Key Issue 6

Smart Buildings Have a Role to Play 7

Smarter Power Grids are Key 8

Expo 2020 Dubai: A Legacy of Sustainability 11

Introduction

The global population is on the move. According to the United Nations, more than two-thirds of the world's citizens will live in cities by 2050, with 90 percent of this urban growth taking place in Asia and Africa.[1]

Given this massive migration to urban areas, the subject of sustainability and sustainable cities is top of mind for many. And rightly so. Governments, non-governmental organizations (NGOs), corporations and global leaders worldwide are all involved and grappling with a fundamental issue: How can the mega-cities of tomorrow provide essential services such as clean water and adequate waste removal? And how can they create a transportation and building infrastructure that reduces the emission of pollutants into the air while taking in so many new residents?

Today, for instance, some 663 million people around the world do not have access to safe and reliable drinking water.[2] A mass influx of new residents into the world's largest cities will bring a surging tide of issues surrounding access to fresh water for human consumption and basic sanitation.

Mega-cities also mean "mega" waste disposal issues. The world's cities already generate over 2 billion metric tons of solid waste each year.[3] By 2050, annual waste generation will increase another 70 percent.[4]

And then there are air quality issues, one of the key challenges being carbon dioxide (CO_2) emissions. As population epicenters, cities consume over two-thirds of the world's energy and account for more than 70 percent of global CO_2 emissions.[5] This number will only grow as escalating urban populations demand and use more energy for heating, cooling and transportation. Smart buildings are key for overcoming many of these challenges because they are responsible for 36 percent of global energy consumption and nearly 40 percent of direct and indirect CO_2 emissions.[6]

As with general population growth, moreover, many if not all of these key sustainability issues are most prevalent in the largest and fastest-growing cities in some of the lesser-developed regions of the world, creating even more urgency around a call for sustainability solutions.

[1] United Nations (June 2019), World Population Prospects 2019: Highlights
[2] Thirst Project
[3] The World Bank (2016), What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050
[4] The World Bank (2019), Solid Waste Management
[5] C40 Cities
[6] The International Energy Agency, IEA Efficient World Strategy

EXPO 2020
SUSTAINABILITY GOALS

1. Leave a legacy of sustainable infrastructure and cutting-edge practices.
2. Catalyze sustainability efforts in Dubai and throughout the United Arab Emirates.
3. Increase public awareness about, and engage society in, sustainability principles and sustainable living.

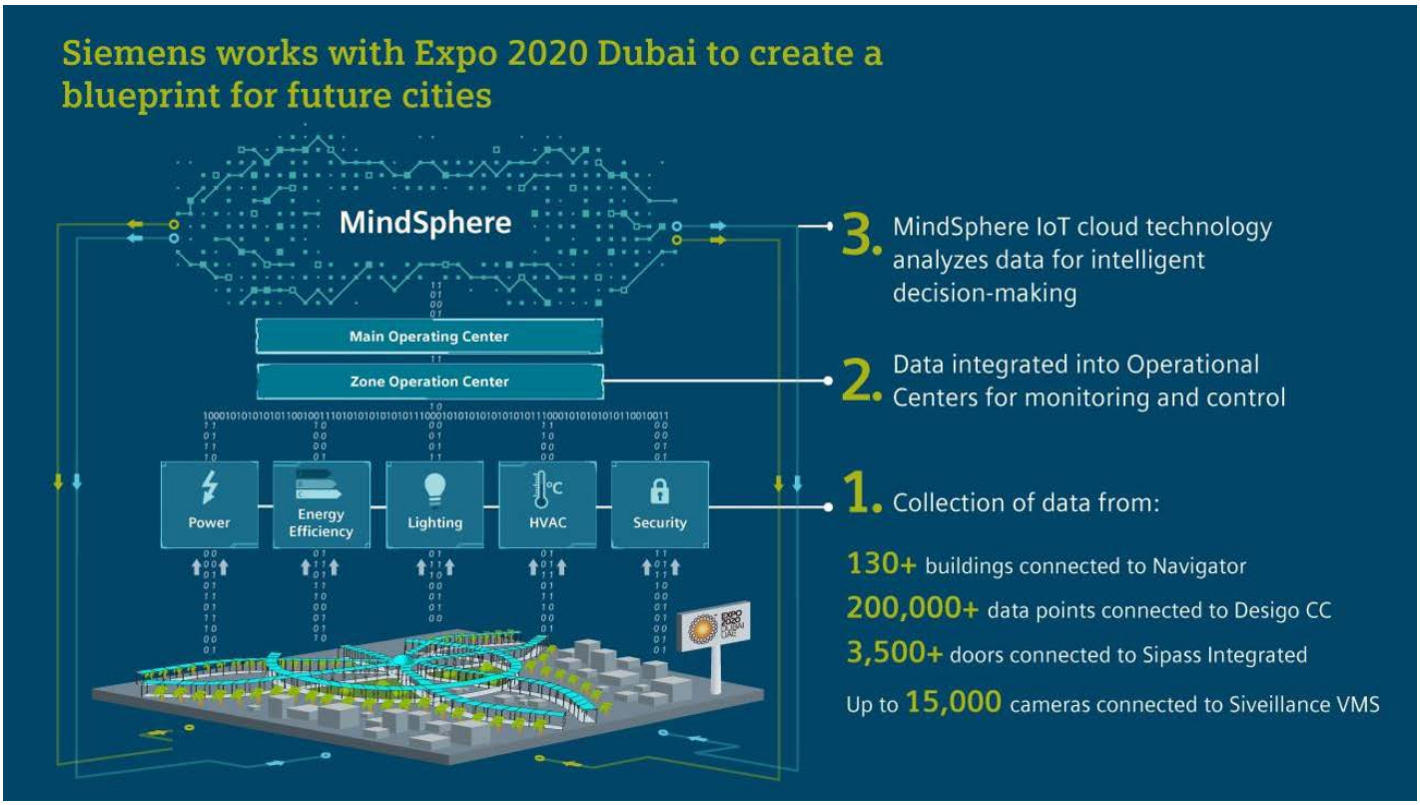
Expo 2020 Dubai: Leading the Way to Sustainability

As they have for millennia, though, cities will also present experimental and thought leadership opportunities for those creating a sustainable future. Creative and effective new ideas and solutions for the challenges of urban water use, waste management and CO_2 emissions are as likely to spring from the universities, think tanks and corporations in the world's largest cities as from anywhere else.

Expo 2020 Dubai is a site that showcases and is enabled by innovative new technologies to address the sustainability issues facing the world's cities — today and in the future.

Sustainability is one of Expo 2020 Dubai's three subthemes. The Sustainability Pavilion at Expo 2020 will explore the potential for buildings to be self-sustaining while aiming to influence thousands of visitors — by empowering them to understand the environmental impact of the daily choices they make. For example, it is targeting net-zero energy and water, and will use renewable sources to produce up to 4GW of energy a year — enough to charge more than 900,000 mobile phones.

Another key theme, Opportunity, challenges visitors to embrace the power of collaboration and recognize how their actions can contribute to the creation of a better world. Mobility explores human progress through movement of people, ideas, goods and data through the ages. The intention is that these three themes, under Expo 2020 Dubai's main theme of 'Connecting Minds, Creating the Future,' will inspire visitors to take action to protect our planet by celebrating innovative global projects that are making a positive impact.



The Expo 2020 Dubai site will cover more than 4 square kilometers, connecting around 400 buildings and featuring more than 190 international participants, including countries, companies, organizations and educational institutions, as well as 200-plus food & beverage outlets. Expo 2020 Dubai will run for six months, welcoming up to 300,000 visitors a day, with an estimated 25 million visits between October 20, 2020, and April 10, 2021.

Siemens, one of the largest technology companies in the world, has been invited to partner with Expo 2020 Dubai to build “a blueprint for future smart cities,” as Afzal Shabaz Mohammed, Siemens Head of MindSphere and Technology Innovation, Expo 2020 Dubai, calls it. The company is implementing a large variety of technologies to ensure comfort, safety and security on the Expo 2020 Dubai site.

While Siemens has worked with World Expos in the past, this is the largest undertaking of its type for the company to date. For example, consider the sheer size of operations. “On site, we connect some 140 buildings to MindSphere, the cloud-based, open IoT operating system," says Afzal.

He adds that turning most of the structures on site into truly smart buildings and providing transparency into their energy usage will help Expo 2020 Dubai to achieve its sustainability goals — in an incredibly demanding environment.

The conversations around sustainability will not stop when Expo 2020 Dubai closes in April 2021. The Expo is in fact a showcase and a call-to-action for a sustainable city. It is an event where the entire world will come together to brainstorm, discuss big issues around sustainability, see technologies in action — and take away ideas to implement in their own cities.

This collaboration at Expo 2020 Dubai, in fact — the sharing of sustainability ideas, ideals, practices and results — is the beginning, the catalyst for real change in the world.

Water Management is a Key Issue

A key global sustainability challenge is the supply and security of fresh water, both for human consumption and basic sanitation, as well as food and energy security, the eradication of poverty and many other aspects of sustainable development.

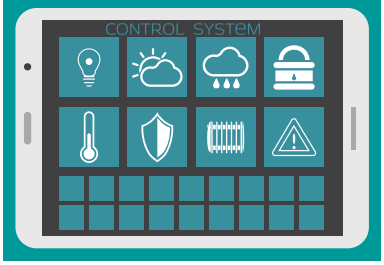
Siemens helps ensure less water is wasted at Expo 2020 Dubai by monitoring and controlling the smart irrigation system via the MindSphere platform. Smart irrigation deploys both weather and soil sensors among crops, lawns and gardens and connections to a central building management system and the Internet of Things (IoT) devices to tell irrigation systems exactly where and when to water and how much water to spray, depending both on atmospheric conditions, as well as the type of vegetation being grown.

This information intelligence allows the system to intelligently collect, monitor and analyze data and control pumps/valves, track water usage and detect leakages in the system. Correlating weather and irrigation data will optimize water consumption throughout the Expo 2020 Dubai site.

EXPERIENCE A SMART BUILDING

Siemens is providing the technologies that will connect, monitor and control every building in Expo 2020 Dubai's Mobility, Opportunity and Sustainability Thematic Districts, including their respective pavilions and the Dubai Exhibition Centre. For example, in the Sustainability Pavilion, MindSphere connects to various data sources within the building to give operators:

- A live read out of water pressure, solar power generated and total energy use.
- A comparison of indoor and outdoor temperatures, along with the current weather.
- Total water use and total water re-use, including a comparison of the two.
- Total waste produced and total waste recycled.
- A steady pulse icon, indicating that the pavilion is "healthy."



Smart Buildings Have a Role to Play

In the quest for sustainability, buildings are a major lever. They are responsible for some 40 percent of global energy consumption. It's also where most people spend up to 90 percent of their time: living and working. Smart building technology from Siemens will be used to measure and monitor sustainability metrics at Expo 2020 Dubai. The company's MindSphere IoT platform, in fact, is designed to do just that, with modules covering key elements of smart cities such as environmental monitoring to optimize energy and water usage. Siemens Navigator, the cloud-based energy management platform powered by MindSphere, connects, collects and analyzes data from thousands of sensors across 140 buildings. These systems will allow Expo 2020 Dubai to prove the concept and demonstrate the feasibility of green and smart technologies related to integrated building and district management systems and practices at scale.

In the future context of a smart city, the potential energy savings are enormous. Imagine instead of a single building reducing its energy consumption by implementing smart lighting, an entire city can do the same, with smart streetlights programmed to dim at times of low traffic, significantly reducing their overall energy consumption and cost.

Smarter Power Grids are Key

What if energy savings were used to power vehicle-to-building and/or building-to-grid power sharing programs, intelligent enough to draw the lowest-cost, most carbon-neutral power source at the right times during peak demand, and at the same time to offload reserves into local battery storage to be tapped whenever needed? Using Navigator, this type of thinking is not only possible, but feasible today.

A networked collection of smart buildings holds the promise of creating a smarter, more responsive resource management "ecosystem" that informs power and water utilities just what energy and water the system needs, when it needs it and how best it can be used at any particular point in time.

From the providers' side, the aggregate data supplied by a collection of buildings means utility providers can offer a variety of incentives. These include off-peak rates, demand management and renewable energy programs that both reduce energy inputs — or instance through the use of gas-fired "peaker" plants — while mitigating harmful energy out-puts such as carbon emissions into the atmosphere.

Examples of on-site metered data for visualization and analysis

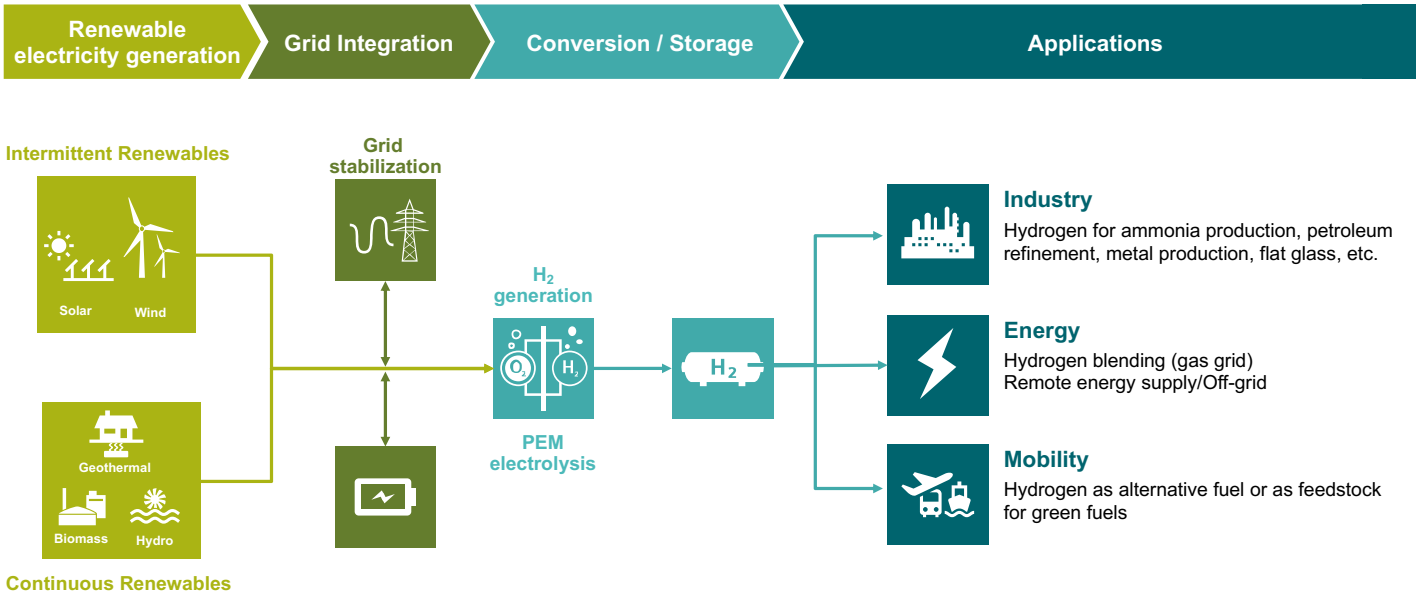
Unit	Environment	Energy	Water	Comfort	Waste
Site Wide	Windspeed & Direction	Total Electricity & Renewable	Domestic & Landscape	Temperature	Solid & Organic
Buildings	Temperature	HVAC	Wastewater	Daylight Levels	Solid
Analytics	CO_2	Share Renewable	Unit Consumption	Anticipation	Trend Waste

With the data provided by Navigator, Expo 2020 Dubai's facilities team will be able to connect, collect and analyze energy and resource usage from across the site. Actionable data can then be used to create resource usage plans and meet sustainability key performance indicators (KPIs), such as reducing overall water and energy consumption.

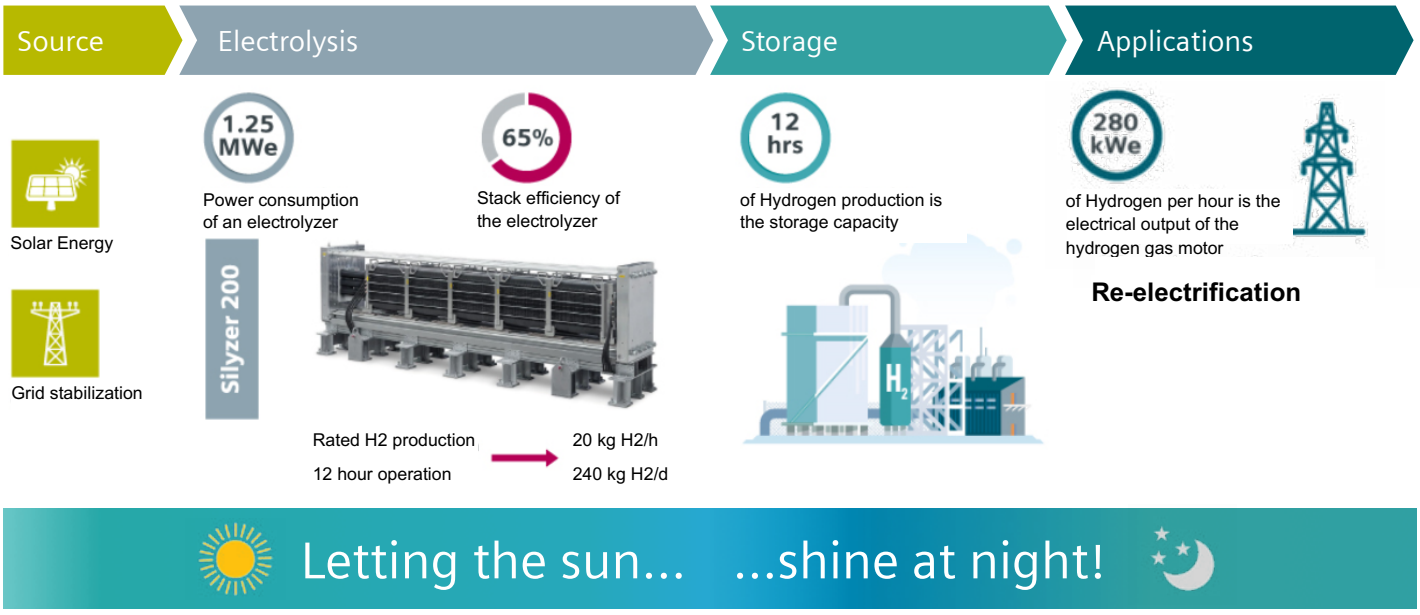
Buildings, as the energy "heavy lifters" of cities, can also be served by locally sited micro-grids that reduce both the cost and carbon footprint of today's electrical transmission and distribution networks and systems.

Studies of energy use at events such as Expo 2020 Dubai can inform future cities about the urban planning strategies, traffic management schemes — and building code changes that can best advance efficient energy and resource management. For example, smart cities can make hydrogen a key building block for sustainable buildings, transportation systems and more. Hydrogen can be stored safely and cost-effectively in large amounts, making it a viable solution for meeting sustainability goals such as decarbonization and renewables integration. That's why at Expo 2020 Dubai, Siemens and the Dubai Electricity and Water Authority (DEWA) are working together to build the region's first hydrogen facility.

Production of green hydrogen offers a viable solution for decarbonization in key sectors



Hydrogen showcase in Dubai



As more individuals, more buildings, more companies and more communities engage in these types of sustainability initiatives, reductions in the carbon footprint of a city can quickly add up to a significant amount. Thus, even small CO_2 reduction efforts can contribute to a larger global movement toward sustainability.

Expo 2020 Dubai:
A Legacy of Sustainability

By modeling a sustainable urban environment at scale, Expo 2020 Dubai intends to be the catalyst for an exchange of ideas around how to build sustainable cities of the future.

And it doesn't just stop there. Expo 2020 Dubai aims to challenge local communities and cities around the globe to seek out new ideas and develop and implement strategies to manage their water resources, municipal waste — and CO_2 emissions sustainably.

The resulting pursuit by cities everywhere to be more sustainable in the future will be one of the most lasting and valuable legacies of Expo 2020 Dubai.

For more information on how Siemens is creating a blueprint for future smart cities at Expo 2020 Dubai, visit **www.siemens.com/expo2020**.

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