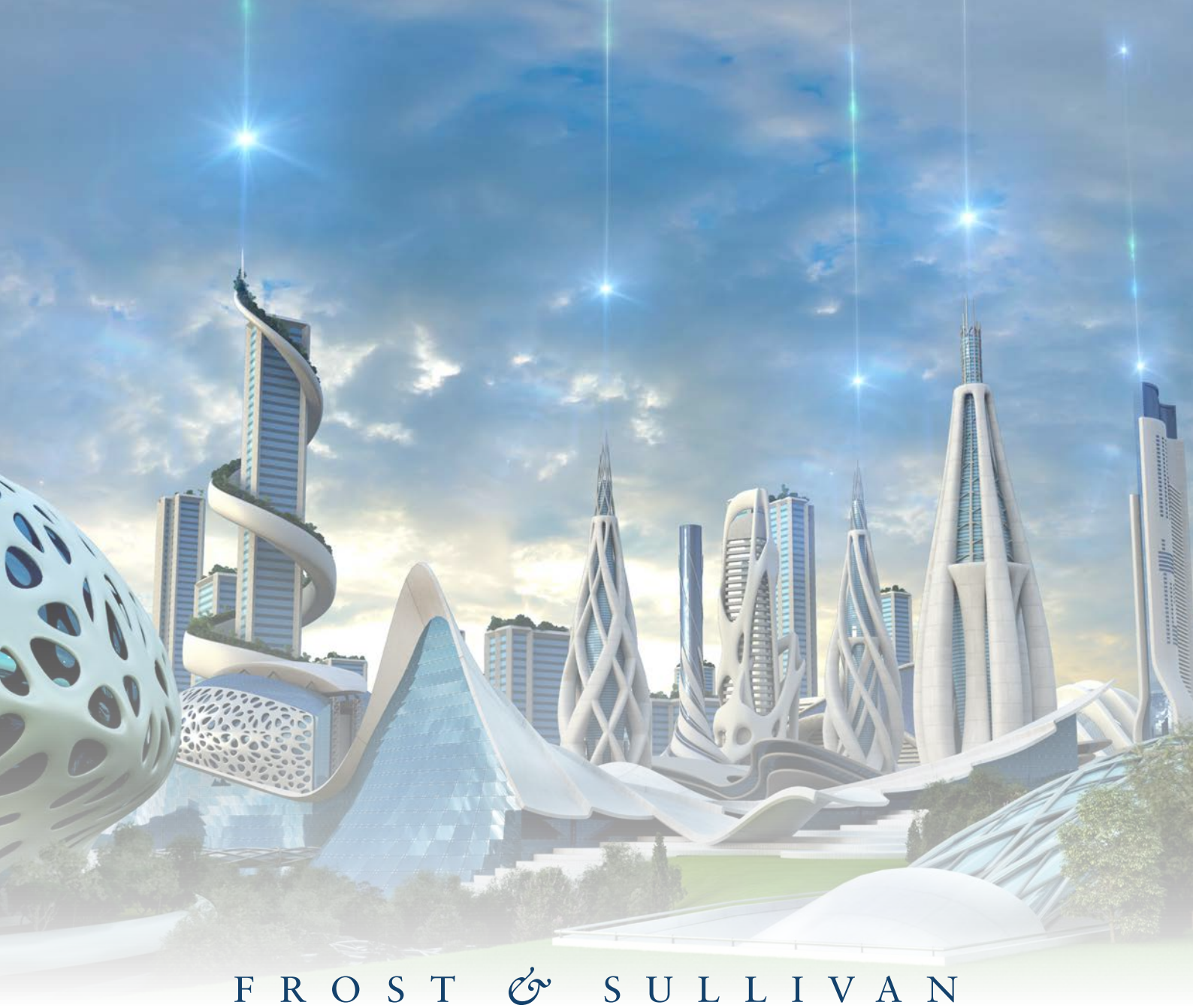


FROST & SULLIVAN

BUILDINGS OF THE FUTURE—AN ECOSYSTEM PERSPECTIVE

INSIGHTS BY: RUDRANIL ROYSHARMA
Director – Energy & Environment, Advisory Practice
Frost & Sullivan

A Frost & Sullivan Insight Prepared
Exclusively for Light Middle East | Intelligent Building Middle East.

Table of Contents

INTRODUCTION

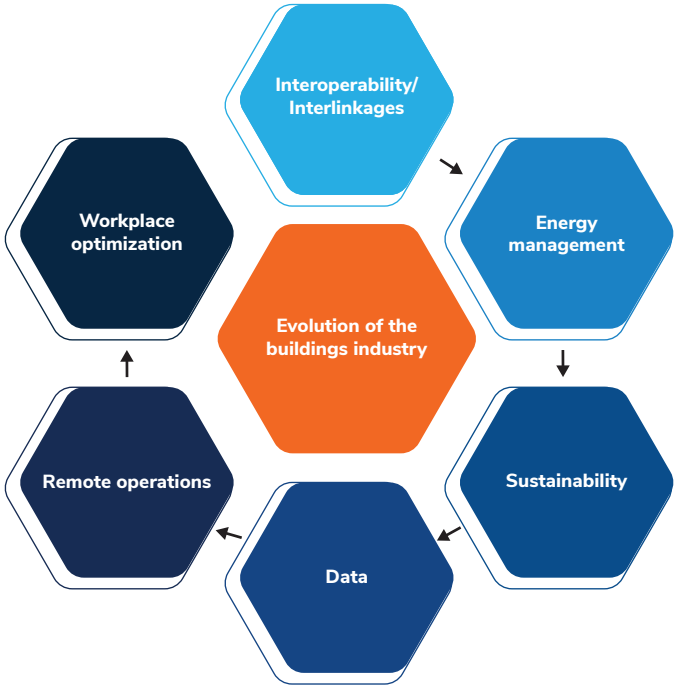
Humankind depends extensively on buildings for living and working. This dependency has increased over time, and buildings have evolved from a simplistic focus on protection through four walls and a roof to a habitat that serves quality of life needs and wants and is expected to amplify the health, well-being, and productivity of occupants.

The significance of buildings is measured based on needs but also in terms of the impact they have. Buildings contribute as high as 55% of the total global electricity consumption, 30% of total global energy consumption, and, concerningly, 28% of global energy-related CO2 emissions. [1] This impact would only worsen over time if the status quo is maintained, where more buildings would be constructed (building construction contributes ~10% of global final emissions).

Interoperability/interlinkages (with cities and energy and transportation infrastructures) are the third-most significant aspect. They further necessitate a need to focus on buildings and improve efficiency, reduce consumption of raw materials, and lower emissions and environmental impact.

An increased awareness of these aspects, coupled with intense stakeholder pressure to drive change, has resulted in an evolution in the building industry.

EXHIBIT 1: EMERGING FOCUS AREAS FOR THE BUILDING INDUSTRY



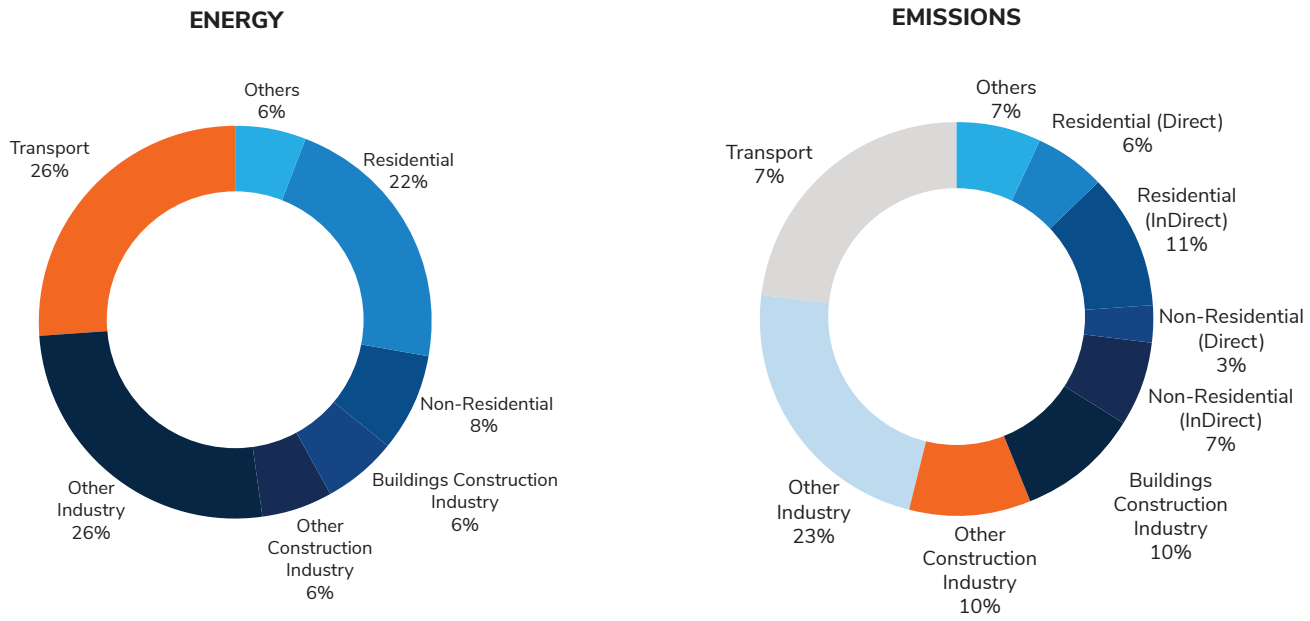
Technology will play a major role in enabling this evolution and will shape the future of buildings, taking them on a “smart” route. It will also optimize and enhance the entire value chain across design, construction, operations, and decommissioning, driving the smart buildings market toward $1.2 trillion by 2025.

GLOBAL TRENDS IN SMART AND SUSTAINABLE BUILDINGS

The buildings industry continued its post-pandemic recovery in 2022 after the reopening of economic activities in 2021. The heating, ventilation and air conditioning (HVAC), refrigeration, facility management, lighting systems, and fire safety and security markets witnessed strong comebacks due to robust customer demand and business transformation initiatives by industry participants. There is increased awareness of climate change, willingness to invest in the digitalization of buildings, and emphasis on improving occupant experience and well-being among building owners and facility managers. Energy efficiency and net-zero energy are some of the key factors driving the smart buildings concept across the world.

Global energy demand is on the rise. Electricity demand grows by an average of 1.8% per year and is expected to account for 50% of the total energy demand by 2050. Buildings are major consumers of energy and electricity, accounting for 36% of the total energy consumption. As people spend more time indoors, electricity consumption increases due to improved quality of life and entertainment, increasing emissions.

EXHIBIT 2: ENERGY CONSUMPTION AND ENERGY-RELATED CO2 EMISSIONS BY SECTOR, GLOBAL, 2020



Note: "Buildings construction industry" refers to the overall industry devoted to manufacturing building construction materials, such as steel, cement, and glass. Indirect emissions are emissions from power generation for electricity.

Source: IEA

A recent report by the Global Alliance for Buildings and Construction (GlobalABC), published through the United Nations Environment Program (UNEP), cites that CO2 emissions from operational buildings reached their highest level in 2019 at 10 GtCO2, contributing to 28% of total global energy-related CO2 emissions. This is concerning because it contradicts the various attempts that have been made, especially over the previous decade, to curtail energy consumption and the environmental impact of buildings.

Digital solutions such as building management systems and artificial intelligence are enabling the development of a smart built environment

Building owners and facility managers are more concerned about sustainability and circular economy because of the building-level sustainability targets they need to achieve. Smart building solutions offer cost efficiencies with additional values, such as carbon savings, energy savings, and occupants' comfort and productivity; these benefits have driven the adoption of smart buildings globally.

EXHIBIT 3: GLOBAL TRENDS IN SMART AND SUSTAINABLE BUILDINGS

AI and IoT-driven Building Solutions	Health and Wellbeing of Occupants	Digital Twin in Smart Buildings	Connected Lighting Opportunities
			
Prioritized investments in the digitalization of buildings to increase adoption of AI and IoT-driven building solutions	Occupant's health and wellbeing to remain top priority for facility managers across regions	Rising demand for data-driven operation and maintenance to accelerate the adoption of digital twin in smart buildings	Rebound lighting industry to explore connect lighting opportunities in improving occupant experience and wellbeing

Integrated Life Safety Systems	Home Energy Personalization Services	Autonomous Home Awareness System	Workplace Innovations
			
Increasing need for adaptive emergency response to further the demand of integrated life safety systems	Pressing need to address utility challenges and changing customer expectations to augment the deployment of home energy personalization services	Expanding AI capabilities in home security to accelerate the growth of autonomous home awareness systems	Shift towards hybrid working model and workplace innovations to accelerate the implementation of smart workplace solutions

Image source: Getty Images

Source: Frost & Sullivan

The global smart buildings market is being disrupted by increasing industry convergence and the emergence of innovative technologies. This has led to a steep increase in the digitalization of buildings, resulting in growth in demand for smart buildings and building management systems (BMS). This is causing industry disruptions, and these technologies influence how buildings are managed today. BMS are an advanced and effective way to operate and manage modern buildings to ensure occupant safety and comfort. They provide efficient and reliable maintenance through building automation, energy management, and other associated systems. The global BMS market is on an upswing and is expected to have a compound annual growth rate (CAGR) of 7.9% from 2021 to 2026. COVID-19 emphasized the need for digital solutions, placing a greater focus on the health and wellness of occupants. These factors, along with the increasing awareness of energy-efficient and sustainable buildings, act as a key growth accelerator for this market.

Artificial intelligence (AI) is another key technology disrupting the buildings sector. The penetration of the Internet of Things (IoT), data analytics, and cloud has increased at a rapid pace in buildings over the past few years. AI-driven solutions take advantage of the connectedness and empower buildings with autonomous intelligence, which offers cost reductions and lower environmental impact. Globally, AI adoption in the homes and buildings industry is in its early stage and has the potential to generate an annual average value of more than $6 billion[2] over the next two to three years.

Key enablers of smart buildings globally:

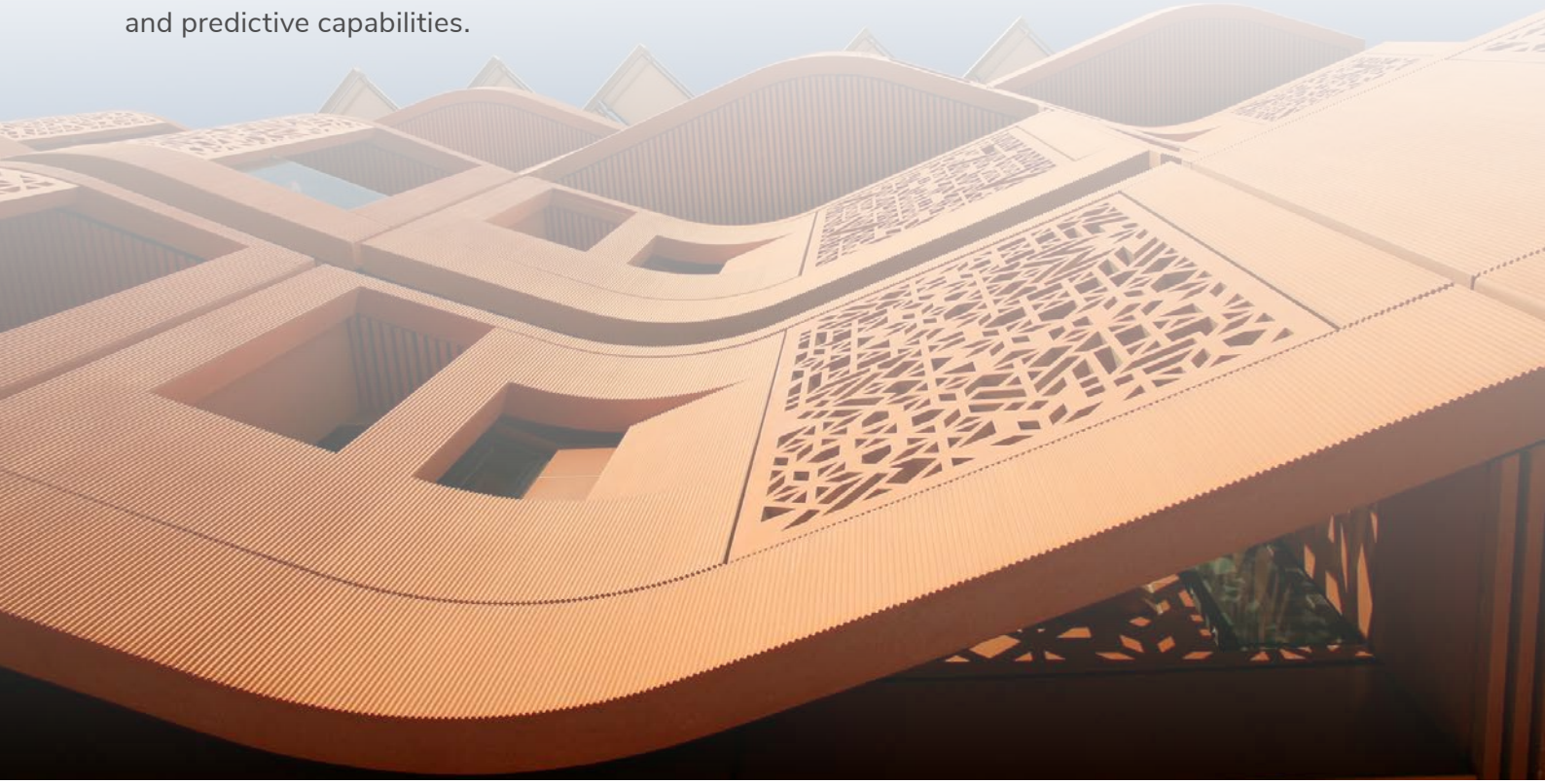
The increasing adoption of digital solutions in buildings: Rapid technological advancements in the IoT space and increasing industry convergence with information and communications technology (ICT) have brought new building capabilities to the fore. Advancements such as building automation and energy management systems have benefited building operators in terms of energy efficiency and cost savings and augmented building occupant and visitor experiences. The integration of AI and data analytics into building ecosystems is boosting the capabilities of new, modern buildings. The COVID-19 pandemic has rapidly accelerated this digital building transformation trend, pushing the adoption of smart buildings to new heights. Smart buildings generate large energy savings in urban infrastructure and enable smart cities, which use various technologies, such as IoT, to create and realize efficiencies, transforming the provision of services to occupants and building owners. BMS will play a key role in achieving net-zero goals and are integral to transforming traditional buildings into smart (digitally connected) and cognitive (responsive and intelligent) buildings.

The need for health, wellness, comfort, and business productivity of occupants: Post-pandemic building solutions are increasing the focus on occupants' health and well-being. The COVID-19 pandemic has emphasized the focus on indoor air quality (IAQ), which was a discussion point before the pandemic.

- Tenants demand better engineering controls, such as efficient HVAC, increased ventilation and humidification, and high IAQ levels. A few of the top air purification technologies that IAQ systems will incorporate are high-efficiency particulate air filters, activated carbon, ionization, UV germicidal irradiation, and electrostatic filters.
- The need to minimize human contact with potentially contaminated surfaces and manage risks to users is increasing the need for more automation solutions in buildings.
- Healthy building certifications, such as those from RESET and WELL bodies, are gaining popularity as buildings return to the new normal. These certifications could become the new standards for periodic assessments in the long term.

Integrating a BMS can significantly improve the health, wellness, comfort, and business productivity of occupants and reduce energy usage, providing cost savings. These systems give building owners an advantage in occupancy or rental rates.

The increasing demand for energy-efficient and sustainable buildings is acting as a market growth catalyst: According to the International Energy Agency, strong floor area and population expansions continue to raise the building sector's energy use, and building emissions are expected to double by 2050. Inefficient processes and energy management result in commercial buildings wasting 30% of their energy. The emphasis on energy security has increased because of the volatility of oil prices. One of the easiest ways to reduce energy usage is through BMS deployment. On average, they can save 13%-66% of energy costs because they come with detection, diagnostics, historical analysis, and predictive capabilities.



Buildings codes—a key regulatory element that would enable faster adoption of smart buildings: Building energy codes are a key tool to mandate the construction and maintenance of low-energy buildings. Building codes are vital to addressing buildings sector emissions and providing clear guidelines on their features. They can be a main driver for improvements in energy performance and the adoption of smart buildings.

Buildings and construction policies saw progress in 2021, with 23 countries revising and updating their Nationally Determined Contributions (NDCs) with a greater level of commitment to building efficiency. Eighty percent of countries have incorporated buildings as part of their NDC action plans, compared to about 69% in 2020. In 2021, the global buildings sector's investment in energy efficiency increased by about 16% from 2020 to approximately $237 billion (Source: IEA). This increase in investments was primarily among European countries such as Germany, UK and Italy, the USA, Canada, and Japan.

The Middle East region is also following the path of its global counterparts and has taken several initiatives toward smart buildings. The UAE Ministry of Energy and Infrastructure, in coordination with Guidehouse and RCREEE, is leading the development of building decarbonization roadmaps for the 22 countries and territories in the Arab League (Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Gaza and West Bank, Oman, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, UAE, and Yemen). [3]

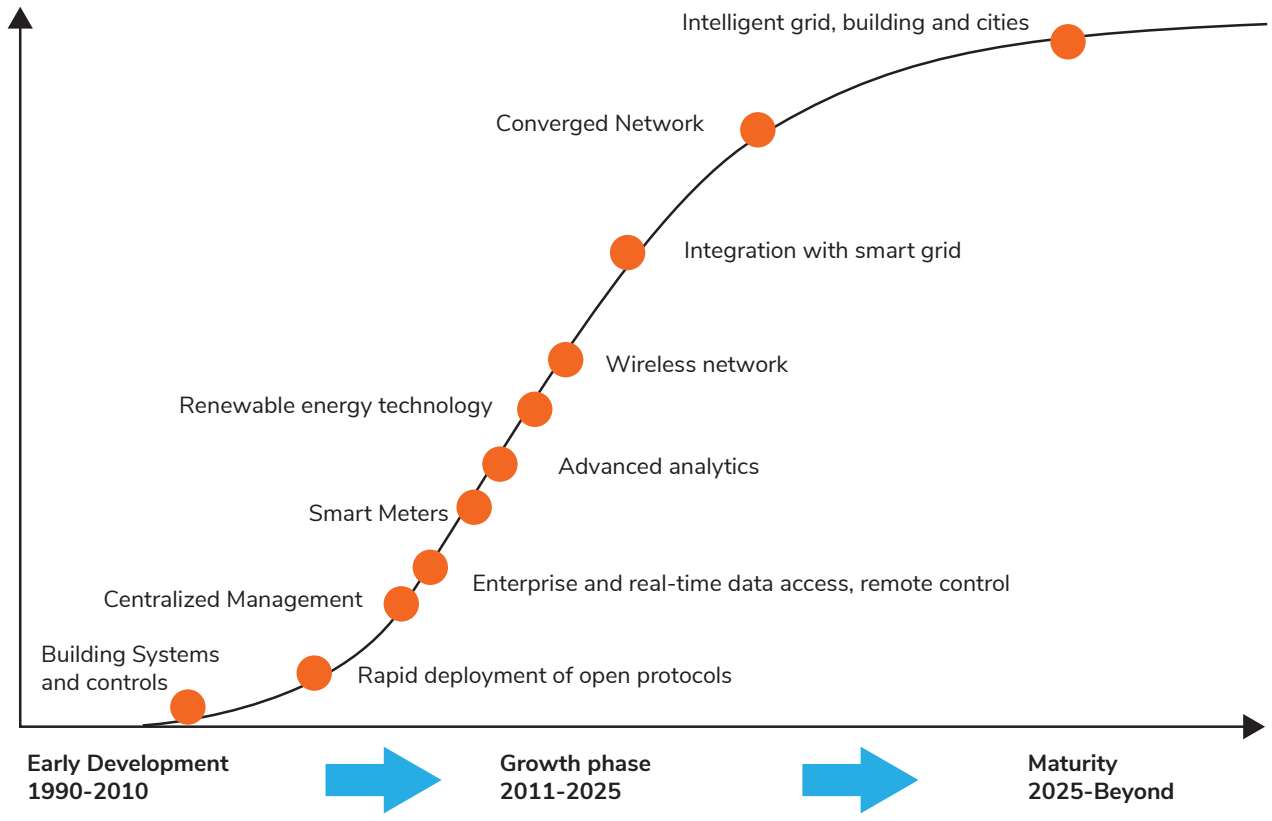
EVOLUTION OF SMART BUILDINGS IN THE MIDDLE EAST

Smart buildings market is in a growth phase in the region, and the UAE is the pioneer in developing sustainable buildings

The Gulf Cooperation Council (GCC)'s construction industry bounced back in 2021 and continued its momentum in 2022, with the largest contribution coming from the buildings sector, especially in the housing, healthcare, and hospitality segments. Circular economy business models, major socioeconomic events, and mega infrastructure projects are factors driving the adoption of smart buildings in the region.

The escalating need for enhanced energy efficiency and optimized performance across the GCC's built environment drives the rapid growth of the region's smart buildings market. Moreover, the industry's ongoing paradigm shift as building assets transition from legacy automation solutions to cognitive systems with intelligent sensor networks, predictive maintenance, and autonomous management capabilities propels the demand for advanced technology (such as IoT, AI, and cloud-based data analytics-enabled solutions).

EXHIBIT 4: SMART BUILDINGS MARKET EVOLUTION, GCC



Source: Frost & Sullivan Analysis

In recent years, supportive government strategies, green building codes, and smart city initiatives have created ample growth opportunities for the GCC's building automation solution providers. National and local-level smart city programs accelerate the adoption of intelligent building automation systems. The region's notable initiatives include the United Arab Emirates (UAE) National Energy Strategy 2050, National Innovation Strategy, Dubai Smart Government, Smart Dubai 2021, Abu Dhabi Economic Vision 2030 program, the Kingdom of Saudi Arabia's (KSA) Vision 2030, Smart Cities Program, and Green Riyadh program. Furthermore, the COVID-19 pandemic expedited the ongoing digitalization of the GCC's built environments. As a result, Frost & Sullivan expects building owners and operators to seek automation solutions increasingly with remote monitoring and intelligent energy management capabilities to optimize their operational expenses and asset performance.

The development of green buildings in the GCC is also creating demand for advanced BMS that promote carbon-neutral operations. The emphasis on energy security has also increased due to the volatility of oil prices in recent years. The UAE ranks among the top 10 countries with the most LEED-certified buildings in the world. Dubai is third on the list of cities with the highest number of LEED-certified buildings. The UAE has more than 600 LEED-certified projects, followed by Qatar and Saudi Arabia. The countries in the region have laws and standards pertaining to green buildings and energy efficiency. Qatar's Global Sustainability Assessment System (GSAS), Abu Dhabi's Pearl Rating System, and Dubai's Green Building Regulations are notable examples. Therefore, implementing BMS would enable the development of energy-efficient buildings in the region.

KEY DRIVERS OF SMART BUILDINGS IN THE MIDDLE EAST

The UAE is a pioneer in the Middle East smart buildings market with more than two-thirds of the region's 1,236 Leadership in Energy & Environmental Design (LEED)-certified projects, according to a study by technology firm Honeywell International. [4] Dubai is the third-largest city in the world, with the highest number of LEED-certified buildings. The UAE makes continuous efforts to evolve its regulations and policies to support the development of a smart and sustainable built environment. For instance, in March 2022, the country launched a new set of green building codes, which specify the standard and conditions a new construction should meet to mitigate its carbon footprint and reduce energy and water consumption. The UAE's Emirates Green Building Council reported a three-fold increase in the number of net-zero certification applications it received in 2022 compared to 2021. This highlights the growing focus on carbon emission reductions and sustainability in the buildings sector. [5]

BMS are a crucial element of the smart building ecosystem in the GCC and are witnessing the emergence of innovative technologies such as building information modeling (BIM) and 3D printing. The overall BMS market in the GCC is forecast to generate revenue of more than $500 million by 2027 [6], growing at a CAGR of more than 5% from 2021 to 2027. Other key growth enablers in the GCC are the digitization of building operations and maintenance and the increasing demand for energy-efficient and eco-friendly buildings.

Higher adoption of IoT for real-time data access: Adopting building automation products and services would continue to grow in the long term due to technological advancements in the IoT space. Advancements, like voice control modulation and remotely monitoring events, have augmented and abridged the consumer experience. Integration of AI and data analytics in the building ecosystem is also anticipated to boost the Middle East market over the long term.

Some GCC countries have placed sufficient emphasis on utilizing green concepts and materials but have paid significantly less attention to installing advanced BMS that manage energy consumption. However, property developers increasingly focus on using energy management systems (EMS) in new buildings as part of the GCC's effort to create sustainable buildings in the region. For example, Etisalat implemented IoT smart building solutions in the UAE's largest bank, First Abu Dhabi Bank (FAB), in December 2020. By using Etisalat's cloud-based IoT smart building platform, all assets and systems within FAB's buildings were integrated and centralized into one platform, providing "anytime, anywhere" access and ease of operations across FAB's entire portfolio.

Simplified building operation and maintenance: HVAC and lighting systems are the major energy consumers in any building; therefore, automating these systems with BMS offers significant advantages, such as energy efficiency and higher cost savings. BMS also simplify the operation and maintenance of buildings; preventive maintenance schedules through BMS provide additional cost savings for asset owners. Increasing awareness among end users is also promising and would drive faster adoption. The Dubai Silicon Oasis Authority, which owns and runs Dubai Silicon Oasis, has successfully upgraded its present integrated BMS to be AI-enabled. The system connects about 60,000 control points from all the buildings and industrial plants, including the Dubai Silicon Oasis Authority headquarters, a shopping center, six office towers, two residential complexes, light industrial facilities, a mosque, and Dubai Digital Park.

Increasing demand for energy-efficient and eco-friendly buildings: The Middle East region faces a distinctive set of socio-economic and environmental challenges in the form of water scarcity, ecological degradation, harsh climatic conditions, and abundance of fossil fuels. Commercial buildings in the Middle East consume much more energy than those in other regions due to extremely hot weather, heavy reliance on air conditioning, and rampant use of glass exteriors. The Middle East building industry is trying to use eco-friendly architecture, sustainable construction practices, and traditional building methods.

Supportive regulatory policy: In the UAE, regulations mandate permits so that all upcoming construction projects are based on green concepts and promote sustainable living and work environments. Emirates like Sharjah, Abu Dhabi, and Dubai have specific green building regulations, while other emirates usually adopt Abu Dhabi's regulatory standards. Maintenance guidelines in the UAE are becoming more stringent as managers must continuously maintain the technical performance of green buildings. Therefore, advanced BMS have become essential in improving green buildings' performance in various environmental benchmark criteria, such as water consumption, energy consumption, and indoor air quality. Air conditioning comprises 70% of the GCC's total annual peak electricity consumption, and cooling demand will triple by 2030. Air conditioning accounts for up to 60% of the total peak load consumption in the UAE. In Qatar, this figure is 70% during summer, with an annual average of 50%. In Saudi Arabia, Qatar, and the UAE, the adoption of the Minimum Energy Performance Standards is a recent development. With such standards in place, the need for EMS and BMS will remain high over the long term.

Continuously evolving tenant/occupant demands for sustainable building management solutions: The expectations of tenants or building occupants regarding environmental sustainability are driving the BMS market. Individuals that rent or work in the buildings have a growing cognizance of climate change and sustainability issues, preferring more environmentally friendly and energy-efficient buildings. Building systems that focus on the health, safety, well-being, and work productivity of users give building owners an advantage with occupancy or rental rates. At the same time, the new generation of workers, residents, and building visitors are technology savvy and prefer to connect with building systems operations via digital tools and user-friendly interfaces. Meeting these needs calls for smart building technology, enabling management and control through BMS. Awareness of indoor air quality has also increased since the start of the COVID-19 pandemic. Several GCC government bodies and municipalities have released new guidelines for the operation and control of HVAC systems to reduce disease transmission via infectious airborne particles and to ensure a safe and healthy building environment.

The Middle East, particularly the UAE, has developed several smart buildings. The most prominent are Bee'ah headquarters and Burj Khalifa.

EXHIBIT 5: SMART BUILDING CASE STUDIES IN THE GCC

BEE'AH Headquarters

Location	:	Sharjah (UAE)
Architect	:	Zaha Hadid Architects
Civil Engineering	:	Buro Happold
Duration	:	2013-2022
Total area	:	9,000 sq. mtr.
Achievement	:	LEED platinum certified
Recognitions	:	Green Building Award at the Gulf Sustainability and CSR Awards

Image source: Buro Happold

Key characteristics of the building:

- The building is powered by a solar array equipped with next-generation technologies for operations at LEED platinum standards to achieve net-zero emissions.
- The photovoltaic system used in the solar plant was designed to accommodate high summer loads, and the excess energy generated during these peak months is then fed back to the grid. [7]
- A GRC (glass fiber-reinforced concrete) roof was used instead of freeform concrete units to deliver the most cost-effective solution.
- The GRC panels reduce solar gain, while slab and glass cooling regulate interior temperatures for optimum comfort.
- On-site water treatment filtrates wastewater to minimize consumption, and its solar farm charges Tesla battery packs to meet the building's energy demand each day and night.
- In keeping with its sustainable construction, the building has a high-performing water management system made of recyclable materials.
- The building complies with sustainable urban drainage systems (SuDS), and its durability and strength make it ideal for large and demanding projects.
- The building's smart management system automatically adjusts lighting and temperature, depending on occupancy and time of day. The rooms are also equipped with powerful collaboration tools for remote and hybrid work scenarios. [8]
- The AI-driven headquarters enable seamless interaction within the building and power personalized experiences for visitors, employees, and management. It is a frictionless building with AI-based capabilities and automated controls that improve building efficiency, employee happiness, and space utilization while reducing overall operating expenses.[9]

Burj Khalifa

Location	:	Dubai, UAE
Architect	:	Skidmore, Owings & Merrill
Owner	:	Emaar properties
Duration	:	2004-2010
Total area	:	3.3 mn. sq. ft.
Achievement	:	LEED gold certified
Awards	:	2010 "Best Tall Building Middle East & Africa" 2016 Smart building award

Image source: www.burjkhalifa.ae

Key characteristics of the building:

- Burj Khalifa is one of the most famous tall buildings in the world and a global leader in smart building technology. It is occupied by hotels, corporate suites, and luxury apartments.[10]
- Burj Khalifa has remained at the forefront of technology innovation, making it truly iconic as the smartest and most sustainable building in the UAE and across the Middle East.[11]
- The BMS relays real-time information to an IoT platform, which uses smart algorithms to identify anomalies and maintenance issues.
- Recycling systems use gravity to discharge water from the plumbing fixtures, floor drains, mechanical equipment, and stormwater into the city's sewer system.
- The air conditioning system draws cooler and fresher air from the upper floors to the ground floors; condensation is collected via a collection system and used to irrigate nearby parkland.
- Unmanned cleaning machines are used to clean the top 27 floors of windows and the glass spire.
- The condensate water that is collected from the HVAC units is used to precool the domestic water from the municipality, which is being used for irrigation. The condensate water totals around 15 million gallons per year.
- The structure of Burj Khalifa has well-maintained safety standards and can withstand earthquakes of up to 7.2 magnitude.

OUTLOOK FOR SMART AND SUSTAINABLE BUILDINGS IN THE MIDDLE EAST

The Middle East, particularly the GCC countries, has always been at the forefront of innovation in the buildings sector. BIM was first authorized for use in the UAE in 2013, with Dubai having the world's biggest 3D-constructed building. The region is also known for its large-scale and complex construction and infrastructure projects (Neom and the Red Sea Project in Saudi Arabia). With the growing focus on climate action and each country committing to emission reductions, there is a need to move toward a more technology-driven, innovative, and digitalized-built environment. This would drive the growth of the smart buildings market in the GCC.

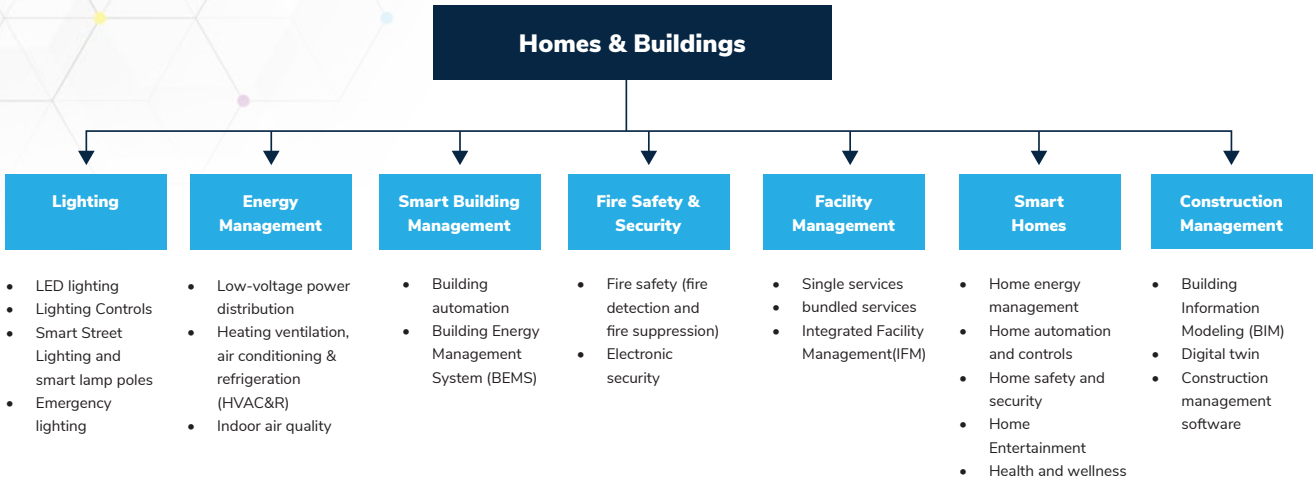
EXHIBIT 6: NET-ZERO TARGETS, GCC

Country	Net-zero Timelines
UAE [12]	2050
Saudi Arabia [13]	2060
Qatar [14]	Reduce 25% of GHG emissions by 2030
Oman [15]	2050
Kuwait [16]	2050 (oil & gas sector only) 2060 (whole country)
Bahrain [17]	2060

Source: Frost & Sullivan Analysis

The positive outlook for the growth of smart buildings in the GCC would have a high-growth impact on several market segments, such as facility management, energy management, fire safety and security, and others.

EXHIBIT 7: MARKET SEGMENTS IMPACTED BY THE ADOPTION OF SMART BUILDINGS, GCC



Strong stakeholder engagements could help address the key challenge of price sensitivity for the adoption of smart buildings

High price sensitivity and less economic incentive for builders: Property developers in the region are open to using green concepts, building materials, and energy-efficient solutions in the construction of buildings. However, people consider energy an abundant resource, particularly in the GCC, and debate often surrounds the overall intent to use BMS as a tool to reduce consumption. The availability of energy resources means that operational expenditure (OpEx) can be affordable, while capital expenditure (CapEx) on advanced BMS becomes questionable. With deeply subsidized energy prices and the high capital investment involved in BMS, developers may feel little economic incentive to invest in infrastructure to monitor and manage energy consumption. In a conventionally price-sensitive GCC market, it has been difficult to justify the high initial investment for many commercial and industrial facilities, particularly for smaller organizations.

Lack of understanding of process implementation and unforeseen ROI benefits: End users in the GCC show a general lack of understanding of the functions and benefits of BMS. This can be due to substantial unforeseen costs for the periodic system upgrades and a general lack of clarity in the maintenance process. Developers remain skeptical about the potential of BMS in providing ample ROI for the large initial CapEx. The widespread belief that the systems are incompetent adds to this skepticism. The lack of understanding of operational aspects of BMS also stems from the lack of proper BMS utilization and adherence to certain behavioral codes. For instance, the failure to close windows and doors when using air conditioning contributes to inefficient energy consumption, leading to a perception that BMS are ineffective in energy management.

Limited availability of skilled technical operators with the requisite experience: The region has limited skilled technical workers with the necessary experience to efficiently maintain BMS-installed facilities, monitor energy usage, and provide building owners and occupants with proper diagnostics and action plans. BMS necessitate a highly skilled workforce and evolve due to technological developments and convergence with information and communications technology (ICT), resulting in the need for highly adaptable skilled workers. Building owners also need to keep pace with the advances and expanding capabilities of BMS.

Despite the challenges, the Middle East region presents immense growth opportunities for smart building solutions due to their climate action commitments and several initiatives launched by public and private sector stakeholders.

REFERENCES

1. United Nations Environment Programme (2020). 2020 Global Status Report for Buildings and Construction: Towards a Zero-emission, Efficient and Resilient Buildings and Construction Sector. Nairobi

2. Frost & Sullivan Analysis

3. UNEP_Global Status Report for Building and Construction_2022

4. https://invest-gate.me/news/gcc-countries-to-follow-uae-lead-in-smart-building-solutions/

5. https://gulfbusiness.com/technologies-underpinning-sustainability-in-the-gccs-construction-industry/

6 Frost & Sullivan Analysis)

7 https://www.burohappold.com/news/burohappold-wins-green-building-award-gulf-sustainability-csr-awards/

8. https://www.archdaily.com/979479/beeha-headquarters-zaha-hadid-architects

9. https://www.johnsoncontrols.com/-/media/jci/openblue/pioneers/beeah/ob2201002_beeah-case-study_final.pdf

10 https://s33644.pcdn.co/wp-content/uploads/2020/06/Intelligent-Building-Top-5-Smart-Buildings-ebook.pdf

11. https://inbuildingtech.com/smart-buildings/burj-khalifa-smart-building/

12. https://u.ae/en/information-and-services/environment-and-energy/climate-change/theuaesresponsetoclimatechange/uae-net-zero-2050

13. https://www.bbc.com/news/world-middle-east-58955584

14. https://thepeninsulaqatar.com/article/05/09/2022/qatar-to-accelerate-work-towards-co2-emissions-reduction-targets

15. https://www.omanobserver.om/article/1128697/oman/environment/oman-committed-to-net-zero-emissions-by-2050

16. https://www.reuters.com/business/cop/kuwait-says-become-carbon-neutral-oil-gas-by-2050-2022-11-07/

17. https://www.reuters.com/business/cop/bahrain-aims-reach-net-zero-carbon-emissions-2060-bna-2021-10-24/

DISCLAIMER

GROWTH PIPELINE ENGINE™

Frost & Sullivan's Growth Pipeline Engine™ supports clients through all phases of growth—Developing, evaluating and prioritizing opportunities, building and implementing go-to-market strategies, and optimizing opportunities. The objective is to be a client's first step on their growth journey.

For more information, e-mail: meenquiries@frost.com

About Frost & Sullivan

For over six decades, Frost & Sullivan has helped build sustainable growth strategies for Fortune 1000 companies, governments, and investors. We apply actionable insights to navigate economic changes, identify disruptive technologies, and formulate new business models to create a stream of innovative growth opportunities that drive future success.

Our passionate commitment to growth starts with our Growth Pipeline Dialog, an all-hands approach that puts your management team in a room with our growth experts, addresses your top challenges, identifies areas of disruption, and develops tailored roadmaps and go-to-market strategies.

With over 1,200 experts and 60 years of experience, Frost & Sullivan is uniquely positioned to help you uncover millions of growth opportunities, guided by our moral imperative to make the world a better place through sustained growth.

DUBAI
2601, Swiss Tower, Cluster Y
PO Box 33372
Jumeirah Lake Towers
Dubai, UAE
Tel: +971 4 433 1893

RIYADH
F16, Level 1, Localizer Mall
2803 Prince Muhammad Bin Abdulaziz Rd
Al Olaya, Riyadh 12222
Tel: +966 11 486 8463

Schedule your complimentary ***Growth Pipeline Dialog™***
today to start your journey toward sustained growth by clicking here.