Smart cities
Fact

1st step to a smart city: reliable access to electricity
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Why cities must become smarter, now

Sufficient fresh water, universal access to cleaner energy, the ability to travel efficiently from one point to another, a sense of safety and security: these are the kinds of promises modern cities must fulfill if they are to stay competitive and provide a decent quality of life to their citizens.

By 2050, 66% of the world’s population is expected to live in urban areas. The challenge will be to supply these populations with basic resources like safe food, clean water and sufficient energy, while also ensuring overall economic, social and environmental sustainability. Already today, cities consume around 70% of all energy produced globally, while generating 80% of world GDP.
Electricity: no city will be smart without it

Cities are giant systems with countless subsystems. All of them depend on electric power and hardware to move people and things, collect data and exchange information. Without electricity, modern city management, the Internet of Things, and all resulting city services remain wishful thinking. Energy is the golden thread that allows cities and economies to prosper. It is impossible to build an efficient urban infrastructure without reliable energy access: no electricity = no smart city.

Fact

70% of energy is consumed in cities

Fact

No electricity = no smart city
Cities need to substantially increase the efficiency in which they operate and use their resources. Major efficiency improvements can be achieved by horizontally interconnecting individual systems such as electricity, water, sanitation and waste management, transportation, and also security, environmental monitoring or weather intelligence. Such an approach allows for increased information sharing and coordination and helps manage incidents in one sector that impact the others. It also offers considerable opportunities in terms of cost reduction and the creation of new value-added services.

But interconnection is easier said than done. Many of the currently deployed systems in cities originate from different suppliers and they are maintained by various agencies that generally work in isolation. To connect them both physically and virtually, standardized interfaces need to be put in place. The IEC provides many of the international standards that are needed to safely connect and automate much of the city infrastructure that generates or uses electricity and contains electronics.

The use of international standards also facilitates the long-term maintenance and repair of city infrastructure. Spare parts can be bought anywhere in the world at more competitive prices.

Most smart cities are not built from scratch in one go. They gradually evolve and become smarter, bit by bit. With time, these individual islands of smartness grow together and interconnect, but only if they use the same harmonized technical rules that are embodied in standards.
Fact

IEC helps connect and automate city infrastructure
Facilitating tailored smart city development

Building a smart city is highly complex. Every city faces its own challenges and requires its own mix of solutions. However, there is one common denominator that greatly simplifies this task: international standards.

International standards can considerably facilitate the development of tailor-made solutions that are adapted to the particular circumstances of a given city. Standards are essential enablers that assure an expected performance level and compatibility between technologies. They embody strong technical and process expertise and facilitate the replication of outcomes. Standards propose common metrics that permit the comparative analysis and benchmarking of solutions.

Standards also open the door to a larger choice of products, increased competition and help foster innovation. In a systems approach they enable the integration of structures from different suppliers. This benefits both the city and its citizens.

Standards = many solutions

The large majority of big and small companies that build electrical and electronic components, devices or systems that are sold beyond a single market participate in IEC work and use IEC International Standards.

And while smart city development will go far beyond integrating the right technologies, it is comforting to know that many of these devices and systems will support smooth and integrated smart city development.

Everything electric and electronic

Electricity and electronics are an integral part of nearly all city systems. For this reason the IEC does not propose a single suite of smart city international standards. Instead, literally hundreds of IEC International Standards come into play to tailor the integration of energy generation, buildings, transportation, lighting, healthcare, safety/security and a multitude of city and financial services to the needs of each individual city.

Here follows a brief overview of some of the city systems that are directly impacted by IEC work.
Smart electrification and energy generation

The work of the IEC underpins just about every aspect of energy generation, distribution, electrical installations, and electricity use:

- Power generation from hydro, marine, solar, wind power, fossil fuels, nuclear, geothermal.
- Transport of electricity over long distances to cities.
- Safe and efficient electricity distribution and use by billions of devices and systems in buildings, offices, medical facilities, shopping centres, transportation systems, factories, public institutions or the utilities that supply water, electricity or remove household waste.

The IEC covers the whole energy chain and can help ensure a continuous supply of affordable, sustainable, quality power. IEC work, including for microgrids, low voltage direct current (LVDC) systems, off-grid energy and energy storage systems, can help cities to maintain power longer and recover power faster after power outages and disasters.

Fact

We facilitate the integration of every energy source
Obstacles to mobility are a major problem facing most cities. With increasing population density, cities have to apply more sustainable solutions to move people to their individual destinations while overcoming traffic congestion and pollution.

IEC work covers the large majority of the electrical and electronic infrastructure of every imaginable transportation technology. It also supports the whole surrounding monitoring, control and service infrastructure in train and metro stations, airports, bus stops, garages and at street level.

IEC International Standards cover electric power supply, steering and control instruments, electric generators, drives and motors, batteries, lighting and signalling, sensors, displays and monitors, wires and all forms of connectors and coupling devices. Functional safety standards make certain that all electronic instructions are without fail executed to the letter, for example, so that metro doors do not open between stops. IEC International Standards also take into consideration overall electrical safety, performance, environmental impact and efficiency.

**Trains, light-railways, trams, metro-systems**

IEC work covers all aspects of automated public transport systems including communication systems within vehicles and with the central command station.
A set of IEC International Standards helps ensure the functioning and efficiency of the whole supporting infrastructure from electronic turnstiles, ticketing machines, computer hard- and software, lighting or announcement systems, escalators and people movers, to the surveillance and instrumentation that avoids collisions and ensures the safety of the whole transportation network.

**Air transport systems**

IEC work covers much of the electrical and electronic equipment used in airplanes. It also protects the sensitive electronics in planes from high-altitude electromagnetic interference.

On the ground, IEC work covers computers, printers and ticket readers at check-in, baggage tagging (RFID), conveyor belts, lighting, announcement systems, security and access control, scanners and biometric readers, escalators and elevators, luggage dispatch, airfield lighting, communication and radio equipment, flight surveillance instrumentation, and more.

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**Fact**

Quality of life and sustainable mobility are intimately linked.

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**Fact**

On the ground and in the air – electricity is everywhere.
Electric, fuel-cell and combustion buses
In addition to the electric and electronic systems that can be found in all buses, the IEC has standardized the safety and performance of AC and DC charging systems for electric buses and the safety and performance of fuel cells for hydrogen fuelled buses.

Cable cars
IEC work ensures the safety and efficiency of the whole cable cars infrastructure.

Electric and other automobiles
Public and private fast and slow charging systems, plugs and sockets on the car and at the charging station, batteries and their safety and performance, in-car electronic displays and components, lamps and lighting.

Traffic lights, displays and monitors

E-scooter, e-bike, driverless pods
All electric and electronic elements

E-vehicles for use in warehouses, shops, at airports, in train stations
All electric and electronic elements
Global urbanization poses a number of water-related challenges – chief among them supplying clean drinking water and disposing of waste water.

In many parts of the world, there is not enough water near cities. It has to be brought into the city with long-distance pipelines, or desalinated from sea water.

Supplying millions of citizens every day with water is a task that requires much planning and the help of a large number of electrical and electronic water management systems and technologies. Millions of electric motors, pumps, valves, sensors and controls rely on IEC International Standards to work safely and efficiently in sometimes harsh environments.

**Fresh water**

It starts at the water utility, where instrumentation keeps a close watch on water consumption and the data sent back from individual water meters. Water extraction pumps are used to pump water from wells or through pipelines to purification, filtration or desalination systems. Automated valves, automatic shutoffs and controllers turn water on and off as needed.
Building and industrial pumps ensure that water pressure remains constant even at the top floor of high-rises or during use in industrial processes.

A myriad of sensors control the start and stop of water flow for example at the individual bathroom tap. They also help control timing and length of flush in toilets, avoid overflow in boilers and storage towers or sense soil water content or freezing temperatures in irrigation systems.

**Wastewater treatment**

Centrally controlled, highly automated pumps, conveyor belts and sorting machines separate solids from other waste. Wastewater is sent through settlement tanks where electrically driven scrapers push sludge to be pumped away. Rotating motors drive clarifiers and air pumps in aeration tanks to allow bacteria to break down the remains of sludge. Cleaned water flows back into rivers or is used for other purposes.

**Fact**

Clean water relies directly on electricity.
Buildings make up 40% of global energy demand. They use electricity and include electronics in nearly everything. IEC International Standards support the large majority of them.

For example: ventilation, air conditioning (HVAC), escalators and elevators, thermostats, timers, heat pumps, solar panels or wind turbines, energy storage systems, household or office appliances, audio, video and related equipment, displays, electric and electronic hardware and installations, access control (biometrics, X-ray, luggage and tag scanners), alarm systems, surveillance feeds (CCTV cameras), etc.

The IEC also supports the millions of sensors that provide feedback, transmit orders and collect data:

- Automatically switch lights, heating, air-conditioning, water on and off
- Turn on escalators and walkways upon approach
- Automatically open and close doors
- Detect fire and motion
- Remote receiving and surveillance or social alarm systems

IEC work in automation allows buildings to adapt to changing environmental conditions and adjust and minimize their energy use.

→ **Fact**

Automation makes buildings more efficient
City services

Public services, healthcare facilities, educational institutions, food distribution and restaurants, financial institutions, all rely on electricity and the many elements of electrical and electronic hardware and systems standardized in the IEC. Without them data collection and city management would be impossible.

Across and beyond individual technologies IEC work also covers:

**Security and cyber security**
Here IEC work helps protect critical infrastructure such as utilities and power generation as well as ensure overall IT security. It also helps reduce the risk of explosions from flammable liquids, fumes or ignitable dust.

**Safety and functional safety**
IEC work helps reduce electrocution risks and accidents due to moving parts in electrical devices.

IEC International Standards for functional safety help ensure that electronic commands are always promptly and properly executed, for example, to ensure that a safety valve closes exactly when it should to avoid a chemical spill, or that an elevator door only opens when the cabin has stopped.

**Electromagnetic compatibility**
The billions of electrical and electronic devices used in cities all emit electromagnetic interferences (EMI) that can disturb or completely disrupt the functioning of electrical circuits, leading to errors or even the complete loss of data. The IEC helps protect sensitive electronics from EMI and limits the interference for example of large-scale batteries in electric vehicles.
Fact

We help protect critical infrastructure and sensitive electronics.
Cities require broad cooperation

More than ever before, many different organizations will need to collaborate to help make cities smarter; technology integration is a special challenge that requires broad cooperation in a systems approach.

The IEC has taken a systems approach to smart cities with the aim of providing a holistic approach to address complex situations. The IEC SyC Smart cities is active in coordinating the standards work of various IEC committees as well as other groups, such as ISO, with the aim of promoting the development of standards to assist in the integration, interoperability and effectiveness of city systems.

The United Nations has called on governments, industry and society to make cities inclusive, safe, resilient and sustainable. This is one of the 17 Sustainable Development Goals (SDGs) at the core of the UN blueprint for building a better world by 2030.

The work of SyC Smart cities specifically addresses the UN SDG 11 on sustainable cities and communities and its targets related to city management and disaster resilience and recovery. For example, new technologies used to make cities smarter can also help improve quality of life in cities and facilitate the transition towards sustainable transport.
Fact

International standards allow many organizations to work together